UMYU Scientifica, Vol. 1 NO. 1, September 2022, Pp 166 – 170
https://doi.org/10.56919/usci.1122.021
ISSN: 2955 – 1145 (print); 2955 – 1153 (online)
A periodical of the Faculty of Natural and Applied Sciences, UMYU, Katsina

ORIGINAL RESEARCH ARTICLE

Proximate analysis of some selected fish feeds marketed within Kano metropolis, Nigeria.

Omola Emmanuel Michael[1], Edoka, Friday Nathaniel [2] and Sa'eed, Mohammed Dayyab[3]
[1]Department of Microbiology, Bayero University, Kano, Nigeria
[2]Department of Chemistry, Ahmadu Bello University, Zaria, Nigerias
[3]Department of Chemistry, Bayero University Kano, Nigeria

ABSTRACT

Fish feeds (Fish bolsters) are produced in form of flakes, pellets, or tablets designed to contain vegetables, proteins, cereals, vitamins, and minerals fundamental for ideal development and wellbeing of fishes. However, the scientific evaluation of the feeds compositions as claimed by most manufacturers is lacking in many parts within Nigeria. Proximate composition analyses were carried out in some selected fish feeds marketed within the Kano metropolis following the method of the Association of Official Analytical Chemists. The result of the proximate investigation showed the following composition: 7.28-11.16% ash, 6.10-12.26% moisture, 11.13-14.29% lipid, 3.01-5.61 % fibre, 37.45-44.30% protein and 20.26-27.70% carbohydrate. There was no critical distinction ($p>0.05$) noticed among the values of all the proximate compositions of the fish feeds studied. However, a few values exceeded the permissible limit, whereas the majority fell within the limits set by relevant regulatory agencies. Considering that most of the feeds were within the permissible limit of regulatory bodies, it could be deduced that the fish feeds are safe for fish consumption.

ARTICLE HISTORY

Received August 16, 2022
Accepted September 18, 2022
Published September 30, 2022

KEYWORDS

Ash content, Crude fibre, Crude lipid, Crude protein, Fish feeds, Moisture content

INTRODUCTION

Fish feed is the significant primary step in the aquaculture generation chain. In Nigeria, the generation of fish feed is basically focused on at exceedingly savage species such as the salmonids, cod, bass and bream. These carnivorous species require a large protein bolster (Manage *et al.*, 2008).

The fish feed has customarily been based on marine fixings fish oil and fish support. An inexpensive source of fish feeds will make fish farming attractive due to its profitability (Ombugadu *et al.*, 2021). To decrease feed cost and make strides the fish cultivating supportability, the latest advancement is the fractional substitution of marine components of animal sources (fish oil and meal) with vegetable fixings (Lunestad *et al.*, 2011). It may be a common perception that vegetable feed ingredients are more vulnerable to development of parasites, due to the natural capacity and transport related variables, compared to bolster fixings from an animal ancestry (Lunestad *et al.*, 2011). Fish feeds can be sullied with aflatoxins and the existence of microorganisms and parasites may contrarily influence the product in two ways, lessening the quality or compromising safety through intoxications, gastrointestinal contaminations or hypersensitivities (Mwihia *et al.*, 2018). Aflatoxins defilement may be a global issue (Fallah *et al.*, 2014). Feed quality is subordinate on a few components such as crude materials utilized, preparing conditions and feed management practices amongst others (Tangendjaja, 2015).

Fish feed formulators are mindful that the diet's composition can influence fish's pigmentation due to the choice of crude materials and nourish fixings at their disposal. Nutrition hence, has critical impact on flesh quality. Care is practised in like manner to permit for these inputs and hence define feeds to meet the dietary prerequisites of the fish and accomplish best execution in terms of flesh coloration and texture (Komolka *et al.*, 2020).

The supplement balance of feed moreover impacts feed utilization and development of fish. It is fundamental to know the supplement prerequisite especially for protein, lipid and vitality, for the ideal growth of a fish species and to define a balanced diet (Ayuba and Iorkohol, 2013).

