SPOILAGE OF FRESH FISH IN EGYPT

BY

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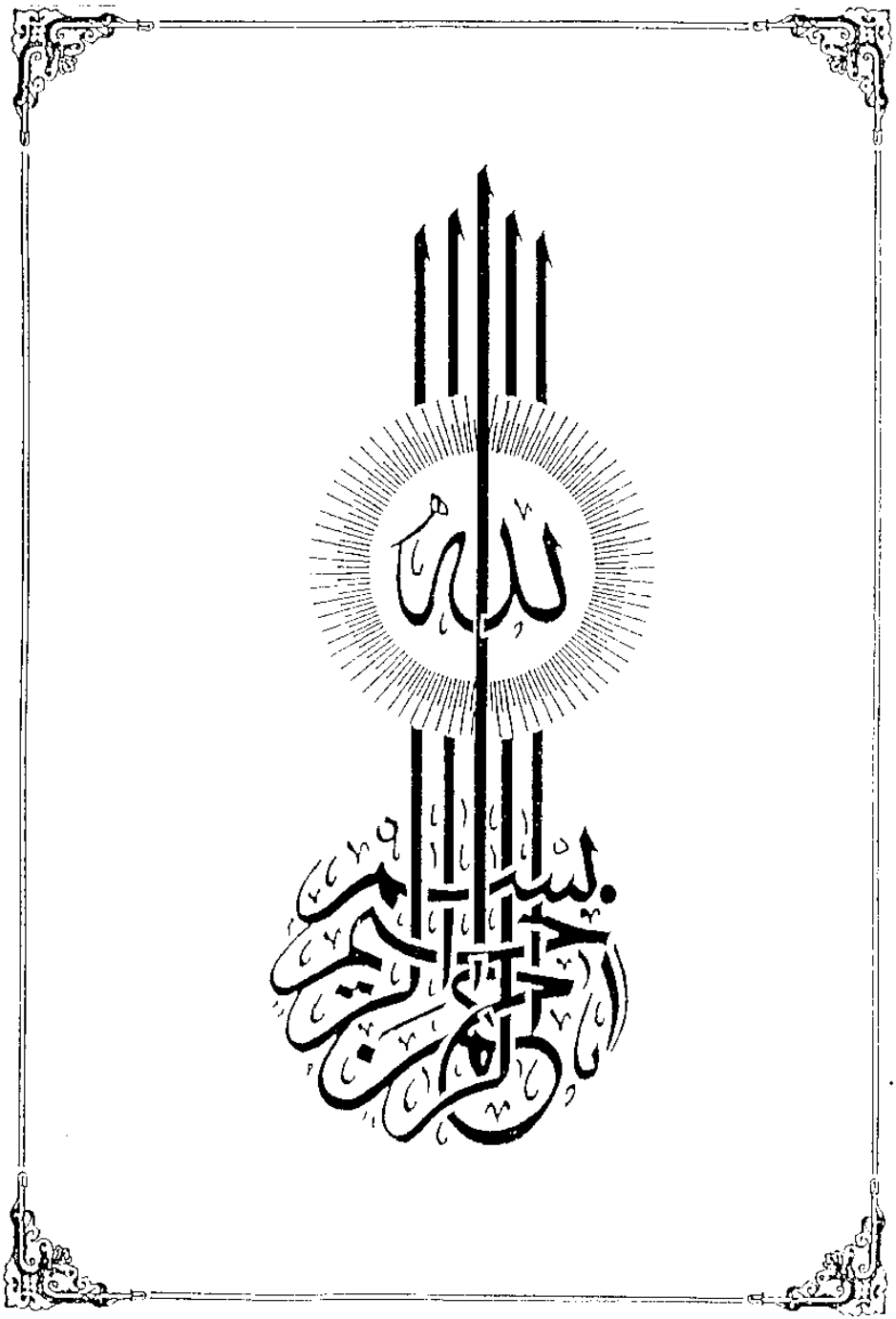

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INTRODUCTION

Fish is a food rich in proteins and fats. Fish proteins have a high nutritive value since these proteins are complete and contain all of the essential amino acids. The amino acids making up the proteins of fish muscle are the same as those of chicken muscle and they are present in approximately the same proportion (Tressler and Lemon, 1951).

