The Component Acids of the Perinephric and Interscapular Fats of a Rabbit

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(Received 22 February 1951)

The component fatty acids and glycerides of the fats of comparatively few species of land animals have been studied in detail. Information so far available relates mostly to the body fats of the domestic animals, ox, sheep and pigs, and to cow and buffalo milk fats. The data available for the component acids of a greater but still limited number of animal fats, however, indicate that a progressive change in the direction of simplification tends to occur as one proceeds from the lower to the higher land animals.

The fats of only two species of rodents have so far been examined in detail, the component acids being recorded respectively for those of male and female white rats (Longenecker, 1939), and of healthy guinea pigs (*Cavia cutleri*) (Baldwin & Longenecker, 1944) fed on a low-fat content diet. The values obtained are quoted in Table 3, together with those of Vickery (recorded by Hilditch, 1947) for the fat of the wild rabbit and with the values obtained in the present investigation for the component acids of the perinephric and interscapular fats of an experimental rabbit.

Lewkowitsch (1922) has recorded iodine values of 101 and 64.4 for the fats from wild and tame rabbits (*Lepus cuniculus*), respectively, noting that the fat from the wild animal dries to a nearly solid varnish in 7 days, whereas that from the tame rabbit exhibits no drying properties. The fat from a wild rabbit, studied by Vickery and reported by Hilditch (1947), had a saponification equivalent of 285.2, and iodine value 124. The component acids included myristic 5%, palmitic 23%, and stearic 4% with 68% of unsaturated acids, the latter having an iodine value of 189.3. The unsaturated acids were not completely identified, but it was shown that linoleic acid was

present to the extent of 35%, whilst linolenic acid was present to the extent of about 20%. This fat, therefore, only resembled that of the rat and the guinea pig in so far that the saturated acids comprise about 30% of the mixed fatty acids, but differed completely from them in the proportions of the unsaturated acids present.

The perinephric and interscapular fats from a healthy Chinchilla rabbit, which had been receiving a daily low-fat diet consisting of 12 oz. (340 g.) green stuff and 4 oz. (110 g.) rat cake (the latter containing 5–6% fat) and water three times a week, have now been investigated.

EXPERIMENTAL

The fatty tissues were dissected out immediately after slaughter and extracted with light petroleum (b.p. 40–60°) and gave fats of the following characteristics:

	Saponification equivalent	Iodine value
Perinephric fat	283.1	72.3
Interscapular fat	283.7	66.3

Determination of the component fatty acids

The mixed acids obtained after hydrolysis of the perinephric fat were resolved by low-temperature crystallization into three fractions consisting of mainly polyethenoid, mainly monoethenoid and mainly saturated acids, respectively, whereas the acids from the interscapular fat were resolved into two fractions mainly unsaturated and mainly saturated, respectively. Each fraction was methylated and fractionated through an electrically heated and packed column, the saponification equivalent and iodine value of each ester fraction being determined. Spectrophotometric examination (Hilditch, Morton & Riley, 1945) of the acids

Table 1. *Low-temperature crystallization of rabbit fat, mixed fatty acids*

	Perinephric			Interscapular		
	Weight		Iodine value	Weight		Iodine value
	(g.)	(%)		(g.)	(%)	
A. Insoluble in ether at -35°	18.58	37.6	7.6	14.31	34.0	5.3
B. Soluble in ether at -35°	15.11	30.5	83.2	27.74	66.0	102.5
C. Soluble in ether at -60°	15.80	31.9	141.1	—	—	—

Table 2. *Component acids of perinephric and interscapular rabbit fats*

Acid	Perinephric fat					Interscapular fat				
	Acid groups			Total fatty acids		Acid groups			Total fatty acids	
	A	B	C	(% w/w)	(% by mol.)	A	B	(% w/w)	(% by mol.)	excl. unsaponifiable
	(37.6%*)	(30.5%*)	(31.9%*)			(34.0%*)	(66.0%*)			
	(%†)	(%†)	(%†)			(%†)	(%†)			
Lauric	—	—	1.1	0.4	0.5	—	3.7	2.4	3.2	
Myristic	5.8	8.0	2.8	5.5	6.5	7.3	2.0	3.8	4.5	
Palmitic	72.1	8.2	2.3	30.5	3.19	75.8	4.7	29.0	30.2	
Stearic	12.0	1.6	—	5.0	4.7	11.9	—	4.0	3.8	
Dodecenoic	—	—	—	—	—	—	0.1	0.1	0.1	
Tetradecenoic	—	—	—	—	—	—	2.2	1.4	1.7	
Hexadecenoic	—	4.1	12.9	5.4	5.7	—	9.9	6.6	6.9	
Hexadecadienoic	—	—	0.5	0.2	0.2	—	0.2	0.1	0.1	
Hexadecatrienoic	—	—	1.0	0.3	0.3	—	0.3	0.2	0.2	
Oleic	9.9	70.1	20.9	31.9	30.4	3.8	53.4	36.7	34.6	
Linoleic	—	6.7	44.7	16.3	15.6	1.1	17.2	11.8	11.2	
Linolenic	—	1.3	8.4	3.1	3.1	—	3.0	2.0	1.9	
Unsaturated C ₂₀₋₂₂	—	—	4.5	1.4	1.2	—	2.8	1.9	1.6	
Unsaponifiable	0.2	—	0.9	—	—	0.1	0.5	—	—	

* Group as % (w/w) of total fat.

† Component acids as % (w/w) of group.

