FATTY ACID COMPOSITION OF FINLES PORPOISE OIL*

HIDEO TSUYUKI** AND SHINGO ITOH**

INTRODUCTION

The Finlesp orpoise, *Neomeris phocaenoides*, belongs to the porpoise family and is the smallest of these family. They grow up body length 1.0–1.3 metres and inhabits in the Indian ocean; from the Cape of Good Hope to Japan, and in Japanese water; Setonaikai, Shikoku, Kyūshū. They live on crastacean, cephalopoda and small fishes, and independently are in no group.

The literature on the porpoise oils seems to have been a few, but it has been reported only simple properties of oil.

The writers report here the component fatty acid of Finles porpoise oil that is analyzed by gas-liquid chromatograph using a hydrogen ionization detector.

The writers wish to express here their thanks to President of The Whales Research Institute, Prof. Dr. Hideo Omura who is kind enough to present us Finles porpoise.

MATERIAL AND METHOD

Sample used

The Finles porpoise used in this experiment was caught in October 1963 at the Hashirimizu of Miura-peninsula, Kanagawa Prefecture, Japan. The sample was frozen as a part of the Finles porpoise, and it was male, but it was unknown about age, body length, body weight etc. The oil was extracted by boiling the material with water from the frozen part and the properties were examined by ordinary methods. These are shown in Table 1.

Preparation of fatty acid methyl ester

The sample oil was converted to fatty acid methyl ester by alkali-catalyzed methanolysis and the obtained methyl ester was refined by silicic acid column according to the procedure of Sano *et al.* (1965, 1966) with the following modification.

The sample oil was soluted in 50 ml of *n*-hexane, and also 10 ml of anhydrous methanol and 2 ml of 1/2 N-potassium hydroxide methanol solution as catalyzer were added. Then, the procedure were conducted on magnetic-stirrer in nitrogen atmosphere for 1.5 hours with periodic mixing. After the procedure, half-saturated sodium chloride solution was added, extracted by *n*-hexane and was washed with water and evaporated after adding anhydrous sodium sulfate. As result, crude

* An outline of this article was presented the Annual Meeting of Japanese Socity of Scientific Fisheries, Tokyo, April 3, 1967.

** Department of Food Engineering, College of Agriculture & Veterinary Medicine, Nihon University (34–1, 3–chome, Shimouma, Setagaya, Tokyo, Japan).

TABLE 1. PROPERTIES OF FINLES PORPOISE OIL

Appearance (at 30°C)	Yellowish orange liquid
Oil content (%)	62.7
Refractive index (at 40°C)	1.4727
Specific gravity (at 26°C)	0.9435
Viscosity (at 50°C)	0.4970
Acid value	2.7
Iodine value (Wijs)	91.3
Saponification value	208.0
Unsaponifiables (%)	0.80

fatty acid methyl ester was obtained. Then, for the purpose of removal of colesterol, colouring material, impurities etc., the crude methyl ester was once again soluted in 5 ml of *n*-hexane, and passed through in glass column (in diameter 1.0 cm) packed with 2.0 grams of silicic acid activated at 120°C for half an hour. The glass column was washed with 60 ml of 2 % ethyl ether-*n*-hexane. The solution extracted by 2 % ethyl ether-*n*-hexane was added anhydrous sodium sulfate and then evaporated. The refined methyl ester was obtained in amount of 4.0 grams which was no smell and colourless, and was used in gas-liquid chromatograph analysis.

In addition, all procedures were conducted in nitrogen atmosphere, including release of a vacuum in the evaporating steps.

Gas-liquid chromatograph apparatus and conditions

Gas-liquid chromatograph apparatus used in this experiment was conducted on a dual-column Shimadzu Gas Chromatograph Apparatus, Model GC-IC, using a hydrogen flame ionization detector. A stainless steel, U sharped column, 225 cm long and 3 mm in diameter, was packed with 20 % diethylene glycol succinate (DEGS) on Shimalite at 1.85kg/cm^2. The column oven was maintained at 215°C, and the flow rate of nitrogen gas was 72–76ml/min. The injector temperature was 260°C and detector temparature 240°C.

The individual fatty acid peaks were identified by comparing retention time with those in a known mixture of standard fatty acids, and semilogarithmic plots of carbon number *vs* relative retention time were used for identification by method of Nelson *et al.* (1960).

The identification of the unsaturated acids was checked further by hydrogenation over platinum black followed by gas-liquid chromatograph on the same condition.

All fatty acids are reported as weight percentages of the total known fatty acids presented by method of Magidman *et al.* (1962).