It should be recalled that for a country like A.R.E. suffers from shortage in livestock can make use of the two long shores on the Mideterranien and Red Sea fishing. Similarly Nasser's lake and the River Nile are good sources for fresh water fish. In fact the amount of fish caught yearly are low as compared with other countries such as Canada, Iceland and Norway in which modern efficient catching methods are applied. In the A.R.E. the amount of fish can be increased by applying those new methods of fishing and accordingly the shortage of animal protein can be solved to a great extent.

Like meat, fish and other sea foods are liable for spoilage by autolysis, oxidation or bacterial activities and most commonly by combination of these factors. Most fish flesh, however, is considered more perishable

are caught such as Mediterranean, Red Sea and Nasser's Lake, modern transportation system supplied with modern methods of refrigeration should be used. Besides new methods of preservation should be investigated.

The purpose of this study is to investigate the following topics :

1- Effect of the removal of intestinal organs together with evisceration on the microbiological and chemical qualities of some widely consumed fish namely bolti, bayad, morgan and sardine fish were investigated during storage at 0°C.

2- Effect of some antibiotics on the preservation of these kinds of fish during storage at 0°, 5°C and room temperature was investigated.

3- Effect of storage in an atmosphere containing carbon dioxide on the keeping quality of fish.

The aim of these studies was to find out a reliable method for prolonging the keeping quality of fish. Microbiological and chemical determinations of total volatile bases, trimethylamine and trimethylamine-oxide together with sensory assessments were under taken

REVIEW OF LITERATURE

Fish as one of our main sources of protein, not only gives a wide range of foodstuffs, but also used as a source of valuable medicinical, feeding and technical products. Such full use of fish can be explained by the various histological structure and chemical composition of its different parts.

There are more than twelve thousand known species of fish inhabiting different oceans, seas, rivers and lakes. About 1500 of these are commercial, i.e. fish that are caught in very large quantities (Zaitsev et al., 1969).

When taken out of water, fish soon die of asphyxia through lack of oxygen. The cause of death is an excessive accumulation of lactic acid and other non oxidized metabolic products in blood and muscles, which paralyse the nervous system. (Zaitsev et al.,1969)

When a fish dies, a number of physical and chemical changes take place in its body, gradually leading to spoilage. These changes occur relatively rapidely such

that fish is probably the most perishable of all flesh foods (Tarr, 1954; Stansby, 1963; Burgess et al., 1965 and Zaitsev et al., 1969).

The following main stages in spoilage are to be distinguished: hyperaemia or release of mucous to the surface, rigor mortis, autolysis and bacterial decomposition. These processes do not follow one another in any strict order. Their beginning, end and duration may vary and one may become superimposed on the other, depending on the conditions of storage (Zaitsev et al., 1969; Spinelli, 1971).

Release of mucous from the mucous glands inside the skin occurs as a peculiar reaction of the dying organism to unfavourable surroundings. The slime consists glycoprotein mucin which is an effective substrate for bacteria, as a result it soon putrifies, and gives off an offensive smell (Frazier, 1958; Zaitsev et al., 1969).

Rigor mortis shows itself in a stiffening of the body as a result of complex biochemical changes in the muscles, producing contractions and strains. How soon rigor mortis sets in after death, and how long it lasts,

depends on many factors : the species, the condition of the fish when landed, the manner in which they are killed, the temperature and other conditions of storage. Fish in a state of rigor mortis is not unfit for use, and the later rigor mortis begins, the longer fish can be stored.

Autolysis is the breakdown process of proteins and fat due to the action of the proteases and lipases in the tissues; since fish tissues consist mainly of protein compounds.

With respect to bacterial decomposition fish proteins suffer pronoumed decomposition which resulted in the formation and accumulation of a number of toxic and malodorous compounds. It was recognized over six decades ago by Bruns (1909) and has since been reaffermed repeatedly by other investigators, that the flesh and internal organs of healthy freshly caught fish are sterile bacteriologically. In constant, the external slime and the digestive tracts of feeding fish support a qualitatively and quantitatively variable flora, while the digestive tracts of fasting fish are frequently free from viable bacteria (Reed and Spence, 1929; Wood, 1940; Hess 1950). Shewan (1962 a) recognized that the flesh remains steril nearly 3 to 4 days at 0°C.

