FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

FISH NUTRIENT: THE FIRST CLASS MIRACLE FOR ALL

By

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INAUGURAL LECTURE SERIES 30

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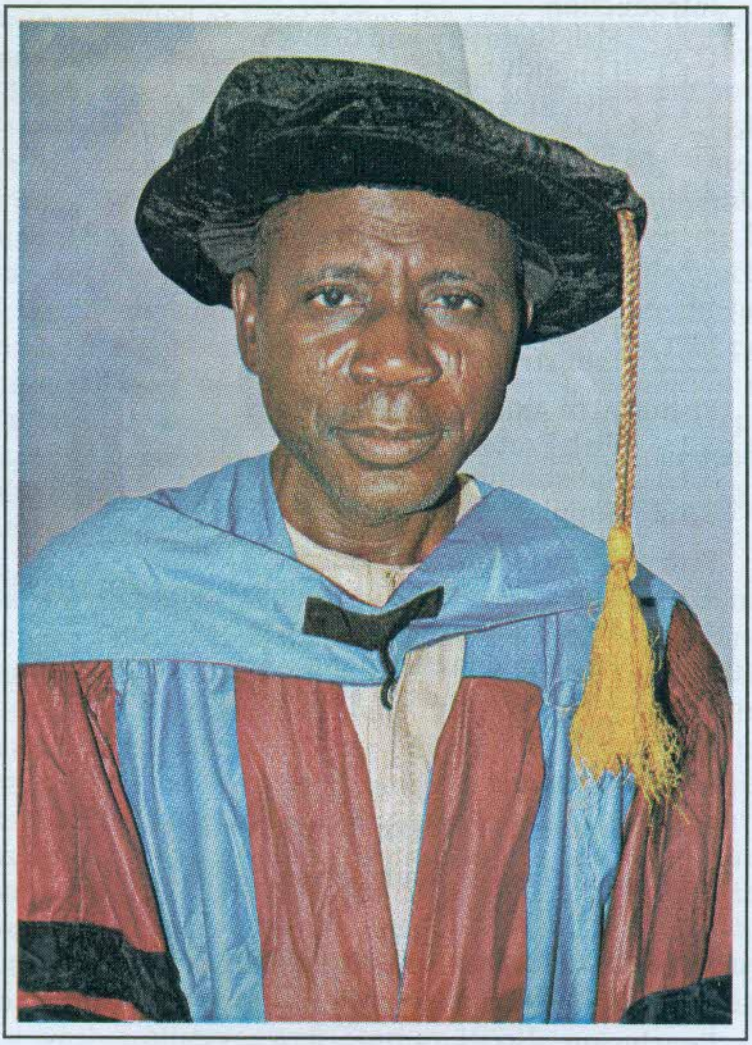

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OUTLINE

1.0 INTRODUCTION

Miracle is defined as what defies the laws of nature or beyond human comprehension, imagination, thinking or logic (Hornby, 2011)). In other words, looks magical. Some nutrient sources have been defined as miracles for their sterling qualities. Fish has been the richest source of nutrients especially essential nutrients – amino acids, fatty acids, vitamin and mineral, and arguably unidentified growth factor (UGF), needed for body metabolism for growth, reproduction, body repairs, body activity and specific dynamic action (SDA) in all animal life, including man. Of all animal protein sources, it is the only one that can be eaten at all ages of life (infancy to old-age), *ad-libitum* or to satiation without threat to life. It is widely eaten, except for obligatory vegetarians, widely used as fishmeal in feeds of poultry, livestock and aquaculture species, hence fish and fishmeal.

However, fish and fishmeal just like any other resource is limited in supply and with demand for fish and fishmeal ever expanding. Fishmeal production stood at 6,000,000 MT/yr in the 90s and expected to stagnate for sometime, while demand in the aquaculture industry alone was expected to double. The use of fishmeal in the poultry industry has arguably become indispensable, such that projections in the 90s, showed that 60% of fishmeal produced in the world was consumed in the industry, when only 10%-20% of fishmeal produced was used in the aquaculture industry (Hardy, 1991). Fishmeal demand is highly elastic estimated at 0.7% (Crowder, 1990). It has a more variable demand than any other animal or plant protein and more price sensitive than others as well (Starkey, 1990).

This indispensability of fish and fishmeal has been attributed to its sterling qualities in terms of i) delicate essential nutrient balance, amino acids and fatty acids ii) availability of essential

nutrients including vitamin and mineral iv) absence of anti-nutritional factors i) presence of unidentified growth factor (UGF). Though it has this competitive nutritional advantage over other protein supplements, it lacks the competitive price advantage, hence, the search for alternative. Several protein supplements of plant or animal origin exist as promising alternatives. These include soybean (*Glycine max*) meal (roasted and full-fat), cottonseed meal, *leucaena leucocepala,* peanut meal, sunflower seed meal, rapeseed of plant origin, poultry meat meal, meat and bone meal, etc. of animal origin.

