UNIVERSITI PUTRA MALAYSIA

DEVELOPMENT OF FISHBURGERS FROM Selaroides leptolepis, Aristichthys nobilis AND Alutera monoceros

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DEVELOPMENT OF FISHBURGERS FROM *Selaroides leptolepis, Aristichthys nobilis* AND *Alutera monoceros*

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MASTER OF SCIENCE
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DEVELOPMENT OF FISHBURGERS FROM *Selaroides leptolepis*,
*Aristichthys nobilis* AND *Alutera monoceros*

BY
SIAH WATT MOEY

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DEVELOPMENT OF FISHBURGER FROM Selaroides leptolepis, Aristichthys nobilis AND Alutera monoceros

by

SIAH WATT MOEY

1997

Chairman : Prof. Dr Yu Swee Yean
Faculty : Food Science and Biotechnology

Selaroides leptolepis, Aristichthys nobilis and Alutera monoceros were used to develop frozen fish product aimed at fastfood outlets and households. At the idea generation stage, 24 product ideas were generated. The 24 product ideas were reduced to three using a series of scoring techniques for screening. Fishburgers were chosen for further development. The formulation for fishburger was established using a sensory panel. A final consumer testing of the product was carried out in a nearby housing area. A sample size of 60 households was used. Results showed that the market potential for this product is expected to be very good as 75% of the respondents are willing to buy this product if it is in the market. The acceptable price range is RM 5.50 to RM 6.50. Fishburgers packed in LDPE bags, PP semi rigid containers and PS tray overwrapped with LDPE cling film were acceptable after 18
weeks of storage at -20 °C. The storage quality in terms of thiobarbituric acid no (TBA), trimethylamine (TMA) and total volatile basic nitrogen (TVBN) showed significant (P<0.05) increases. There were decreases in salt soluble protein, pH, moisture content and microbial counts. Fishburgers in PP semi rigid containers had the best stability followed by samples in LDPE bags and PS + LDPE. The effects of washing and storage on the quality of S.leptolepis and A.nobilis surimi kept at -20 °C for 24 weeks were studied. Surimi was prepared from unwashed, once-washed and twice-washed minces. The storage quality in terms of texture, colour, elasticity, moisture content, pH and SSP values for all samples showed significant (P<0.05) decreases during storage. There were increases in expressible moisture, TMA, TVBN and TBA. Results also showed that twice-washed mince of both species were generally more stable than once-washed and unwashed minces.
Abstrak tesis yang dikemukakan kepada Senat Universiti Pertanian Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains.

PENGEMBANGAN BURGER IKAN DARI *Selaroides leptolepis*, *Aristichthys nobilis* DAN *Alutera monoceros*

oleh

SIAH WATT MOEY

1997

Pengerusi : Prof. Dr Yu Swee Yean

Fakulti : Sains Makanan dan Bioteknologi

*Selaroides leptolepis*, *Aristichthys nobilis* dan *Alutera monoceros* digunakan untuk pengeluaran hasilan dari ikan bersasaran pada restoran makanan segera dan keluarga dengan menggunakan proses pengembangan hasil. 24 idea produk telah dihasilkan. Dengan menggunakan teknik saringan, 24 idea produk telah dikurangkan sehingga 3 idea produk. Burger ikan telah dipilih untuk pengembangan yang seterusnya. Formulasi burger ikan telah ditentukan melalui sesi-sesi penilaian deria. Penilaian pasaran secara umum dijalankan disekitar kawasan perumahan berhampiran. Seramai 60 panel digunakan. Hasil dari kajian menunjukkan potensi burger ikan yang dihasilkan adalah baik memandangkan 75% daripada mereka ingin membeli hasilan tersebut jika ia dipasarkan. Harga yang sanggup ditawarkan adalah pada julat RM 5.50 dan RM 6.50. Burger ikan yang dibungkus dalam beg LDPE, kotak PP dan trey PS dibalut dengan filem LDPE boleh diterima selepas disimpan selama 18
minggu pada -20 °C. Kualiti penyimpanan dari segi nilai tiobarbiturik asid (TBA), trimetilamin (TMA) dan ‘total volatile basic nitrogen’ (TVBN) menunjukkan peningkatan yang bererti (P<0.05). Terdapat penurunan yang bererti (P<0.05) pada nilai protein larut garam (SSP), pH, kandungan lembapan dan bilangan microorganisma. Burger ikan dalam kotak PP mempunyai kestabilan penyimpanan yang paling baik diikuti oleh sampel dalam beg LDPE dan trey PS + LDPE. Kesaran bilangan cucian dan penyimpanan selama 24 minggu pada suhu -20 °C keatas kualiti surimi dari S.leptolepis dan A.nobilis juga dijalankan. Surimi disediakan dari isi ikan tanpa dicuci, dicuci sekali dan dicuci sebanyak dua kali. Kualiti penyimpanan dari segi tekstur, warna, kekenyalan, kandungan lembapan, pH dan nilai protein larut garam mengalami penurunan yang bererti (P<0.05). Manakala terdapat peningkatan yang bererti (P<0.05) bagi nilai ‘expressible moisture’, TMA, TVBN dan TBA. Keputusan juga menunjukkan bahawa kualiti penyimpanan surimi hasil dari dua kali cucian isi ikan dari kedua-dua spesis ikan adalah lebih baik berbanding dengan yang dicuci sekali dan tanpa dicuci.
CHAPTER 1

