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FURTHER OBSERVATIONS ON THE NATURE OF DERMOID CYST FAT *

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The fatty material found in ovarian dermoid cysts has long been thought to be sebum (Sotnitchewsky (1)), and there are several cases in the literature (e.g. Plaut and Sobel (2)) where dermoid cyst fat has been used in place of sebum for experimental purposes. A direct comparison between the composition of dermoid cyst fat and human forearm sebum has already been made (Wheatley (3)) in which several differences in composition were observed, and it was concluded that the dermoid cyst fat represented a 'sebum' produced by a pathological process. The previous work was directed at an investigation of the over-all composition of the fat and of the nature of the unsaponifiable matter. No attempt was made to study the nature of the fatty acids present, indeed a detailed analysis of these acids has not yet been recorded. The recent introduction of gas-chromatography for the analysis of complex mixtures of fatty acids (James and Martin (4); James and Wheatley (5)) now makes this analysis possible, and from the pattern of the gas-chromatogram can be judged whether, in fact, the dermoid cyst fat is a sebaceous secretion.

EXPERIMENTAL

The fatty acids isolated from the dermoid cyst fat were methylated using diazo-methane and the esters submitted to analysis on the gas-chromatogram. Total fatty acids were also obtained from a pooled sample of human forearm 'sebum' (obtained as described by MacKenna, Wheatley and Wormall (6)), methylated and a second chromatogram run.

Gas-chromatography. The columns were prepared from treated Celite as described by James and Martin (4) with Apieson M stop-cock grease (Shell Chemicals Limited) as the stationary phase (2g. to each 10g. Celite). The latter gives columns with a much higher resolution than the lubricating oil extract previously used (5). The column temperatures were maintained at 197° with boiling ethylene glycol, and samples were applied to the column by means of a capillary pipette. After the run of total fatty acids, the sample was brominated in ether to remove unsaturated acids and a second chromatogram of the saturated acids obtained. From the two chromatograms the composition of the mixed fatty acids could be calculated using the method for correcting peak areas already described (5).

RESULTS

The gas-chromatograms obtained for the fatty acids of dermoid cyst fat and of human forearm 'sebum' are shown in Fig. 1. The essential similarity of these two chromatograms indicate that the dermoid cyst fat is almost certainly of sebaceous origin. The better resolution of the Apieson M stationary phase is shown by the complete separation of the peaks due to the unsaturated

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TABLE 1

The component fatty acids of ovarian dermoid cyst fat and human forearm 'sebum'

Acid	Dermoid Cyst Fat	Forearm 'Sebum'
	%	%
n-C_{10} (capric)	0.1	0.3
n-C_{11}	0.1	0.2
iso-C_{12}	0.1	0.1
n-C_{12} (lauric)	0.8	4.4
polyiso-C_{13}	0.6	0.4
iso-C_{13}	0.3	0.5
n-C_{13}	0.4	0.4
polyiso-C_{14}	0.1	0.1
iso-C_{14}	0.1	0.3
monounsaturated C_{14}	2.6	1.9
n-C_{14} (myristic)	9.4	7.8
polyiso-C_{15}	2.2	1.5
diunsaturated C_{15}	0.5	1.0
iso-C_{15}	2.1	2.0
monounsaturated C_{15}	1.4	1.9
n-C_{15}	5.9	4.2
polyiso-C_{16}	0.8	1.3
monounsaturated C_{16}	23.8	12.0
n-C_{16} (palmitic)	24.9	22.7
polyiso-C_{17}	5.0	3.4
diunsaturated C_{17}	0.5	1.6
iso-C_{17}	0.9	2.1
monounsaturated C_{17}	2.6	1.4
n-C_{17}	1.5	1.6
polyiso-C_{18}	1.6	2.9
monounsaturated C_{18} (oleic)	9.7	17.2
n-C_{18} (stearic)	2.0	5.7

Iso- indicates a single methyl branch near the end of the carbon chain.
Polyiso- indicates the presence of several methyl branches in the carbon chain.

C_{14} and the *n*-C_{14} acids (peaks 9 and 10) and also by the detection of the presence in sebum of highly-branched C_{13} acids (peak 5) which were not detected in our earlier chromatograms. The composition of both fatty acid fractions have been calculated as shown in Table 1. The principal differences in composition of these two materials are that forearm 'sebum' contains less unsaturated C_{16} acid and more oleic acid than does dermoid cyst fat. The first of these differences is undoubtedly due to the oxidation of the sebum on the forearm and the second to extraneous contamination of forearm 'sebum' e.g. by soaps etc.