Dietary protein and vitality levels are known to influence the development and body composition of fish species (Lovell, 2013). Inadequate vitality in diets causes a protein

Correspondence: Omola, E.M. Department of Microbiology, Bayero University, Kano, Nigeria.
✉ omolamichael@yahoo.com; Phone: +2348065464463
How to cite: Omola, E.M., Edoka, F.N. and Sa'eed, M.D. (2022). Proximate analysis of some selected fish feeds marketed within Kano metropolis, Nigeria.. UMYU Scientifica, 1(1), 166 – 170. https://doi.org/10.56919/usci.1122.021

to squander due to the increased amount of dietary protein utilized for vitality. The produced ammonia can contaminate the water and make it unfit for fish farming (Isah *et al.*, 2021). Fish nutrition and feed quality specifically influence fish wellbeing and efficiency (Womg *et al.*, 2016). There is this challenge of lack of scientific evaluation on Nigeria's commercial fish feed composition. This study, therefore, explores the proximate composition of some commercial fish bolsters marketed within the Kano metropolis.

MATERIALS AND METHODS

Research Design

Completely randomized design was adopted since the experimental materials are homogenous with the treatment as the only source of variation.

Reagents

All the reagents used were Anal-R- grade chemicals: H_2SO_4 (Merck, Germany), NaOH (REDA, India), HCl, (Sigma-Aldrich, U.S) and Boric acid solution (H_3BO_3), (BASF, Germany). Deionized water was used throughout to avoid interference by other ions. All plastic containers and glassware utilized were altogether washed with a cleanser arrangement, washed with tap water and doused in 10% (v/v) HNO_3 (Chaudhary, India) for 8 hours. They were at that point flushed with deionized water and dried in an oven prior to use.

Sampling Area

The sampling area is Kano metropolis, it lies on latitude $12^{0}00$ N and longitude $8^{0}30$E (kano.gov.ng). Kano city is the capital of Kano state, North Western, Nigeria. It is arranged within the same liana geological locale, south of Sahara. Kano is the commercial nerve center of Northern Nigeria and is the moment biggest city in Nigeria, after Lagos. The Kano city secured 499 square kilometres with a population of 3,999,000 according to the 2020 Nigerian census figures estimate (kano.gov.ng).

Sample collection

Seven different fish feed brands namely: Coppens, Vital feeds, Skirting, Aqua max, Aler aqua, Raanan and Top feeds commercially accessible in Kano city were acquired from distinctive areas within the city. The fish feeds were collected in a hermetically sealed holder, transported to the analytical chemistry laboratory of Bayero University Kano and put away in an airtight container before analysis.

Sample preparation

Known amount of the samples were finely ground using mortar and put in a waterproof holder for subsequent chemical analysis.

Proximate Analysis

The proximate composition of the fish nourish samples were analyzed following the standard strategies given by the Association of Official Analytical Chemists (AOAC, 2005). Triplicate samples of each fish feeds were utilized to determine the following chemical compositions.

Moisture Content Analysis

Moisture (Dampness) was done based on the distinction between the net weight after drying to a constant weight. A clear petri - dish was weighed and 3g of the test were put on it, and after that weighed (W_1). This was then placed in an oven at 120^{0}C for 3 hours. The dish was then brought out and cooled in a desiccator for 30 minutes and reweighed (W_2), (AOAC, 2005). The following equation calculated the percentage dampness content,

$$\% \text{ Dampness} = \frac{(W1-W2)}{W2} \times 100$$

Where:
W_1 = weight of sample
W_2 = weight of dried sample

Crude Protein Analysis

Protein was decided by Kjeldahl strategy. Precisely 0.15 g of the dried (dampness free) sample was weighed and transferred into the Kjeldahl digestion flask; 2 cm^3 sulphuric acid (H_2SO_4), (Merck, Germany), two kjeltabs (catalyst salts) were at that point included. The flask was twirled in a range to blend the contents altogether, it was at that point put on the heater to start the digestion, which lasted for about 1 hour until the blend became clear. The process was at that point cooled, and 10 cm^3 of refined water was added. The process was presented into a distillation tube and made soluble by gradually adding 15 cm^3 of 40% NaOH (REDA, India). Distillation proceeded for 10 mins, and NH_3 produced was collected as NH_4OH in a cone shaped flask containing ten $cm^3$of 2% boric acid solution (BASF, Germany) with a few drops of methyl red indicator. During distillation, a yellowish colour showed up due to NH_4OH. The distillate was, at that point, titrated against standard 0.02 M HCl (Sigma-Aldrich, U.S) solution to the endpoint by the appearance of pink colour. A clear test was more overrun through all the steps with avoiding the sample. The percentage crude protein was at that point obtained by multiplying the percentage of total nitrogen by a conversion factor of 6.25.