Sources of contamination :

Contamination of fish with microorganisms occurs from many sources. Bisset (1948) stated that the degree of infection is influenced by the bacterial content of the water. Zobell and Upham (1944) found general similarity between bacteria occurring in fish and those of their marine environment. Hess (1950) reported that the sources of bacterial contamination of fish flesh, which is itself sterile when the fish caught, are the slime covering the fish and dirty surfaces with which the fish comes in contact on deck together with the fishing vessels and the fish plants. Niewolak (1960) showed that the ice used for refrigeration was a source of contamination since it carried psycrophilic and proteolytic bacteria. On the other hand, Gillespie and Ostovar (1971) proved that fish slime was a good bacteriological medium and supported growth 10^2 - 10^{10} organisms/g.

More recent data suggest that fish can be infected and carry out pathogenic bacteria such as salmonella, staphylococcus aureus, vibrio, etc., even when caught in unpolluted waters (Gaugausch, 1962; Boev, 1963; Janssen and Meyers, 1968; Streicham, 1968; Mitsumura et al., 1969;

Rosen and Levin, 1970; Evelyn, 1971). However, Shewan (1970) reported that the flora of wet fish as normally landed at the U.K. markets was vertually free from pathogens or indicator organisms associated with the usual bacterial standards such as E. coli and St. aureus. Beech (1972) reported that evisceration contaminates the flesh with intestinal organs and low storage temperature is essential to prevent these from multiplying.

Bacterial penetration of fish tissues :

The degree of penetration of the surface bacteria into the tissue of the fish is not well established. Three possibilities exist: a) movement inwards from out surfaces such as belly flaps and from gill possibly mainly via the major blood vessels, b) movement outwards from the gut or gut cavity, and c) movement inwards from the skin surface.

Canadian workers, Dyer et al., (1946) believed that most of the flesh remains sterile for about 10 days at least, and the spoilage occurs mainly on the skin. Other workers, on the other hand, consider the flesh to be readily invaded through the skin after death (Lücke and Erercks, 1940; Maltschewsky and Partmann, 1951). It is usually

the development of odours and spoilage when the fish were examined as whole gutted fish. It was recommended by Norwegian regulations (1950) , United States Fish and Wildlife Fishery Product Report (1953), and F.A.O. Fish. Report (1968) to remove the gills and intestines from some kinds of fish in order to keep their qualities during storage.

Generally, almost all literature dealing with the organoleptic criteria for judging the quality of fresh and spoiling fish suggested that the condition of the gills is one of the most important factors to be considered (Reay and Shewan,1949; Tarr 1954; Jensen, 1956; Shewan and Ehrenberg; 1956; Shewan 1961, Burgess et al., 1965; Zaitsev et al., 1969).

Bacteriological determination :

Nearly all tests for quality of fish which have been proposed have taken into account only bacteriological deterioration (Tarr, 1954).

Tests designed to determine the bacteriological quality of fish are of two kinds, namely those which

depend on a determination of the size of the bacterial population present, and those which measure products of the metabolism of the organisms. The entire subject of bacteriological spoilage of fish is complicated, for the predominating microflora is not always the same, the types which develop depend on the variety of fish, its chemical composition, the storage temperature, whether the fish are whole, eviscerated or cut in fillets , and other factors. In addition, the total bacterial population of different portions of the fish may vary enormously (Hunter, 1920; Dyer et al., 1946; Lerke et al., 1965).

a) Microbial flora :

The obvious and one of the most frequently employed, experimental methods of ascertaining the degree of bacterial spoilage is a determination of bacteria present (Tarr, 1943). However, Castell et al., (1948) stated that bacterial counts are valuless as a measure of the degree of spoilage of fresh fish. As a general statement this may hold true, but no more so than it does for chemical tests for products of metabolism of organisms causing spoilage. It is extremely doubtful if any single