Of these, soybean was the most promising of the plant proteins for its first class quality - its richness in essential amino-acids and fatty acids. It is known as the Miracle Crop internationally, the Cow Crop of China, the Cinderella Crop of the West, or the Pearls of the Orient and originated from China 2000 yr. BC. It is the world most valuable and widely grown oil seed legume (Osho, 1991), which stood at 11.8 million MT/yr (Vohra and Kratzer, 1991). With this great promise, THE SEARCH BY RESEARCH BEGAN.

1.1 Fish Biometry and Growth

Biometrically, fish has variable biometry (size and shape) of several morphometric and meristic characteristics. Fish can be as big as shark and be as small as clupeid, minnows, etc. Of great importance to all fish studies is the length-weight relationship, as this depicts fish growth and just like the body-mass-index (BMI) of man can be used to predict the physiological state of fish.

1.1.1 Length-Weight Relationship

Growth in fish is exponential, represented by growth equation;

$Y=aX^b$ (Huxley, 1932)

Linearized as;

$\text{Log } Y = \text{Log } a + b \log X$

$W=a + bL$ (where $W = \text{Log } Y$ and $L = \text{Log } X$) (Le Cren, 1951)

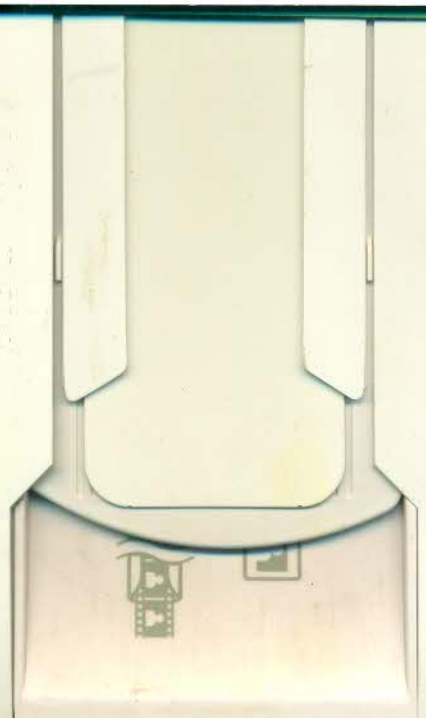
W = weight of fish, L = standard length of fish, "b" is the regression co-efficient/gradient of the growth equation and "a" is intercept on the Y-axis.

This has been well documented in the course of my research in three fish species; viz, *Lates niloticus* (Nile perch), *Sarotherodon galilaeus* (Tilapia) and *Synodonis schall* (Upside-down catfish) (Figs. 1-3).

This study depicts the fish growth pattern which can be isometric when b is 3, negatively allometric when b is less than 3, or positively allometric when b is greater than 3.

Just as the body-mass index (BMI in man, the physiological state or state of well-being of the fish can be established using the condition factor of fish called the *pondera*-index denoted by K, calculated thus;
$K=100W/L^3$ OR $KL^3 = 100W$.

Healthy range of "b" is species specific and should be established for any particular fish. A fish with a value below this range of well-being is unhealthy as a result of being under-weight, while a fish with a value above the range can be said to be unhealthy as a result of over-weight (obesity).



