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Development of Fishmeal from De-boned Stunted Tilapia Using a Fishmeal Processing Plant

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Abstract

Globally the demand for and use of fishmeal has increased rapidly, especially in some of the emerging aquaculture countries in Africa and Asia. In this study, stunted tilapia was processed into de-boned fishmeal. 40kg of freshly harvested stunted tilapia was processed into coarse fishmeal using a compact fishmeal plant (Denmark type: FR-100). The product was further decalcified by sieving out bones and scales and then pulverized. The ratio of fresh weight to finished de-boned weight was 8:1. The de-boned/scaled tilapia fishmeal contained 76% crude protein, 8.0% moisture and 14.0% ash. Stunted Tilapia provides a nutritional and socio-economic resource of great potential benefit that can be brought into the food security chain through a process of using fish as a natural feed for fish.

Key words: Stunted tilapia, fishmeal, decalcification.

Introduction

Fishmeal is the main and preferred source of protein used in agricultural feed industry because of the excellent nutritional composition. However, the rising demand and limited supply makes fishmeal an expensive protein source (FAO, 2006). The cost of imported fishmeal in 2004 ranged from US$870 – 1, 350 per tonne, while the cost of locally produced fishmeal was US$1 500 per tonne (Ayinla 2007). The inconsistent supply, the growing demand and price among other problems are limiting the use of fishmeal and putting a great pressure on the feed resource industry.

Tilapia are native to Africa, but have been introduced in many countries around the world. In aquaculture, tilapias are regarded as opportunistic omnivores and herbivores feeders, feeding on phytoplankton and detritus; they are disease-resistant, mature early, prolific breeders and tolerate poor water quality with low dissolved oxygen levels. Most will grow in brackish water and some will adapt to full strength sea water. Tilapia is considered a poor man's fish and an "aquatic chicken." With increasing popularity among consumers, tilapias have become the world's second most popular farmed fish, after carps as global production of farmed tilapia reached 2.3 million tons in 2006, valued at about $2.4 billion (Fitzsimmons 2008).

Since nutrition represents over 70% of total variable cost of culture inputs, the major challenge facing the aquaculture industry is the production of cost effective diets for farmed fishes, using inexpensive, locally available ingredients. This simply means that searching for unconventional, cheap feed inputs as an alternative to imported fishmeal is a must. Alternative protein sources such as soybean meal (Richardson *et al.*, 1985; Gatlin and Philips, 1989), yeast (Mahnken *et al.*, 1980; Tacon and Jackson, 1985; Tacon, 1994; Aires Oliva-Teles *et al.*, 2001; Ebrahim *et al*., 2008), oil seed (Refstie *et al*., 2000), and algae (Broun, 1980; Appler H.N, 1982; Zeinhom, 2004; El-Hindawy *et al*., 2006; Tartiel *et al*., 2008) have been tested using different models. Thus, the aim of this study therefore is to add value to stunted tilapia by a way of processing it into de-boned tilapia fishmeal for use in the aquaculture industry.

Methodology

Forty (40) kilograms of fresh stunted tilapia were collected from Makoko fish landing site in Lagos Nigeria. Fishes were processed into de-boned tilapia fishmeal using a compact fishmeal processing plant (Denmark, type FR100) Plate 1. Processing method involved feeding fresh stunted tilapia into a cooker through the hopper situated above the plant. The cooker consists essentially of a long steam jacketed cylinder through which the fish are moved by a screw conveyor with a steam injector connected above it. The raw fishes are pre-cooked at a holding temperature of about 70 - 80^{o}C for about 5 minutes. The coagulated mass then enters a press situated at the middle of the component.

In this component, the fish are conveyed through a perforated cylindrical tube whilst being subjected to increasing temperature. Water and oil are squeezed out through the perforations leaving a pressed solid cake which then enters a drum-like drier situated at the base of the machine. The product; a mixture of dried coarse tilapia flesh, scales and bones were further processed into de-boned/scale free tilapia fishmeal by a way of manual sieving to remove scales and bones. The dried de-bone/scale tilapia was then milled to produce finely milled de-boned tilapia fishmeal powder.

Plate 1: Compact Fishmeal Processing Plant (Denmark, type FR100)

Results and Discussion

Tilapia plays an important role in food security and poverty alleviation in the developing countries (De Silva, 2004). Stunted Tilapia attracts little commercial value to fish farmers due to their small sizes, scaly and bony nature which does not attract consumers, who prefer fleshier and less bony fish. In this study, we evaluated the processing of freshly harvested stunted tilapia into De-boned tilapia fishmeal. Processing method involved two major steps which include processing fresh stunted tilapia into coarse meal and further into de-boned tilapia fishmeal. The weight of dry de-boned stunted tilapia fishmeal realised from the processing of 40kg fresh weight was 5kg resulting in a ratio of 8:1 for the fresh stunted tilapia and finished dry de-boned/scale tilapia fishmeal respectively as seen in Fig 1:

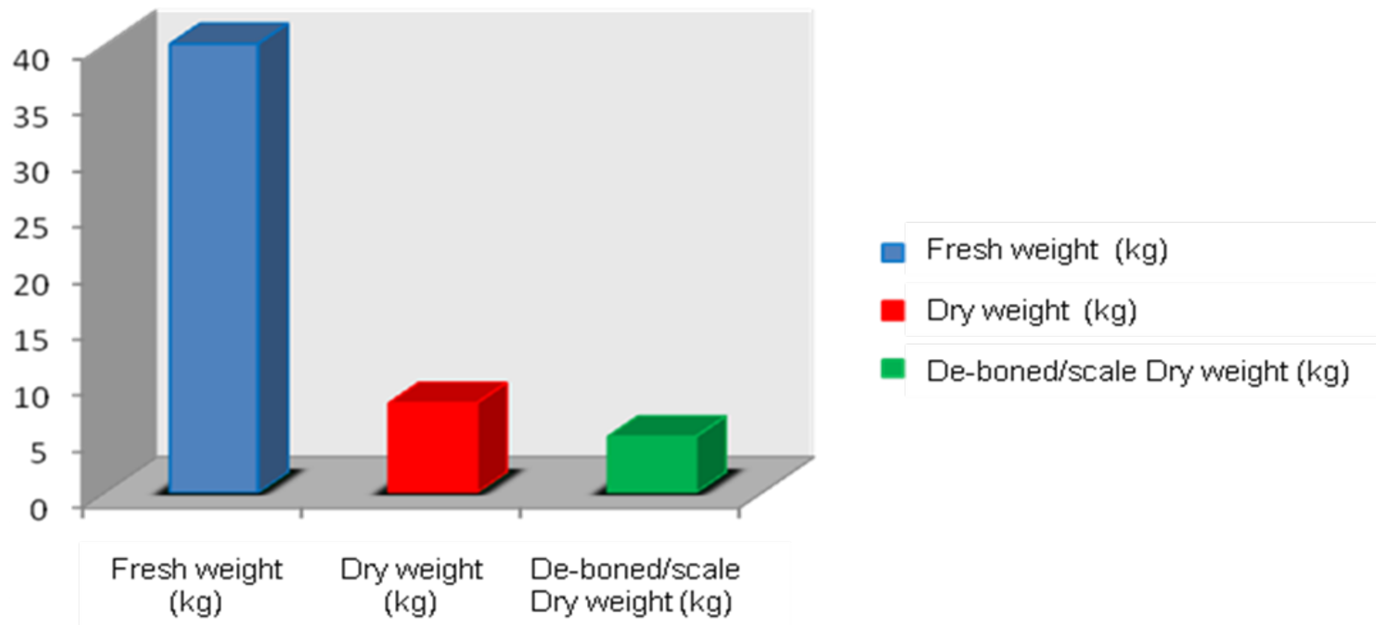

Fig 1: Chart showing Fresh weight, Coarse dry weight and De-boned dry weight of Stunted tilapia

Table 1: Chemical composition of conventional fishmeal

Parameters	Conventional Imported Fishmeal
CRUDE PROTEIN	72
MOISTURE	13.5
ASH	20

Source: Ayinla (1991)

Table 2: Chemical composition of de-boned tilapia fishmeal

Parameters	Conventional Imported Fishmeal
CRUDE PROTEIN	76
MOISTURE	8
ASH	14

Before examining the chemical compositions of interest for the finished dry de-boned/scale tilapia fishmeal it will be interesting to consider the composition of the conventional fishmeal to provide a ground for comparison. Table 1 shows the chemical composition of a conventional fishmeal with a percentage crude protein, moisture and ash content of 71%, 13.5% and 20.0% respectively. The chemical composition for dry de-boned stunted tilapia fishmeal in this study revealed a 76% crude protein, 8% moisture and 14% ash Table 2. The moisture content recorded in this study for de-boned stunted tilapia fishmeal agrees with the findings of Olaitan *et al.,* 2011. Burt *et al.,* 1992 reported that moisture content of between 5% and 10% are within normal limits which agrees with the findings of this study as too high moisture content encourages faster mould and bacteria infestation and too low moisture content could be as a result of over scorching of product during drying processing and may cause denaturing of essential protein.

The percentage of ash content recorded in this study shows a remarkable decrease from that reported by Olokor and Raji (2011) and Akande *et al.,* 2014 for whole tilapia fishmeal with 20% ash content. This could be due to the fact that in this study, most of the tilapia bones and scales were removed during processing. The percentage crude protein recorded for de-boned tilapia fishmeal in this study was also considerably higher than that reported by Akande *et al.,* 2014 for whole tilapia fishmeal. Differences in crude protein concentrations could be due to the lower ash content in de-boned stunted tilapia fishmeal. It is assumed that the higher the ash content the more diluted the crude protein concentration.

This study also examines the processing of stunted tilapia and presents it as a good potential source of fishmeal that if well harnessed will greatly reduce importation of foreign fishmeal, encourage more farmers to mass produce stunted tilapia, increase employment and as a more acceptable high protein fishmeal to satisfy the growing demand for this product. In conclusion, stunted tilapia can become a viable solution to the problem of high cost of feeding in fish production by a way of introducing a better quality product (de-boned/scale stunted tilapia fishmeal) into the aquaculture industry. Development of fishmeal from stunted tilapia will increase investment opportunities, job creation, tilapia diversification, quality standaerdization both for local and foreign market as source of foreign exchange earnings through export of stunted tilapia fishmeal to other developing countries to promote and enrich the aquaculture value chain.

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