RESULTS AND DISCUSSION

The data obtained 26 of fatty acids as shown in Table 2. In these, saturated fatty acids are as follows; C_8, C_{10}, C_{12}, C_{13}, C_{14}, C_{15}, C_{16}, C_{18}, C_{19} and C_{20}, and unsaturated fatty acids are as follows; C_{12} monoenoic, C_{14} monoenoic, C_{14} dienoic, C_{16} monoenoic, C_{16} dienoic, C_{16} trienoic, C_{18} monoenoic, C_{18} dienoic, C_{18} trienoic, C_{20}

TABLE 2. FATTY ACID COMPOSITION OF FINLES PORPOISE OIL

Fatty acid No.	Weight per cent of total fatty acid
8	0.1
10	0.2
12-branched	0.3
12	0.9
12–1	0.7
13	0.2
14-branched	0.4
14	8.4
14–1	4.1
14–2	0.7
15	1.1
16	7.2
16–1	26.9
16–2	1.9
16–3	1.2
18	0.9
18–1	20.4
18–2	2.1
18–3	2.0
19	1.6
20	1.8
20–1	1.4
20–3	1.7
20–4	4.6
22–5	3.9
22–6	5.3

TABLE 3. A COMPARISON OF SATURATED AND UNSATURATED FATTY ACID OF FINLES PORPOISE OIL

Fatty acid No.	Weight per cent of total fatty acid	
	Saturated	Unsaturated
8	0.1	—
10	0.2	—
12	1.2	0.7
13	0.2	—
14	8.8	4.8
15	1.1	—
16	7.2	30.0
18	0.9	24.5
19	1.6	—
20	1.8	7.7
22	—	9.2
Total	23.1	76.9

monoenoic, C_{20} trienoic, C_{20} tetraenoic, C_{22} pentaenoic and C_{22} hexaenoic. Moreover, there are branched-saturated fatty acids of C_{12} and C_{14}.

In the aspect of percentages of total fatty acids, the prominent fatty acid is C_{16} monoenoic (26.9%), the next prominent is C_{18} monoenoic (20.4%). Other per-

centages of component fatty acids were in order of high content as follows; saturated C_{14} (8.4%), saturated C_{16} (7.2%), C_{22} hexaenoic (5.3%), C_{20} tetraenoic (4.6%), C_{14} monoenoic (4.1%), C_{22} pentaenoic (3.9%), C_{18} dienoic (2.1%), C_{18} trienoic (2.0%), C_{16} dienoic (1.9%), saturated C_{20} (1.8%), C_{20} trienoic (1.7%), saturated C_{19} (1.6%), C_{20} monoenoic (1.4%), C_{16} trienoic (1.2%), saturated C_{15} (1.1%), saturated C_{12} (0.9%), saturated C_{18} (0.9%), C_{12} monoenoic (0.7%), C_{14} dienoic (0.7%), branched saturated C_{14} (0.4%), branched saturated C_{12} (0.3%), saturated C_{10} (0.2%), saturated C_{13} (0.2%), and saturated C_8 (0.1%).

Viewing in comparison of saturated and unsaturated fatty acids (shown in Table 3), the total of saturated fatty acids is 23.1%, on the other hand, the total of unsaturated fatty acids is 76.9%.

SUMMARY

1) The properties of Finles porpoise oil were studied.

2) Fatty acid composition of Finles porpoise oil was analyzed by gas-liquid chromatograph using a hydrogen ionization detector on a DEGS column.

3) The results obtained are as follows;

Total saturated fatty acids	23.1%:
octanoic	0.1%
decanoic	0.2%
dodecanoic	0.9%
dodecanoic (branched)	0.3%
tridecanoic	0.2%
tetradecanoic	8.4%
tetradecanoic (branched)	0.4%
pentadecanoic	1.1%
hexadecanoic	7.2%
octadecanoic	0.9%
eicosanoic	1.8%
Total unsaturated fatty acids	76.9%:
C_{12} monoenoic	0.7%
C_{14} monoenoic	4.1%
C_{14} dienoic	0.7%
C_{16} monoenoic	26.9%
C_{16} dienoic	1.9%
C_{16} trienoic	1.9%
C_{18} monoenoic	20.4%
C_{18} dienoic	2.1%
C_{18} trienoic	2.0%
C_{20} monoenoic	1.4%
C_{20} trienoic	1.7%

C_{20} tetraenoic	4.6%
C_{22} pentaenoic	3.9%
C_{22} hexaenoic	5.3%

REFERENCES

HERB, S. E. MAGIDMAN. P. LUDDY, F. E. and RIEMENSHNEIDER, R. W. (1962). Fatty acid cow milk, II. Composition by gas-liquid chromatograph aided by other methods of fractionation. *J. Am. Oil Chemists' Soc.*, 39: 142–146.

NELSON, G. J. and FREEMAN, N. K. (1960). Phospholipide and phospholipide-fatty acid component of human serum lipoprotein fractions. *J. Biol. Chem.*, 235: 578–583.

SANO, Y. AYUKAWA, D. and MURASE, K. (1965). Studies on the Antarctic whale oils by gas-liquid chromatography using a hydrogen ionization detector. II. *J. Japan Oil Chemists' Soc.*, 14: 171–178.

SANO, Y. (1966) Studies on the Antarctic whale oils by gas-liquid chromatography using a hydrogen ionization detector. III. *J. Japan Oil Chemists' Soc.*, 15: 99–108.