GENERAL INTRODUCTION

The trend in the consumption of animal protein sources has been and still is a switch from red meats toward white meats. At first it was a move from pork and beef to poultry, but now it is extended to fish. There are probably several reasons for this increase in consumption of fish but the major reason is most likely that health authorities and dieticians recommend that fish is a healthy food which has a good balance of protein, vitamins, minerals and a relatively low caloric content. In addition, certain species of seafood are excellent sources of ω-3 polyunsaturated fatty acids which have therapeutic effects (Balasubramaniam et al., 1985; Kronhout et al., 1985; Kinsella, 1988).

Current world fish production is around 100 million tonnes (Poulter et al., 1988). However, there is a considerable waste through such practices as discarding the by-catch when harvesting more valuable species such as shrimp; spoilage of products due to inadequate storage or handling systems; and processing methods that do not efficiently preserve the protein content for human use. If fish are to make a greater contribution to the quantity of protein available to the world, by-catch and
other underutilised resources must be used. In addition, the yield or value of fully utilised species must be increased.

With the availability of the mechanical deboner, many underutilised fish species and the frames after filleting become potential sources of food proteins. The minced meat obtained after deboning is more unstable than intact fish muscle (Martin, 1976; Babbitt, 1986), therefore, it must be processed immediately. The most common way to preserve this minced flesh is by processing it into surimi. Surimi is mechanically deboned, washed and stabilised fish flesh widely used as an intermediate product for a variety of fabricated seafoods, including kamaboko, fish sausage, crab legs and imitation shrimp products (Lee, 1984).

Surimi is usually made from white-fleshed and low fat fish species. The versatility of surimi for production of a vast variety of minced fish analogues, coupled with the decline in the Alaskan pollack fishery, has prompted substantial efforts to study the suitability of other fish species for surimi production. In the United States, menhaden (*Brevoortia sp.*), a small, oily and dark blue to brown herring-like fish which represent 92% of the fish is used for reduction into fish meal and surimi processing (Bimbo, 1988). In the southern hemisphere, there is potential for production of surimi from hoki (*Macruronus novaezelandiae*) and blue whiting (*Micromesistius sp.*) particularly in New Zealand (MacDonald et al., 1990). Similar efforts are being carried out in Europe, the United Kingdom, Norway and other countries to explore the possibilities of using locally-available species for surimi processing (Putro, 1989). In developing tropical countries especially Southeast Asia,
species widely used for frozen surimi production include threadfin bream (*Nemipterus sp.*), bigeye snapper (*Priacanthus sp.*), barracuda (*Sphyraena sp.*) and croaker (*Pennahia sp.*). The development of surimi and minced fish production has been inspired by the continuous availability of cheap shrimp trawl by-catch and underutilised species, plus the growing popularity of fish jelly products complementing existing traditional cuisines. Various new products developed include fish balls, fish noodles, fish rolls, fish cakes and chikuwa (Venugopal et al., 1992).

Surimi manufacturing will receive greater attention for further development in the coming years in line with the need for product diversification to meet the growing demand of different ethnic groups worldwide for surimi-based analogues. In addition, production is expected to play an important role in improving the nutritional status of people in the region through optimal utilisation of underutilised species for production of fish jelly products and surimi-based analogues. Recently, supermarkets have included various fish jelly products among their range of products. This trend signals the need for further studies related to product development, quality improvement, presentation and prolonging the shelflife of these products.