$$\text{Sample nitrogen} + H_2SO_{4(aq)} \longrightarrow (NH_4)_2SO_{4(aq)}$$

$$(NH_4)_2SO_{4(aq)} + 2NaOH_{(aq)} \longrightarrow 2NH_{3(aq)} + 2H_2O + Na_2SO_{4(aq)}$$

$$NH_{3(aq)} + H_3BO_{3(aq)} \longrightarrow NH_4^{+}{}_{(aq)} + H_2BO_3^{-}{}_{(aq)}$$

$$H^{+}{}_{(aq)} + H_2BO_3^{-}{}_{(aq)} \longrightarrow H_3BO_{3(aq)}$$

The percentage of protein content was estimated by utilizing the following equation:

$$\% \text{ Nitrogen} = \frac{((S-B)\times N\times 0.014\times D\times 100)}{Weight\ of\ sample\times V} \quad \% \text{ Protein} = \% \text{ N} \times \text{F}$$

Where:
S = sample titration reading, N = Normality of HCl

B = Blank titration reading
D = Dilution of sample after digest
V = Volume taken for titration 0.014 = Milligrams equivalent weight of nitrogen
F = Conversion factor for nitrogen to protein (6.25) (AOAC, 2005).

Crude Lipid Analysis
The ether extract strategy used the soxhlet apparatus (Pelican, India) to determine crude lipid. Three grams (3g) of the sample were carefully weighed (W1) into a collapsed fat-free filter paper, and a little fat-free cotton fleece was placed on top. This was, at that point, appropriately tied with a thread at both closes and weighed (W2). The content was then placed in the extraction thimble, and little cotton wool was placed on top. The apparatus was then connected after adding 300cm^3 of 80℃ petroleum ether. The extraction was, at that point, carried out for 5 hours utilizing the heating mantle and making, beyond any doubt a continuous flow of water within the condenser. The sample was at that point removed, air-dried and then placed in an oven at 80 ^{0}C until a constant weight was obtained (AOAC,2005).

The percentage of crude lipid was computed using the following formula:

$$\% \text{ Crude lipid (fat)} = \frac{(W3-W2)}{W1} \times 100$$

Where:
W_1 = weight of sample
W_2 = weight of empty fat flask
W_3 = weight of flask + lipid

Crude fibre Analysis
The crude fibre was determined by subjecting 3g of the remaining sample from moisture analysis and ether extraction to successive treatments with boiling 100cm^3 of 0.25 mole /dm^3 Sulphuric acid (H_2SO_4) under reflux for 30 minutes, this was washed a few times with hot water until it was corrosive free. The remnant was again subjected to the same treatment utilizing 100cm^3 of 0.312mole/dm^3 NaOH solution; this was too washed altogether with hot water until it was base free. It was dried to consistent weight in an oven at 100℃, cooled in a desiccator and weighed. The weighed sample was burned in a furnace (Lennox, U.S) at 550℃ for 2 hours until a steady weight was obtained. The crude fibre was calculated as the loss in weight after ashing.

$$\% \text{ Crude fibre} = \frac{(W2-W3)}{W1} \times 100$$

Where:

W_1 = weight of sample
W_2 = weight of dry residue before ashing
W_3 = weight of residue after ashing

Ash Content Analysis
For ash determination, a clean empty crucible was placed in a muffle furnace at 600℃ for an hour, cooled in a desiccator, and after that, the weight of the empty crucible
was recorded (W1). Precisely 3g of dried (dampness-free) sample was placed into the crucible and weighed (W2). The sample was, at that point, placed in the muffle furnace at 550℃ until the appearance of grey-white ash indicated the total oxidation of the organic matter within the sample. The crucible was cooled and weighed (W3). Percentage ash was worked out by the following formula:

$$\% \text{ Ash} = \frac{(W3-W1)}{(W2-W1)} \times 100$$

Where:
W_1 = weight of crucible
W_2 = weight of sample + crucible
W_3 = ashed weight

Carbohydrate Content
This was obtained through estimation by difference, where the entire %moisture content, %crude protein content, %crude lipid content, %crude fibre content and %ash content was deducted from 100.

