FATTY ACID COMPONENT OF SENEGAL MANATEE FATS

SHINGO ITOH
AND
HIDEO TSUYUKI

Department of Food Engineering, College of Agriculture & Veterinary Medicine, Nihon University, Tokyo.

ABSTRACT

The fats in cerviel, thoracic and dorsal fatty tissues, and thoracic muscle tissue of Senegal manatee, *Trichechus senegalensis*, were analyzed for total lipid content and fatty acid components. Although the above three fatty tissues of Senegal manatee contained very rich amounts of fat, the muscle tissue contained consisderably small quantity of fat.

The fatty acid components of Senegal manatee fats contained high levels of $C_{14:0}$ (14.97–18.66%), $C_{16:0}$ (24.57–27.78%), $C_{16:1}$ (6.69–7.32%) and $C_{18:1}$ acids (36.86–39.75%), and had a unique proportion with higher levels of saturated acids (50.16–52.93%). Although the fatty acid component and distribution pattern in Senegal manatee fats deviated from most of marine and fresh water mammals, those was nearly closed to that of Dugong fat.

INTRODUCTION

Manatees—sea cows—are completely aquatic and live solely on vegetation beneath the water along coasts, and in estuaries and rivers. They are named as *Trichechus manatus* in rivers and off coasts of Florida to British Guiana, as *T. inunguis* in rivers of Brazil and as *T. selegalensis* in rivers of West Africa. Their adults reach up to 3 m in length and have remarkably fatty tissue body.

We have investigated the fatty acid component of Senegal manatee, *T. senegalensis*, fats. No previous studies of *T. senegalensis* fat have been reported in the literature.

Greatest thanks are due to Mr. Kazue Nakamura of the Kanagawa Prefectural Museum who was kindly enough to present us the Senegal manatee fat.

MATERIAL AND METHODS

The Senegal manatee, *T. senegalensis*, studied was caught by trawling at 60 km of upper stream from the estuary of the Gambia river of West Africa in January 1973. The mammal was an immature male of about 158.0 cm in length. The portions of cervical, dorsal and thoracic fatty tissues, and thoracic muscle tissue were cut up into small pieces and respectively extracted several times with chloroform—methanol (2: 1) using a high-speed blender. The solvent was dried with anhydrous

sodium sulfate and completely distilled off under high vacuum. The properties of recovered sample fats are shown in Table 1. Each sample fat was then subjected to preparative thin layer chromatography on 0.25 mm thick layers of silicic acid (Wakogel B—5, Wako-Junyakaku-Kogyo) developed with petroleum ether—ethyl ether—glacial acetic acid (90: 10: 1). The fats in the above three fatty tissues were almost entirely triglycerides and slightly the spots of cholesterol and cholesterol esters. On the other hand, the fat from thoracic muscle tissue was almost triglycerides similar to other sample fats. It had not only cholesterol and cholesterol esters, but also slightly phosphatides. The sample fats in cervical, dorsal and thoracic fatty tissues were softenend at 33.9–34.2°C and cleared finally at 35.4–36.0°C in 1 mm id capilary. The fat from thoracic muscle tissue was softened at 32.6–34.1°C and cleared at 35.0°C.

The sample fats converted to fatty acid methyl esters by the method of Metcalfe *et al.* (1966), using BF_3-methanol reagent. So as to purify, the fatty acid methyl esters were then subjected to preparative thin layer chromatography on 2.00 mm thick layers of Wakogel B-5 developed with petroleum ether—ethyl ether—glacial acetic acid (90: 10: 1).

TABLE 1. PROPERTIES OF DIFFERENT TISSUE FATS OF SENEGAL MANATEE.

