SEAL MEAT: A POTENTIAL SOURCE OF MUSCLE FOOD OR WASTE?

FEREIDOON SHAHIDI AND JOZEF SYNOWIECKI

Department of Biochemistry, Memorial University of Newfoundland, St. John's, Newfoundland, Canada, A1B 3X9

SUMMARY

Harp seal (Phoca groenlandica) is harvested during May-July of each year in the coastal areas of Newfoundland and Labrador. While the pelts and blubber fat layers are widely used, utilization of seal meat is very limited. Lack of information on the nutritional quality of seal meat may be a contributing factor. Thus, the chemical composition of seal meat and products thereof were investigated. Results indicated that seal meat had a protein content ranging from 21.6 to 24.3%. Its fat content varied from 1.1 to 2.1%. The amino acid composition of seal meat was well-balanced, and its intramuscular lipid components may serve as a rich source of omega-3 fatty acids. The content of haemoproteins in seal meat varied from 5.3 to 9.1%. The dark colour and the intense flavour of comminuted seal meat was modified by an aqueous washing process. The washed mince so obtained had reduced levels of haemoproteins (0.1 to 0.4%) and flavour intensity.

INTRODUCTION

Seals belong to the Pinnipedia, the group of "fin-footed" animals which also includes walruses, sea lions, and fur seals. The pinnipedia are hairy, warm-blooded, air-breathing mammals. They are insulated from the cold by a thick layer of blubber under their skin. Although they are well used to life in the sea, they return to the land or ice for giving birth to their young or to rest. Seals usually give birth to one pup and are suckled by the mother for several month after birth. The milk is very rich in fat (Mansfield, 1967).

Harp seal (Phoca groenlandica) is found in abundance in the southern Labrador and in the Gulf of St. Lawrence. Their population is estimated at 2.5 million heads in this area. The total allowable catch of harp seals at the present time is 186,000 heads annually. However, in recent years only 60,000 to 70,000 heads have been hunted (Shahidi et al. 1990). Hunting of pups is banned by regulation.

The major primary products of seal include seal oil rendered from blubber and seal pelts. The consumption of seal meat, particularly flippers, is generally confined mainly to Newfoundland. Some seal carcass meat is also sold in canned form in Newfoundland. The rest is either dumped or is reduced to silage.

Underutilization of seal meat may be due to a) lack of information about it nutritional quality and b) the dark colour and intense flavour associated with it.

As part of a program to investigate the quality of seal meat, chemical composition, pigment content and colour characteristics, and amino acid composition of mechanically separated seal meat (MSSM) were determined. Effect of aqueous washing on the colour and flavour intensity of the comminuted seal meat was also studied.

MATERIALS AND METHODS

Materials

Seals were slaughtered during the months April-July. They were bled, skinned, blubber removed and eviscerated. Subsequently they were placed inside plastic bags and stored in iced containers for up to 3 days. The carcass was washed with a stream of cold tap water for about 15 seconds to remove the residual blood and was then trimmed of most of its surface fat.

Seal meat was separated either manually or by mechanical means from the carcass. In manual separation the cuts of meat after deboning were ground twice using an Oster meat grinder (Braun AG, Model KGZE, Frankfurt, West Germany) through a 7 and then a 4 mm grind plate. Other samples were mechanically deboned using a Poss deboner (Poss Limited, Model PDE 500, Toronto, Canada). Small portions of comminuted seal meat, separated by manual or mechanical means, were vacuum packed and kept frozen at -20°C until use.

The mechanically separated seal meat (MSSM) was washed 3 times, sequentially, with water using a water to meat ratio of 3:1 (v/w). Other samples were washed twice with a 0.06% and then a 0.3% NaCl solution at a solvent to meat ratio of 3:1 (v/w). Washings were carried out at 2°C for approximately 10 min. The washed meat was then collected and pressed to reach an acceptable moisture level.

Methods

Moisture content was determined by oven drying of about 2 g of the sample at 105°C to a constant weight. Crude protein content was calculated as the total nitrogen (N) determined by the AOAC (1980) method (i.e., N x 6.25). The ash content was determined according to the AOAC (1980) procedure.

Total lipids were extracted according to Bligh and Dyer (1959). The hemoprotein pigments were extracted into a 0.001 M acetate buffer at pH = 4.5 and their content was determined spectrophotometrically at λ = 540 nm according to Rickensrud and Henrickson (1967).

The individual amino acids were determined after the hydrolysis of the freeze-dried samples for 24 h at 110°C with 6 N HCl (Blackburn 1968) and then separating the amino acids on a Beckman 121MB amino acid analyzer. Tryptophan was determined separately according to the method of Penke *et al*. (1974). The tristimulus colour parameters, L (lightness/darkness, 100 for white and 0 for black), a (red, +; green, -) and b (yellow, +; blue, -) of the top surfaces of meat samples were measured with an XL-20 colorimeter (Gardner Laboratory, Inc., Bethesda, MD). Standard plate No. XL20-167C with Hunter "L" value of 92.0, "a" value of -1.1, and "b" value of 0.7 was used as reference.

Subjective evaluation of colour and flavour intensity of unwashed and washed seal meat was performed using a 10-point scale system. In this system, 1 refers to the least and 10 to the most intense attributes.