% Carbohydrate = [100 - (% moisture + % crude protein + % crude lipid + % crude fibre + % ash)] (Bukar and Saeed, 2014).

Statistical analysis:
All data collected were subjected to a one-way analysis of variance (ANOVA). Least significant difference (LSD) test was carried out at ($P<0.05$) to determine whether there was significant difference between the means of the feed samples utilizing excel window 10.

RESULTS AND DISCUSSION

The result of the proximate composition of fish feeds samples is shown in Table 1. Aqua Max was observed to have the highest dampness content (12.26) while Coppens was observed to have the least dampness content (6.10). These results fall within the range of values of (<12) recommended by FAO (2007), except Aqua Max which was slightly greater than the recommended value. Most of the results were slightly higher than the range of values of (6.87-8.10%) reported by Ayuba and Iorkohol (2012), and (5.12 - 8.26%) reported by Modupe *et. al.,* (2012). Dietary moisture level is anticipated to influence the texture and palatability of fish feeds and therefore increased moisture level may enhance feeding and improve growth performance. There was no critical distinction between the moisture content of the fish bolsters at ($p>0.05$).
Ash content of the selected fish feeds ranged from 7.28 – 11.16% as shown in table 1. This is in agreement with the findings of Ayuba and Iorkohol, (2012), who recorded 5.33 - 9.45% ash content in some fish feeds. However, Al-Mahmud *et al.*, (2012) reported 14.79 -18.84%. The ash content obtained in this study falls within the range

of FAO recommendation of (<14) (FAO 2007). Ash content determination is important because the amount of minerals determine physico-chemical properties of feeds, as well as retard the growth of microorganisms.

Lipid content varied between 11.13 and 14.29% (Table 1). The values of the lipid content of all the feeds are higher than the recommended range of 5.7 – 8.0 by FAO (2007). Hassan, (2001) asserted that lipids are primarily included in formulated diet to maximize their protein sparing effect. These lipids may also have been incorporated into the feeds by the producers in order to enhance the energy levels of the feeds. However, it is important to monitor the lipid content since it affects the quality or value of the feeds. There was no major distinction between the lipid content of the fish feeds studied.

Crude protein content in the selected fish feeds ranged from 37.50 – 44.30% (Table 1). From the result, it was observed that Skirting got hold of the most protein content of (44.30) while Ranaan got the least protein content of (37.50%). Crude protein is one of the foremost critical supplements to evaluate in a prospective feed due to the reality that it is one of the foremost expensive to supply and its insufficiency can have an extreme impact on the growth performance of fish (Mahaesar *et al.,* 2010).

Table 1: Mean Proximate Composition of some Fish Bolsters Sold in Kano Metropolis

Sample ID	Moisture	Ash	Lipid	Protein	Fibre	Carbohydrate
Aler Aqua	8.07 ±0.567	8.16 ±0.058	12.36± 0.010	41.56 ±0.006	3.01 ±0.006	26.82 ±0.049
Aqua Max	12.26 ± 0.058	7.85 ±0.006	12.00± 0.0010	41.12 ±0.006	5.61 ±0.010	20.26 ±0.061
Coppens	6.10±0.00	10.41 ±0.006	11.13± 0.060	43.65 ±0.000	3.61 ±0.006	25.08 ±0.058
Ranaan	6.16 ± 0.058	11.16 ±0.580	13.70± 0.006	39.45 ±0.000	3.72 ±0.010	27.70 ±0.202
Skirting	7.16 ± 0.078	7.28 ±0.000	14.29± 0.000	44.30 ±0.006	2.71 ±0.010	24.25 ±0.624
Top Feed	7.60 ± 0.00	7.28 ±0.000	12.12± 0.006	41.11 ±0.006	3.73 ±0.006	27.58 ±0.010
Vital Feed	8.16± 0.058	10.13 ±0.058	12.66± 0.006	41.12 ±0.006	4.99 ±0.010	23.22 ±0.100
Mean (±SD)	7.92± 1.976	8.98 ±1.463	12.69± 0.994	41.76 ±1.464	3.91 ±0.984	24.99 ±2.554
FAO	<12	<14	5.7-8	35-42	< 4	15-25

KEY: Mean (±SD) standard deviation of triplicate determinations.