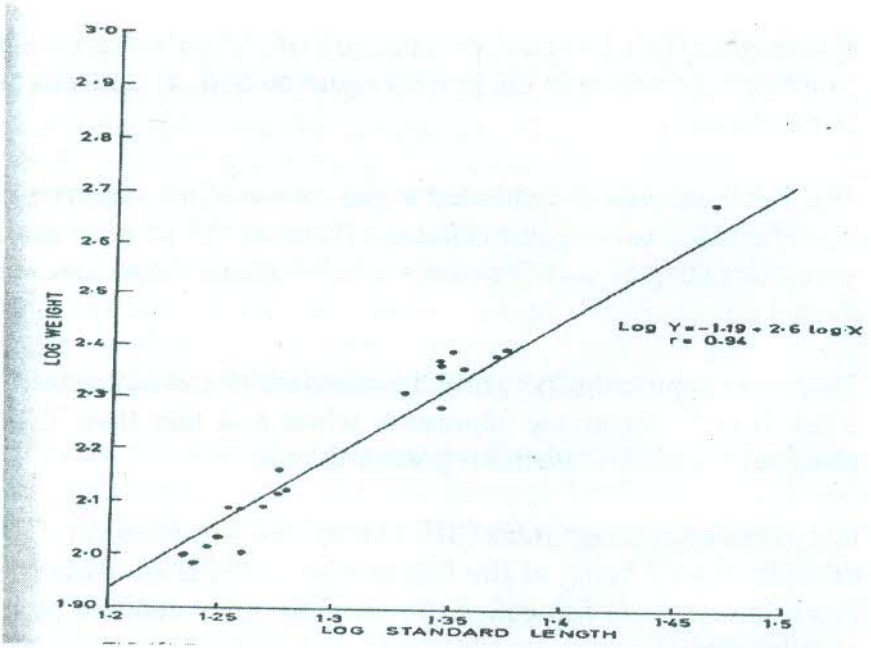


Fig. 1: Length-weight relationship of *Lates niloticus* from Zaria Dam

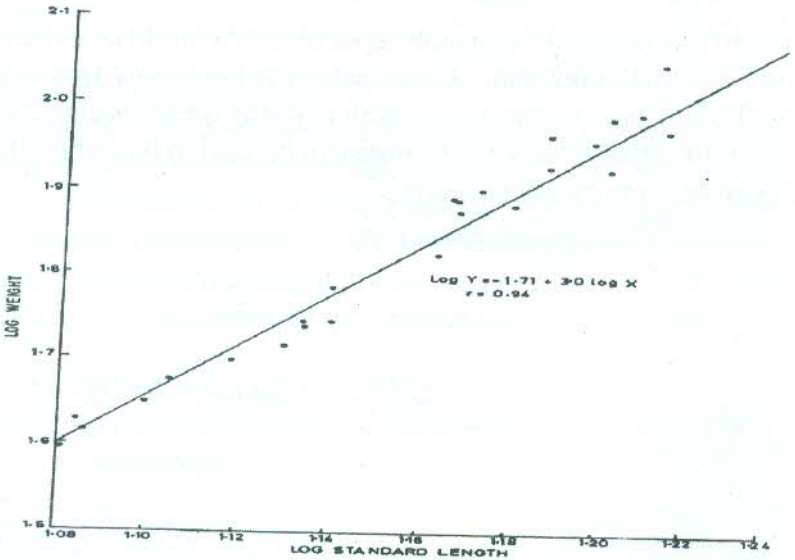


Fig. 2: Length-weight relationship of *Synodontis schall* from Zaria Dam

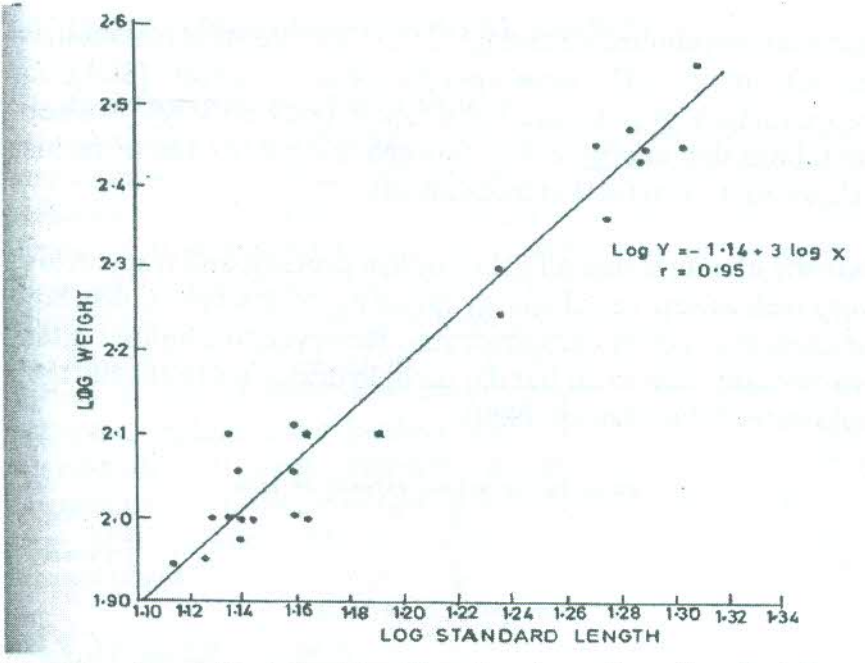


Fig. 3: Length-weight relationship of *Sarotherodon galilaeus* from Zaria Dam

1.1.2 Fish Bioenergetics

This is all about energy-budget in fish. Energy input E(In), Energy output E(Out) and Energy balance for growth E(P) represented with energy budget equation;
E(In) = E(Out) + E(P) (Jobling, 1994).

The energy budget pathway (Fig. 4) from ingestion to utilization has indicated that ingested energy otherwise called Gross Energy (I) from all nutrients (protein, lipid and carbohydrate) is digested. The indigestible energy is voided out as faecal energy (FE - Fk), while the digestible energy (DE) is digested and absorbed through the blood stream to the body tissue by active transport of sodium-potassium pump for metabolism.

At the tissue level, the DE is made of metabolizable energy (ME)