Table 3. *Component acids of rodent fats (% by mol.)*

Acid	Rats (Longenecker, 1939)		Guinea pig (Baldwin & Longenecker, 1944)	Experimental rabbit (Present work)		Wild rabbit (Hilditch, 1947)
	Male	Female		Perinephric	Interscapular	
Lauric	—	—	1.5	0.5	3.2	—
Myristic	1.6	1.8	6.4	6.5	4.5	5
Palmitic	21.6	24.4	20.6	31.9	30.2	25
Stearic	3.6	3.6	5.5	4.7	3.8	4
Arachidic	2.0	0.8	—	—	—	—
Dodecenoic	—	—	—	—	0.1	—
Tetradecenoic	—	0.3	1.0	—	1.7	—
Hexadecenoic	4.1	4.8	2.2	5.7	6.9	12
Hexadecadienoic	—	—	—	0.2	0.1	
Hexadecatrienoic	—	—	—	0.3	0.2	
Oleic	51.9	44.3	34.9	30.4	34.6	—
Linoleic	13.0	18.6	18.3	15.6	11.2	34
Linolenic	—	—	1.2	3.1	1.9	20
Unsaturated C ₂₀₋₂₂	2.2	1.4	8.4	1.2	1.6	—

recovered from selected ester fractions enabled the amounts of hexadecadienoic and octadeca-di- and octadeca-tri-enoic acids to be estimated, respectively. The octadeca-di- and octadeca-tri-enoic acids were further characterized and found to consist for the most part, if not entirely, of ordinary seed-fat linoleic and linolenic acids, since tetrabromostearic acid, m.p. 114°, and hexabromostearic acid, m.p. 180°, were readily obtained from suitable ester fractions.

DISCUSSION

It is seen that there is no major difference in the compositions of the perinephric and interscapular fats of the rabbit, the saturated acid contents in particular being very similar. The interscapular fat is, however, somewhat more saturated than the perinephric fat, this being due to an increase in the amount of oleic acid (about 4%) at the expense of a corresponding decrease in its linoleic acid content.

This is of considerable interest, since it is known that the perinephric fats are more saturated than fats located at other sites in the body for other animals so far investigated. The hexadecenoic acid content of both fats is of the order of 5–7%, this value being of the same order as that which obtains in the body fats of rats and guinea pigs (Table 3). Hexadeca-di- and hexadeca-tri-enoic acids in small amounts were found to accompany the hexadecenoic acid in both perinephric and interscapular fats.

Judged from the composition of their fats the rodents appear to occupy an interesting transitional position in the scale of biological evolution. Thus the palmitic acid content is of the order of 20–30% of the amount characteristic of the higher land animals, whereas the hexadecenoic acid content is considerably higher than that which obtains in these animals, indicating that rodent fats are inter-

mediate in type between those of the higher land animals and those of the reptiles and amphibia so far reported, in which the palmitic acid content is somewhat reduced, being of the order of 10–20%, hexadecenoic acid being present in these fats to the extent of 5–15%.

Table 3 records the component acids of the rodents so far investigated. It is seen that the fats of the tame rabbit are on the whole similar to those of the other (tame) rodents. The palmitic acid content of the rabbit fats, however, is somewhat higher than that of the rat and guinea pig fats. The unsaturated C_{18} -acid content resembles that of the guinea pig rather than that of the rats, the guinea pig, however, elaborating a considerable amount of polyethenoid C_{20-22} acids, the amount being of the order of that present in the fats of Amphibia and reptiles. The saturated acids of the wild rabbit fat are likewise of the same order as those found in the fats of the tame rodents, but there is a marked difference in the proportions of the unsaturated acids present.

It appears, therefore, that the fats of the tame rodents fed on a suitable low-fat diet are generally similar, but judged from the only detailed data available there is reason to believe that the type of fat elaborated by the tame rodents is not typical of that of the wild varieties of the same species.

SUMMARY

1. The composition of the perinephric and interscapular fats of an experimental rabbit has been investigated.

2. The proportions of the component acids of both fats were very similar, the perinephric fat being somewhat the more unsaturated.

3. Both fats were broadly similar to those of other tame rodents, but differ appreciably from that recorded for a wild rabbit.

We wish to thank Prof. T. P. Hilditch, F.R.S., for his sustained interest in this investigation, and Prof. R. A. Morton, F.R.S., for placing the rabbit at our disposal.

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Studies in the Biochemistry of Micro-organisms.

84. THE COLOURING MATTERS OF *PENICILLIUM NALGIOVENSIS* LAXA. PART 1. NALGIOVENSIN AND NALGIOLAXIN. ISOLATION, DERIVATIVES AND PARTIAL STRUCTURES

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(Received 20 February 1951)

Penicillium nalgiovensis Laxa was first described by Laxa (1932), who isolated it during an examination of the microflora of Ellischauer cheese, a form of Camembert cheese peculiar to the Nalžovy region of Southern Bohemia—hence the specific name. The production of this type of cheese was started about 1880 in an attempt to reproduce the flavour and aroma of Camembert cheese. During the ripening process, the surface of the cheese is covered with white, velvet-like mycelium which gradually becomes greenish-grey in colour. The surface eventually becomes flecked with reddish patches from which cultures of *P. nalgiovensis* can be isolated. According to Laxa this mould is one of the principal species associated with the ripening process. The species is

included by Raper & Thom (1949) in the *P. canescens* series of the *Asymmetrica-divaricata*. Growth of the species on cheese and in laboratory culture, particularly on media containing proteins, is associated with the production of considerable amounts of red pigment. The species has not been reported from any other source than Ellischauer cheese.

It was noted in this laboratory that the mycelium of *P. nalgiovensis*, grown on Raulin-Thom solution, gave strong red colours when moist portions of it were immersed in cold concentrated sulphuric acid or in aqueous sodium hydroxide, and pale to light red colours when immersed in aqueous sodium carbonate. On exhaustive extraction of the dried mycelium with light petroleum an orange solid