These results fall within the range of values recommended by FAO (FAO, 2007), except in Skirting and Coppens where the value was slightly higher but consistent to Ayuba and Iorkohol (2012) who reported 43.75 - 52.65%, Al-Mahmud *et al.*,(2012) and Modupe *et al.,(*2012); reported 51.32 - 65.34% and 57.20 - 62.61% crude protein respectively. The high protein level could be a deliberate act by the producers in order to ensure rapid growth performance of the fish.

From the result, Aqua max got hold of the most percentage composition (5.61%) of the crude fibre while Skirting had the least percentage composition (2.71%). These values fall within the range of values of (<4) recommended by FAO (2007), except in Vital feeds and Aqua Max in which the value was slightly higher but falls within the range of 3.20-12.75 disclosed by Ayuba and Iorkohol, (2012). Crude fibre provides physical bulk, permits better binding, and moderates the passage of feeds (Isah *et al.*, 2021). There is no significant difference in the values of the feeds studied at (p>0.05).

The carbohydrate, which is additionally alluded to as the nitrogen-free extract, was determined in the range of 20.26 - 27.70%. The values of the feeds fall within the range of 15 - 25% recommended by FAO (2007), except in top feed and Ranaan, which could be due to the cheap availability of carbohydrate sources. Carbohydrates in feeds are sources of energy and provide heat. There was no significant difference between the percentages of carbohydrates obtained from all the samples considered at (p> 0.05).

CONCLUSION

In conclusion, despite the lacking in the scientific evaluation of the feeds composition by some manufacturers, majority of the fish feeds studied are within the passable limit set by FAO. Considering the fact that larger parts of the fish feeds are within the passable limit set by FAO, it could be deduced that the fish feeds are safe for fish consumption. It is recommended that the regulatory agency in Nigeria, National Agency for Food Drug and Control (NAFDAC) should enforce strict compliance and further studies be carried out to assess other feeds with comparable rate of growth performance and digestibility.

ACKNOWLEDGEMENT

We appreciate the excellent technical assistance of the staff of the Chemistry Department of the Bayero University, Kano, Nigeria.

REFERENCES

A.O. A. C (2005); Official Method of Analysis 18th edition, Association of official Analytic Chemist, Washington D.C. , U .S .A.

Al-Mahmud, N., Hassan, M.D. R., Hossain, M. B and Minar, M. H (2012). Proximate composition of fish feed ingredients available in Lakshmipur Region Bangladesh. *American-Eurasian V. Agriculture* and *Environment Science;* 12 (5). 556-560.

Ayuba, V. O. and Iorkohol, E. K. (2013). Proximate composition of some commercial fish feeds sold in Nigeria. *Journal of Fishery* and *Aquaculture Science*. 6(1): 248-252. **[Crossref]**

Bukar, H. and Saeed, M.D. (2014) Proximate Analysis and Concentration of Some Heavy Metals in Selected Poultry Feeds in Kano Metropolis, Nigeria. *Bayero Journal* of *Pure* and *Applied Sciences* 7 (1): 75 – 79. **[Crossref]**

Fallah, A.A., Pirali-Kheirabadi, E., Rahnama, M., Saei-Dehkordi, S.S., Pirali-Kheirabadi, K.K, (2014) Mycoflora, Aflatoxigenic Strains of Aspergillus section Flavius and Aflatoxins in Fish Feed. *Quality Assurance and Safety of Crop* and *Foods* 6(4): 419 – 424. **[Crossref]**

FAO, (2007). Managing Livestock Environment Interactions. COAG 2007/4.Rome (available at ftp;//ftp.fao.org).