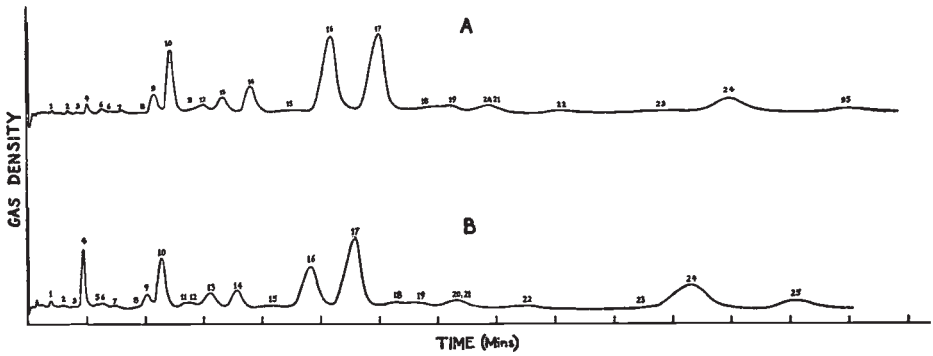

FIG. 1. Gas-chromatograms of the total fatty acids (as methyl esters) of dermoid cyst fat (A) and human forearm 'sebum' (B). Column length 4 ft., stationary phase Apieson M grease, temp., 197°, N_2 pressure 75.3 cm. Hg., flow rate 76 ml. N_2/min.

Peaks are due to the following acids (1) n-C_{10} (capric), (2) n-C_{11}, (3) *iso*-C_{12}, (4) *n*-C_{12} (lauric), (5) *polyiso*-C_{13}, (6) *iso*-C_{13}, (7) *n*-C_{13}, (8) *polyiso*-C_{14}, (9) monounsaturated C_{14}, (10) *n*-C_{14} (myristic), (11) diunsaturated C_{15}, (12) *polyiso*-C_{15}, (13) *iso*-C_{15}, (14) *n*-C_{15}, (15) *polyiso*-C_{16}, (16) monounsaturated C_{16}, (17) *n*-C_{16} (palmitic), (18) diunsaturated C_{17}, (19) *polyiso*-C_{17}, (20) *iso*-C_{17} overlapping (21) monounsaturated C_{17}, (22) *n*-C_{17}, (23) *polyiso* C_{18}, (24) monounsaturated C_{18} (oleic), (25) *n*-C_{18} (stearic). Some acids below C_{10} are present in traces.

The slight differences in the retention times for the two chromatograms are due to 'ageing' of the column, i.e. loss of stationary phase.

DISCUSSION

Comparison of the fatty acid composition of dermoid cyst fat and of forearm 'sebum' indicates that the former is undoubtedly of sebaceous origin, and it appears likely that it is nearer to the composition of true sebum than previous investigations indicated. Investigations of the composition of the fatty acids of various samples of sebum both from man (unpublished) and from certain animals (Wheatley and James (7)) indicates that the pattern of the gas-chromatogram is reasonably constant for a given species but varies appreciably with different species. Moreover the fatty acid pattern of sebum differs from that of any other tissue fat of the same animal. Rabbit sebum, for instance, contains appreciable amounts of highly-branched fatty acids (7) yet these particular acids have not been detected in any other rabbit tissue fat (James (8)). On this basis similarity of fatty acid pattern can be taken as presumptive evidence of a similar origin for two fats.

The principal differences between dermoid cyst fat and forearm 'sebum' previously observed were the absence of free fatty acids and the presence of a higher proportion of true waxes in the former material. Evidence has now accumulated that the free fatty acids of human sebum are liberated by hydrolysis (Nicolaides and Wells (9)), either on the skin surface or in the mouths of the sebaceous glands, after the sebum is formed. It is, therefore, unlikely that these would be present in dermoid cyst fat which is secreted in a confined space. The higher proportion of waxes is more difficult to explain. We are now certain that forearm 'sebum' is contaminated by epidermal cholesterol and possibly

by other lipids (Boughton, MacKenna, Wheatley and Wormall (10)), but it is not yet possible to judge exactly the extent of this contamination. Undoubtedly the dermoid cyst fat suffers from similar contamination but to a lesser extent than does forearm 'sebum.' It is possible that the higher proportion of waxes in the dermoid cyst fat could be explained on this basis, though this may not be the complete explanation. Nevertheless the available evidence indicates that dermoid cyst is a genuine sebaceous secretion, though formed by a pathological process, and that its composition is sufficiently close to that of pure sebum for it to be used instead of sebum in certain types of experiments.

SUMMARY

1. The component fatty acids of ovarian dermoid cyst fat have been analyzed and compared with a similar analysis of human forearm 'sebum' fatty acids.

2. It is concluded that, although it is formed by a pathological process, dermoid cyst fat is a genuine sebaceous secretion.

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