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COMPOSITION AND STABILIZATION OF SHARK LIVER OIL EXTRACTS OF SELECTED SHARK SPECIES

by

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DECLARATION

"The work described in this thesis was carried out by me under the supervision of Professor A. Bamunuarachchi (Department of Chemistry, University of Sri Jayawardanepura, Nugegoda, Sri Lanka) and Dr. W. M. K. Perera (Senior Research Officer, Institute of Post Harvest Technology, National Aquatic Resources Research and Development Agency , Colombo 15, Sri Lanka) and the report on this has not been submitted to any university for another degree".

Date : 1999-11-11

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DECLARATION OF THE SUPERVISORS

"We certify that the above statement made by the candidate is true and that this thesis is suitable for submission to the University for the purpose of evaluation"

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

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ABSTRACT

COMPOSITION AND STABILIZATION OF SHARK LIVER OIL EXTRACTS OF SELECTED SHARK SPECIES.

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ABSTRACT

In the recent years, scientists have given more emphasis on the use and stability of fish lipid in the food industry as it consists of unsaturated fatty acids with distinct health and pharmaceutical value. This thesis presents the results of a series of experiments carried out on shark liver oil with regard to its composition, extraction methods, seasonal variations of oil content and stabilization using natural antioxidants.

Liver samples of fifteen shark species landed in the West coast of Sri Lanka were analyzed for proximate composition. Silky shark (*Carcharhinus falciformis*), Hammerhead shark (*Sphyrna lewini*) and Oceanic white tip shark (*Carcharhinus longimanus*) were selected for further studies as they have been identified as the predominant species with comparatively high liver oil content.

As the quality of raw livers has an affect on the oil quality, selection of fresh livers for oil extraction is very important. Organoleptic score card developed in the present study categorized 4.3% of the livers as best in quality while 30.4, 56.5 and 8.7 percentages as good, medium and poor in quality respectively at landing sites of Negombo and

Beruwala. Icing (0°C) and good handling practices on board would help to maintain the freshness of livers for more than 15 days.

Fatty acid composition of liver oil of three species were determined. Palmitic acid (C16:0; 22-26%) was dominant followed by oleic (C18:1; 13-23%) out of twenty fatty acids identified. Significantly ($p<0.05$) highest n-3 poly unsaturated fatty acids(PUFAs) recorded by silky shark (*Carcharhinus falciformis)* (27.4%) followed by hammerhead (*Sphyrna lewini)* (24.6%) and oceanic white tip (*Carcharhinus longimanus)* (20.2%) sharks. The contribution of eicosapentaenoic and docosapentaenoic acids for the total n-3 PUFAs by the three shark species was very high. Oceanic white tip (*Carcharhinus longimanus)* contributed highest value (94%) while hammerhead *(Spyrina lewini)* and silky shark (*Carcharhinus falciformis)* contributed (85%) and (77%) respectively. The ratio of n-3/n-6 was highest (6) in oceanic white tip shark (*Carcharhinus longimanus)* liver oil. The variation pattern of liver oil content of silky (*Carcharhinus falciformis)* and hammerhead *(Sphyrna lewini)* shark species showed more over similar and high values in December and law values in March - April. But, oceanic white tip shark (*Carcharhinus longimanus)* showed peak values in October. Results of this study revealed that liver oil content varies with the species, season and gender.

Influence of extraction methods ie., steam rendering, wet rendering, incubation, alkali digestion and acid silage on the quality and yield of shark liver oil was determined. Results suggested that extraction of oil using steam rendering and ensilage methods are suitable to be introduced as small - scale industry to coastal communities in Sri Lanka.

Influence of natural antioxidants ie., tamarind (*Tamarindus indica)*, garcinia (*Garcinia cambogia)* and bilin (*Averrhoa bilimbi)* and butylatedhydroxy toluene (BHT) on quality of liver oil extracted by ensilage and steam rendering methods was studied. The results showed the possibility of obtaining high quality liver oil using bilin (*Averrhoa*

bilimbi) juice during the extraction of oil by ensilage method and butylated hydroxy toluene (BHT) (200 ppm) in steam rendering extraction procedures.

Shark liver oil was treated with ethanolic extracts of turmeric (rhizome of *Curcuma domestica)*, tamarind (fruit and seeds of *Tamarindus indica*) and synthetic antioxidants (BHT and ascorbic acid) to determine the effectiveness of treatments as antioxidants. Turmeric *(Curcuma domestica)* turned out to be the most effective. A level of less than 250 ppm of ethanolic extract of turmeric *(Curcuma domestica)* was sufficient to prevent oil oxidation and comparable to 200 ppm of BHT.