Hassan, M.R. (2001). Nutrition and Feeding for Sustainable Aquaculture Development in the third Millennium. Technical Proceedings of the Conference on Aquaculture in the third Millennium, J. R. Arthur eds., M. J. Phillips publishers, Bongkok, Thailand. Pp 193-219. **[Crossref]**

Isah, J., Shuaibu, B.S., Mohammed, J. and Hamza, A.O. (2021). Proximate and Heavy Metals Compositions of Some Commercial Fish Feeds available in Keffi Metropolis, Nassarawa State. *Chemsearch Journal* 12 (1) : 85 – 91.

Komolka, K., Bochert, R., Franz, G.P., kaya, y., Pfuhl, R. and Grunow. B. (2020) Determination and Comparison of Physical Meat Quality Parameters of Percidae and Salmonidae in Aquaculture. *Foods* :9 (4) : 388 https:// doi.org / 10. 3390/foods 9040388. **[Crossref]**

Lovell, R. T (2013). Nutrition and Feeding of Fish, Van *Nostrand Reinhold Chapman* and *Hall, I. T Pub. Co*., New York, Page 253.

Lunestad, B.T., Levsen, A. and Rosnes, J.T. (2011). Tracing Pathogens in the Food Chain. *Woodhead Publishing Series in Food Science, Technology and Nutrition*. Pp 433 – 464 **[Crossref]**

Manage, A.., Hove, H. and Julshamn, K (2008) Monitoring and Surveillance to improve Farmland Fish Safety. *Woodhead Publishing Series in Food Science, Technology and Nutrition*. Pp 547 – 564. **[Crossref]**

Mahaesar, S .A., Sherazi, S. T. H., Niaz, A, Bhanger, M. I., Uddin, S and Rauf, A (2010). Simultaneous assessment of zinc, cadmium lead and copper in poultry feeds by differential pulse anodic stripping voltammetry. *Food* and *Chemical Toxicology*, 48(8-9): 2357-2360. **[Crossref]**

Modupe, O.D., Olutona,G. O., Ajani, F. and Bello-Olusoji, O. A (2012). Determination of Mineral Trace Element and Proximate Analysis of fish Feed. *Global Science Book*.

Mwihia, E.W., Mbuthia, P.G., Eriksen, G.S., Gathumbi, J.K., Maina, J.G., Mutuloki, S. Waruiru, R.M., Mulai, I.R., and Lyche, J.R (2018) Occurrence and Levels of Aflatoxins in Fish Feeds and Their Potential Effects on Fish in Nyeri, Kenya. *Toxins* 10 (12): 543-564. **[Crossref]**

National Agency for Food Drugs Administration and Control (NAFDAC). Corporate Headquarters. Plot 2032 Olusegun Obasanjo Way. Zone 7 Wuse, Abuja, Nigeria. nafdac@nafdac.gov.ng

Ombugadu, E.O. , Attah, A.S., Ahmed, H.O., Aimankhu, O.P., Uzoigwe, N.R., Kwala, G.J., Dogo, K.S., Njila, H.L., Echor, B.O., Deme, G.G., Aliyu, A.A., Ayuba, S.O., Odey, S.A., Anyebe, G.E., Micah, E.M., Ayim, J.O., Benson, R.F., Mafuyai, M.J., Nkup, C.D.,Ashigar, M.A., Samuel, M.D., Da'an, S.A., Polycarp, .I.A., Angbalaga, G.A. and Stephen, D.S.(2021) Dietary Inclusion of *Citrullus lanatus* Seed in Fish Feed : Proximate Analysis , Growth Performance and Feed Utilization in *Clarias gariepinus* Fingerlings. *Journal* of *Aquaculture* and *Livestock Production*. 2(2): 3 - 7

Tangendjaja, B (2015) Quality Control of Feed Ingredients for Aquaculture. In Feed and Feeding Practices in Aquaculture; Elsevier, Amsterdam. *The Netherlands* 141 – 169. **[Crossref]**

Wong, M.H., MO, W.Y., Choi, W.M., Cheng, Z. and Man, Y.B (2016) Recycle Food Wastes into High Quality Fish Feeds for Safe and Quality Fish Production. *Environmental Pollution* 219: 631 – 638. **[Crossref]**