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Changes in the quality and yield of fish chub due to temperature fluctuations persevered with local spices

[1] Jummai AT, [2] Negbenebor CA, [3] Okoli BJ

[1] National Biotechnology Development Agency, Federal Ministry of Science and Technology, Abuja, Nigeria
[2] Department of Food Science and Technology, University of Maiduguri, Nigeria
[3] Department of Chemical Sciences, Bingham University, Karu, Nigeria

Abstract
Temperature is a factor which affects microbiological quality of feeds during their storage. Three storage temperatures of the feeds for fish were taken into account in this study: -11°C, 5°C and 20°C. Analyses comprised the survival of proteolytic, ammonifying, psychrophilic and mesophilic bacteria as well as fungi. It was found that after 72-day storage of fish feed at the three temperatures, fungi showed the highest survival (56% - 80%). As regards the four physiological groups of bacteria, the highest survival was observed for mesophilic bacteria (6.25% - 9.58%), followed by psychrophilic ones (2.5 - 3.25%) and ammonifiers (0.07 -0.11%), while proteolytic bacteria showed the lowest survival (0%). No live cells of the latter bacteria were observed after 64-day storage of the feed at -11 and 5°C, and after 72-day storage at 20°C.

Keywords: micro-organisms, survival, fish feed

1. Introduction

Complete feeds produced commercially are both important and indispensable in fish farming. They are usually in form of dry complex feeds composed of plant (cereal seeds, bran, rapeseed or soybean meal or cake, legume seeds) and animal components (meat-bone and fish meal, poultry off-fall, meat, powdered milk, animal fats) supplemented with vitamins and minerals [1].

Protein represents the major component of fish feeds. It is a source of energy for the fish, but also a medium for micro-organisms, especially proteolytic bacteria and ammonifiers. Good quality of the products used and proper hygiene of the technological processes decrease the risk of microbiological contamination of fish feeds.

Storage conditions, especially temperature and humidity, represent another important factor affecting microbiological quality of feeds. Improper storage temperature may prolong survival of the micro-organisms present in the feed [11], or even enhance their multiplication and production of toxic substances. Toxin-producing fungi are especially dangerous, most of all those producing aflatoxins, patulins, and trichotecens which are strongly cancinogenic and mutagenic [6].

Microbiological analysis should be used in classifying a feed as suitable for use; its results should not exceed the respective standards. At present, fish feeds used in Poland must conform to the Polish Standard (PN-76/R-64791) [9] referring to dry feeds. This standard defines necessary microbiological examination of the presence of active micro-organisms, such as: proteolytic and ammonifying bacteria, saprophytic and toxin-producing fungi. No works have been found in the available literature on the survival of micro-organisms present in fish feeds during storage, although there are papers devoted to the survival of bacteria in other environments, e.g. lake water [3, 7, 10] fish, meat, milk, cheese, broth and soil [3, 4, 5]. These studies dealt with the survival of single strains of bacteria.

The objective of the present study was to examine survival of the physiological groups of proteolytic and ammonifying bacteria, fungi (mentioned in the standard PN-76/64791), as well as psychrophilic and mesophilic bacteria present in fish feeds during their storage at -11, 5 and 20°C.

2. Materials and Methods

Sources of Materials

The fish samples *Clarias gariepinus* used for this study were obtained from Gamboru Maiduguri fresh fish market and transported to Food Science and Technology Department Laboratory and were then processed immediately. The fish samples were stored under frozen condition (-18°C) in freezer before analysis. The spice *Monodora myristica*, common salt (Dicon salt), casing (small intestine of cow), sorbitol (Archer Daniels, Midland UK) were obtained from Monday Market Limited, Maiduguri.

Preparation of the Spice

The *Monodora myristica* (Plate I) fruits were dehulled to remove the outer coat and processed as presented below and samples were wrapped in aluminium foil then autoclaved at 15 Psi 121°C) for 15 minutes to destroy any microorganism present on the sample.

Preparation of Fish Chubs

The fish sample was thoroughly cleaned with 4% salt solution to remove the slime and to minimize contamination. The fish was weighed, headed, gutted, filleted and chopped into smaller sizes. The fish sample was divided into 4 groups, each of the groups was treated separately as indicated below.

i) Control sample + Nitrate (0.33%) + Salt (1.5%).
ii) Sorbitol (0.4%) + Nitrate (0.33%) Salt (1.5%).

iii) Nutmeg (*Monodora myristica*) (0.2%) + nitrate (0.33%) water. Twenty grams of glucose was dissolved in the extract