	Fatty tissues			Thoracic muscle tissue
	Cervical	Dorsal	Thoracic	
Appearance (at 30°C)	Whitish semi-solid	Whitish semi-solid	Whitish semi-solid	Yellowish semi-solid
Oil content (%)	78.0	69.1	71.8	5.8
Refractive index (at 50°C)	1.4527	1.4531	1.4532	1.4536
Acid value	0.21	0.29	0.24	0.32
Iodine value	48.1	47.3	46.9	47.4
Saponification value	209.1	210.8	209.2	207.7
Unsaponifiables (%)	0.34	0.38	0.35	0.51

The gas liquid chromatography (GLC) analyses of methyl ester samples were performed with Shimadzu Model 4PTF apparatus using a hydrogen ionization detector under the following conditions: 267 cm by 3 mm diameter glass column containing 5% DEGS on Chromosorb W (AW, DMCS), and operating at the temparature programmed from 70–190°C, 4°C per minute for short-chain components and isothermally at the temparature 205°C for long-chain components. The carrier gas was flowed at the rate of 35 ml per minute by nitrogen gas.

The fatty acids were identified by comparison with standard mixtures (Applied Science Laboratories, Inc.) and GLC analyses with the same apparatus under the same conditions between before and after hydrogenation by platinum black reagent at the regular intervals. All fatty acid peaks were caluculated as weight percentages of total known fatty acids presented by the method of Ettre and Kabot (1962).

TABLE 2. FATTY ACID COMPONENT OF DIFFERENT TISSUE FATS OF SENEGAL MANATEE.

Fatty acids	Fatty tissues			Thoracic muscle tissue
	Cervical	Dorsal	Thoracic	
Saturated				
6:0	0.81	trace	0.72	—
8:0	0.31	0.19	0.27	0.16
10:0	3.14	1.59	2.52	2.09
12:0	1.65	1.30	1.54	1.70
Iso 14:0	0.04	trace	trace	0.05
14:0	15.98	14.97	18.66	15.72
15:0	0.50	0.28	0.42	0.33
Iso 16:0	0.31	0.37	0.35	0.08
16:0	24.82	27.78	24.57	26.12
17:0	0.54	0.47	0.36	0.55
18:0	2.73	2.53	2.77	2.84
19:0	0.09	0.05	0.04	0.02
20:0	0.74	0.63	0.70	0.54
Total saturated	51.66	50.16	52.93	50.21
Monounsatrated				
12:1	0.14	trace	0.09	0.11
14:1	0.41	0.28	0.36	0.33
16:1	7.18	7.30	6.69	7.32
18:1	37.60	39.75	36.86	39.17
20:1	0.33	0.21	0.25	0.21
22:1	0.26	0.20	0.19	0.24
Total monounsaturated	45.92	47.74	44.71	47.38
Polyunsaturated				
14:2	0.36	0.27	0.35	0.33
16:2	0.24	0.42	0.28	0.30
16:3	0.49	0.42	0.43	0.46
18:2	0.32	0.22	0.34	0.41
18:3	0.41	0.28	0.40	0.51
20:2	0.20	0.22	0.24	0.13
20:3	0.04	0.05	0.03	0.02
20:4	0.06	0.04	0.04	0.02
22:2	0.06	0.05	0.04	0.05
22:3	0.04	trace	0.02	0.01
22:5	0.09	0.06	0.08	0.07
22:6	0.11	0.07	0.11	0.10
Total polyunsaturated	2.42	2.10	2.36	2.41
	100.00	100.00	100.00	100.00

RESULTS AND DISCUSSION

The properties of fats extracted from different tissues of the experimental Senegal manatee are shown in Table 1. High amounts of fat content were observed in cervical, dorsal and thoracic fatty tissues as 78.0%, 69.1% and 71.8% respectively. But thoracic muscle tissue contained only a small amount fat of 5.8%. It can be

seen that other properties are nearly closed to each other.