Of the many species of fish caught in the waters off the coast of Malaysia, a significant proportion constitutes commercially unimportant and hence underutilised species (29% of the total marine fish catch in 1994) (Kementerian Pertanian Malaysia, 1994). Currently, most of the underutilised species are processed by traditional methods such as curing, which do not involve high costs. However, such products do not enjoy high-market value (Yu and Siah, 1996). *Selaroides leptolepis* made up to 3% of the total marine fish catch of 1,065,585 mt in Malaysia, in 1994.
(Kementerian Pertanian Malaysia, 1994). It is a relatively small pelagic fish and a substantial quantity is salted, or salted and dried. *Aristichthys nobilis*, or big head carp is a common species cultured in disused mining pools in Malaysia. Freshwater fishes are less acceptable to consumers compared to marine species mainly because of their soft texture and muddy flavour (Yu, 1991). There is no statistical data on the total landing of *A. monoceros* species or leather-jacket. In line with the government-backed policy of increasing the usage of freshwater fish and as well as better utilisation of trawl by-catch, it is the objectives of this study to:

1. Develop frozen fish jelly products from *S. leptolepis*, *A. nobilis* and *A. monoceros* surimi.

2. Evaluate the storage stability of frozen fish jelly product as affected by different forms of packaging.

3. Evaluate the storage stability of frozen *S. leptolepis* and *A. nobilis* surimi as affected by the number of washing.
CHAPTER 2

LITERATURE REVIEW

There is excellent scope for the use of fish mince in fabricated products which simulate the accepted texture, flavour and appearance characteristic of the popular high-value items like shrimp, crab legs, scallop, and lobster. The initial step in the development of such products is the conversion of the mince into an intermediate product known as surimi, a white protein material of excellent nutritional value (Venugopal et al., 1992).

'Surimi' is a Japanese term for mechanically deboned, water-washed fish flesh (Lee, 1984). The surimi process serves to remove fat, blood, odourous substances, water-soluble proteins, and minerals from the myofibrillar proteins of the muscle and thereby serves to improve the gel strength, elasticity, appearance, and stability of minced fish flesh. The myofibrillar proteins of fish meat, notably myosin, are considered to be primarily responsible for gel formation in cooked products (Roussel and Cheftel, 1988).

Traditionally, the manufacture of fish gel products in Japan was one way of extending the shelf life of fish (Suzuki, 1981). It involved adding salt to washed fish
mince and heating the paste, usually by steaming to form heat set gel (Konstance, 1991). A wide range of products based on this process continue to be produced in Japan today. In the traditional process, surimi, because of its perishable nature, was processed directly into kamaboko products, but in today's industrial processes, it is invariably made into a frozen 'intermediate' product which is manufactured into kamaboko or other gel products at a later date (Mackie, 1992).

Since the beginning of the 1980s, much interest in surimi has been generated throughout the seafood and food industries by the rapid growth in the popularity of surimi-based products, especially crab analogues in the United States and Europe. The characteristics of surimi paste as the raw material of processed foods may be summarized as follows (Kammuri and Fujita, 1990):

1. Surimi paste becomes a gel if it is heated after kneading with an appropriate amount of salt. In this process, the surimi paste forms a white elastic gel.
2. Since surimi paste has little colour, taste, and odour, a wide variety of food can be manufactured by adding adequate amounts of seasonings, spices, flavours, coloring agents, etc.
3. Because surimi is a sol, it can be shaped into many forms by moulding.
4. Various kinds of gels, each having a different mouthfeel, can be manufactured by adding starch, egg white, soybean protein, wheat protein, or other materials to surimi paste. Fat can be blended into surimi and emulsified at a concentration up to about 20%. These products have a smooth mouthfeel. When a large amount of water is added, the product becomes a very elastic gel.
5. Shaped surimi can be heated by various methods such as broiling, steaming, boiling, and frying.

6. Since surimi paste has a binding ability, it is possible to make a surimi block containing various kinds of vegetables or pieces of meat.

Japan has been improving surimi technology for several hundred years. The development of the industry has been sustained by (Okada, 1992):

1. The virtually unlimited resources of underutilized and less utilized species will ensure a sufficient production of surimi at reasonable cost to meet the need for these material for surimi-based products.

2. Frozen surimi has a long shelf life and is a highly functional protein ingredient.

3. Current technology permits mass production with consistent quality.

**Definition of Surimi and Surimi-based Products**

It is necessary to distinguish `surimi` from `minced fish` and `surimi-based products` as these terms are often confused in popular literature (Figure 1)(Okada, 1992). When fish flesh is separated from bones and skin (usually mechanically), it is called `minced fish`, the starting material for surimi production and an ingredient for some processed fish products in its own right.

After the minced fish is water-washed to remove fat and water-soluble components, it becomes `raw surimi`. This raw surimi is a wet concentrate of the