RESULTS AND DISCUSSION

The recovery of seal meat from beaters was over three times higher when mechanical means of separation were employed. Yields of 82±3% were obtained for mechanically separated meats whereas manual separation afforded an average yield of 24±1% from dressed carcasses (Shahidi *et al*. 1990).

Proximate composition of seal meat is given in Table 2. Results indicate that seal meat is reasonably lean in nature and has a high protein content ranging from 21.6 to 24.3%. Mechanical separation resulted in an increase in the lipid and ash content of the recovered meat. Thus, the lipid content of MSSM ranged from 4.6 to 6.1% whereas manually separated meat had a total lipid content of 1.1-2.1%. Incorporation of lipids from bone marrow and residual bone particles in the MSSM were responsible for enhanced lipid and ash content in the resultant products, respectively (Table 2).

A comparison of the crude protein, lipid and moisture content of seal meat with other animal muscles is provided in Table 3. The protein content of seal meat generally exceeded those of beef, pork, cod and herring (Botta *et al*. 1982; Schweigart, 1987). The fat content of intact seal muscles only exceeded that of cod, but it was much less than those of beef, pork and herring. The moisture content of seal meat was similar to those of beef and pork (Schweigart, 1987).

The composition of essential amino acids of seal meat, separated manually or by mechanical means, is summarized in Table 4. Results indicate that mechanical separation of the flesh had no significant influence on the content of essential amino acids. Furthermore, the content of these essential amino acids in seal meat was equal or exceeded those of beef and pork proteins (Rice, 1971).

Seal meat possesses a very dark colour and an intense fishy flavour. Thus, the effect of aqueous washing on the colour and flavour characteristics of MSSM was investigated. Results shown in Table 5 indicate that over 95% of the hemoproteins present in seal meat could be removed by washing the product thrice with water or saline solutions. This in turn resulted in lightening of the colour of the resultant product, as indicated by both subjective and objective methods of determination (Table 6). The resultant washed meats had a more desirable beefish colour. However, the flavour intensity of the final products were not improved to any great extent.

CONCLUSIONS

Results presented here indicate that seal meat is an important source of protein with a well-balanced amino acid composition. Its dark colour could be improved by a washing process and its flavour, although not affected much by washing, could perhaps be modified by incorporation of suitable seasonings. The meat is very lean in nature and its lipids are known to have a high content of long-chain omega-3 fatty acids which are recognized for their beneficial health effects. Thus, seal meat may be considered as an excellent source of muscle food suitable for human consumption.

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Table 1. Glossary of Age Classes of Harp Seal

Newfoundland Name	Age	Colour of Coat
Whitecoat	< 2 weeks	white natural fur
Beater	3 weeks to < 1 year	fully moulted pup with spotted grey fur
Bedlamer	1-4 years	immature seal with spotted grey fur
Harp	≥ 5 years	grey

Table 2. Proximate Composition of Seal Meat

Composition	Meat Separated	
	Manually	Mechanically
Moisture	73.6 - 73.8	72.4 - 75.1
Crude Protein, N x 6.25	22.2 - 22.5	21.8 - 24.3
Lipid	1.1 - 2.1	4.6 - 6.1
Ash	1.00 - 1.01	1.55 - 2.09
Hemoprotein Pigments	5.3 - 9.1	5.7 - 5.9

Table 3. Composition of Seal Meat as Compared with Some Other Animal Muscles

Species	Crude Protein	Total Lipid	Moisture
Harp Seal	21.6 - 24.3	4.1 - 6.1	72.4 - 75.1
Beef[a]	20.3	4.6	74.0
Pork[a]	20.7	7.1	71.5
Cod[a]	17.4	0.7	82.1
Herring[a]	16.8	18.5	63.9

[a]According to Botta et al. (1982).

Table 4. Essential Amino Acid Composition of Seal Meat from Beaters

Amino Acid	Manually Separated	Mechanically Separated
Histidine	5.0 ± 0.1	5.0 ± 0.1
Isoleucine	5.1 ± 0.1	4.6 ± 0.1
Leucine	7.5 ± 0.2	7.4 ± 0.1
Lysine	9.1 ± 0.1	8.7 ± 0.2
Methionine	2.0 ± 0.1	1.7 ± 0.1
Phenylalanine	4.7 ± 0.1	4.6 ± 0.1
Threonine	4.4 ± 0.1	4.5 ± 0.1
Tryptophan	1.1 ± 0.0	1.2 ± 0.0
Valine	5.9 ± 0.1	5.8 ± 0.1

Table 5. Removal of Hemoproteins in MSSM by Washing

Meat	% Removal
Unwashed MSSM	-
Washed 3x with H_2O	95.1
Washed 2x with 0.06% NaCl and then 1x with 0.3% NaCl	97.6

Table 6. Effect of Washing on Colour and Flavour Intensity of MSSM

Meat	Flavor Intensity[a]	Colour Intensity[a]	Hunter Value		
			L	a	b
Unwashed MSSM	7.0	9.0	17.25	5.25	2.11
Washed 3x with H_2O	5.0	5.0	36.12	8.73	8.20
Washed 2x with 0.06% NaCl and 1x with 0.3% NaCl	5.0	4.5	40.60	8.70	9.60

[a] Values are on a 10-point scale where 1 refers to extremely low flavour intensity or light colour and 10 to extremely high flavour intensity or dark colour.