The fatty acid components of fats contained in different tissues of the African manatee are listed in Table 2. The sample fats were found to consist of 31 kinds of fatty acids with 6 to 22 carbon atoms, but the proportion of $C_{6:0}$ acid absents in thoracic muscle tissue fat. The fatty acid components and distribution patterns were very closed to each other. High amounts of $C_{14:0}$ (14.97–18.66 %), $C_{16:0}$ (24.57–27.78 %), $C_{16:1}$ (6.69–7.32 %) and $C_{18:1}$ acids (36.86–39.75 %) were observed in all tissue fats. The combined percentages of $C_{14:1}$, $C_{16:0}$, $C_{16:1}$ and $C_{18:1}$ acids were respectively 85.58 % of cervical fat, 89.80 % of dorsal fat, 87.05 % of thoracic fat and 91.53 % of thoracic muscle fat in total each fatty acid. The main constituents of the saturated acid were similarly $C_{14:0}$ and $C_{16:0}$ acids whereas the monounsaturated acids were $C_{18:1}$ and $C_{16:1}$ acids. The least amounts of polyunsaturated acids with more than double bonds were contained 2.42 % of cervical fat, 2.10 % of dorsal fat, 2.36 % of thoracic fat and 2.41 % of thoracic muscle fat. It is interesting to note that 97.58 %–97.90 % of total fatty acids were only saturated and monounsaturated acids. The African manatee fats consist of the highest amounts of total saturated acids. The ratio of total saturated acids *vs* unsaturated acids is about half and half as followed: 51.66 % *vs* 48.34 % of cervical fat, 50.16 % *vs* 49.84 % of dorsal fat, 52.93 % *vs* 47.07 % of thoracic fat and 50.21 % *vs* 49.79 % of thoracic muscle fat, respectively.

In the comparison with the fat contained in Dugong, *Halicore dugong* (Tsuyuki and Itoh, 1967), the Senegal manatee fats are most nearly allied to its fat. The Dugong fat was observed the high amounts of $C_{14:0}$ (9.8 %), $C_{16:0}$ (23.0 %), $C_{16:1}$ 7.7 %) and $C_{18:1}$ acids (41.3 %) being similar to the Senegal manatee fats. The fatty acids of $C_{10:0}$ (0.1 %), $C_{12:0}$ (0.2 %) and $C_{14:0}$ (9.8 %) contained in the Dugong fat were slightly smaller levels than those of the Senegal manatee fats. But the fatty acids of $C_{14:0}$ (0.8 %), $C_{14:2}$ (0.9 %), $C_{16:2}$ (1.6 %), $C_{17:0}$ (1.2 %), $C_{18:2}$ (3.4 %) and $C_{18:3}$ (4.1 %) contained in the Dugong fat were reversely higher levels than those of the Senegal manatee fats. It is a point of interest that the fatty acids with more than 20 carbon atoms were not observed in the Dugong fat with exception of $C_{20:0}$ (1.7 %) and $C_{20:4}$ (1.5 %). Although the fatty acid component and distribution pattern between the Senegal manatee and the Dugong fats were nearly symmetrical for most fatty acids, those deviated from most of marine and fresh water mammal fats.

一般財団法人 日本鯨類研究所
THE INSTITUTE OF CETACEAN RESEARCH

SUMMARY

1. The properties of fats contained in different tissues of Senegal manatee, *T. senegalensis*, was studied.

2. The fatty acid components of different fatty tissues and muscle tissue fats extracted from the mammal had been determined by GLC analysis.

3. It was confirmed that four main fatty acids of $C_{14:0}$, $C_{16:0}$, $C_{16:1}$ and $C_{18:1}$ accounted about 90 % of total fatty acids in those tissue fats; 26 others were found in only low quantities.

4. The Senegal manatee fat was nearly similar to the Dugong fat in the fatty acid component and distribution pattern.

REFERENCES

ETTRE, L. S. and F. J. KABOT, 1963. Relative response of fatty acid methyl esters on the flame ionization detector. *J. Chromatog.*, 11: 114–116.

METCALFE, L. P., A. A. SCHMITZ and L. R. PELKA, 1966. Rapid preparation of fatty acid esters from lipids for gas chromatographic analysis. *Anal. Chem.*, 38: 154–155.

TSUYUKI, H. and S. ITOH, 1967. Fatty acid composition of the Dugong oil. *Bull. Jap. Soc. Sci. Fish.*, 33: 1035–1037.

ICR
一般財団法人 日本鯨類研究所
THE INSTITUTE OF CETACEAN RESEARCH