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RESEARCH NOTE

Nucleic acid content of seal meat

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The contents of total nucleic acids, deoxyribonucleic acid (DNA) and ribonucleic acid (RNA), in seal meat and as affected by mechanical deboning or aqueous/saline washings were determined. Ribonucleic acids were the major contributors to the total nucleic acids of seal meat while they are generally the minor components of nucleic acids in bovine muscles. Mechanically separated seal meat (MSSM) had a larger content of nucleic acids than manually separated seal muscles. Thus, the concentration of DNA and RNA increased from 0·6 and 1·3 to 1·1 and 1·9–2·3 mg/g meat, respectively. Washing had a beneficial effect in decreasing the content of nucleic acids in the prepared products.

INTRODUCTION

It has been shown that seal meat has a well-balanced protein composition and its lipids contain a high proportion of omega-3 polyunsaturated fatty acids. In particular it is of interest to notice reduced incidences of heart diseases in the Eskimo population in Northern Canada where seal meat is regularly consumed.

The recovery yield of meat from carcasses of seal was increased from about 22% to over 80% by mechanical deboning. Mechanically separated seal meats (MSSM) contained varying amounts of bone marrow and some bone particles forced through the screen which separate bones from muscle proteins. Bone marrow is the main site of blood cell formation and, therefore, it is the tissue with a high content of nucleic acids. The MSSM had a high protein content and a well-balanced amino acid distribution which was better than, or equivalent to, those from beef and pork (Shahidi *et al.* 1990). These findings were in good agreement with those reported by Botta *et al.* (1982).

In humans, the purine portion of nucleic acids is degraded to uric acid which has low solubility at the physiological pH and is poorly extracted by the urinary system. It can result in the formation of urate crystals in tissues and joints as well as stone deposition in the urinary system. The Protein Advisory Group (1970) has suggested that presence of 2 g nucleic acids per day in the normal diet would be an upper safe limit for healthy young adults.

The purpose of this study was to quantify nucleic acids in mechanically separated seal meat (MSSM) and surimi-like products prepared from MSSM and to determine if nucleic acid levels in such products are high enough to be considered as nutritionally hazardous.

MATERIALS AND METHODS

Beaters, seals of up to 1 year old, and bedlamers of 1 to 4 years old, were bled, skinned, blubber fat removed and eviscerated. Seal carcasses were placed inside plastic bags and stored in iced containers for up to 3 days. Then, the carcasses were washed with a stream of cold water for about 15 s to remove the surface residual blood and were trimmed of most of their subcutaneous fat. Seal meat from carcasses was then separated mechanically using a deboner model PDE 500, POSS Limited, Toronto, Ontario. Small portions of separated meat were vacuum packed and kept frozen at −20°C until use.

Mechanically separated seal meat (MSSM) was washed once with water (pH = 5·9 to 6·0) using a water to meat ratio of 3:1 (v/w). Other samples were washed twice with 0·06% and then 0·3% NaCl solution at a solvent to meat ratio of 3:1 (v/w). Each washing was done at a temperature of 2°C for 10 min while stirring manually. The washed meat was then collected by centrifugation at 2000 × *g* for 5 min.

Deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) were extracted as described by Schmidt–Thannhauser (1945) and as modified by Munro and Fleck (1966). DNA in the extract was determined by the indole procedure of Ceriotti (1952).

RNA was determined by ultraviolet spectrophotometry at 260 nm using a Beckman DU-8 spectrophotometer. Protein interference at this wavelength was eliminated by applying a correction factor of 0·001 absorbance unit per 1 μg/ml protein concentration in RNA extracts. The phenol-biuret procedure of Lowry *et al.* (1951) was used to measure the protein concentrations. Calf Liver RNA and Calf Thymus DNA from Sigma Chemical Company, were subjected to the same treatments as the tissue extracts and were used as standards in this study.

RESULTS AND DISCUSSION

Table 1 shows that the total content of nucleic acids and DNA in manually separated seal meat are comparable with those in bovine muscle, determined by Trenkle *et al.* (1978), Guenther *et al.* (1979) and Arasu *et al.* (1981). RNA content in manually separated seal meat was about 1 mg/g higher than that in beef muscle. These differences may be caused not only by the species but also by age, sex and nutritional and diet regime of the animal. The influence of these factors on the content of nucleic acids has been reported by Davidson (1947).

The total nucleic acids content in MSSM varied from 2·91 to 3·36 mg/g of meat, and was much lower than those in mechanically separated beef (8·33 mg/g meat).

Table 1. Nucleic acid contents in seal meat[a]

Sample	mg/g sample		
	DNA	RNA	Total
1-year old beater, female	0·61 ± 0·03	1·36 ± 0·28	1·97
1-year old beater, female	0·53 ± 0·02	1·32 ± 0·04	1·85
1-year old beater, male	0·59 ± 0·02	1·39 ± 0·05	1·98
MSSM, Lot No. 2	1·10 ± 0·13	2·26 ± 0·11	3·36
MSSM, Lot No. 3	1·09 ± 0·01	1·82 ± 0·04	2·91
MSSM washed 1 × H_2O	0·95 ± 0·06	1·87 ± 0·23	2·82
MSSM washed 2 × 0·06% then 0·3% NaCl solutions	0·61 ± 0·06	1·02 ± 0·06	1·63
Bovine *longissimus* muscle[b]	1·40	0·37	1·77
Cattle *longissimus* muscle[c]	0·35	0·36	0·71
Longissimus muscle from cattle of different age[d]	0·49–0·58	—	—
Bovine, mechanically deboned meat[b]	7·60	0·73	8·33

[a] Results are mean values of four determinations ± standard deviation. MSSM, mechanically separated seal meat.
[b] From Arasu *et al.* (1981).
[c] From Trenkle *et al.* (1978).
[d] From Guenther *et al.* (1979).

This is perhaps due to the fact that a smaller amount of bone marrow was present in MSSM than that present in mechanically separated beef.

First washing of MSSM with H_2O, at pH = 5·9, decreased the amount of nucleic acids in seal meat by about 16%, from 3·36 to 2·83 mg/g of sample. More effective for removal of nucleic acids was washing of MSSM with 0·06% and then 0·3% NaCl solutions. After these washings the total nucleic acids content of MSSM decreased by 44%, from 2·91 to 1·63 mg/g of sample.

The safe upper limit of nucleic acids consumption for young adults is 2 g per day. This amount of nucleic acids is contained in 595 g of MSSM, as compared with 240 g of mechanically deboned beef.

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