Nutrient Composition of *Coptodonzillii*in the Water Dams in Ekiti State, Nigeria

B.J. Akin-Obasola, and O.T. Adu,
Department of Fisheries and Aquaculture Management,
Ekiti State University, Ado Ekiti, Nigeria
E-mail: bola.akinobasola@eksu.edu.ng

Abstract

Fish is one of the cheapest sources of animal protein and essential nutrients required in human diets. The recommendation of new species of fish for human consumption should only be made after assessing the nutritional qualities. Ten (10) samples of Coptodonzilliiwere collected from each of Ureje, Ero, Egbe and Itapaji dams in Ekiti State, South western, Nigeria and frozen immediately. The samples were analyzed for proximate composition and contents of amino acids. Coptodonzillii protein content was not significantly different among the dams but varied between 51.05 to 55.26% in the order of Ureje>Itapaji>Egbe>Ero dams. The moisture content was similar among the fish collected from the dams at 25.33-25.95%. The fat content was highestin fish from Itapaji and Egbedams while fish from Ureje dam contained the highest ash (12.21%). The essential amino acid analysis revealed that arginine values were not significantly different ($P<0.05$) among the fish from Ureje, Ero andEgbe dams; isoleucine was highest in fish from Ureje and not different between Egbe and Ero dams; leucine was highest at Egbe dam while histidine, methionine, cystine, tyrosine and valine were not significantly different among the dams. The nutrient composition of Coptodonzilliivaried with location and was comparable with the limits obtained for other species which provided the basis for recommending the fish as fit for human consumption.

Keywords: *Coptodonzillii,* dams, proximate composition, amino acids, Ekiti State

Introduction Fish is one of the potential sources of animal protein and essential nutrients for the maintenance of a healthy human body especially in developing countries (FAO, 1994, Fawole*et al*., 2007). In Nigeria fish constitute 40% of the total dietary animal protein intake and total annual consumption is more than 1.36 million tons (Abdullahi, 2007). Furthermore, the fisheries industry has a demand and supply deficit of over 60% and so a serious development challenges. One of these is the steady decline in capture fisheries sources due to normal global trends and the aggravation by specific local disturbances in Nigerian coastal and offshore waters. This scenario has led to a shift in focus to inland water resources especially for aquaculture, which efforts have yielded encouraging results in the past few years (Abdullahi, 2007). This upward trend is expected to continue.

Fish is an excellent source of protein, compared to other sources, as can be seen from its amino acid composition and protein digestibility (Louka*et al*., 2004). Fish is generally appreciated as one of the healthiest and cheapest sources of protein and it has amino acid composition that is higher in cysteine than most other sources of protein (Duffus, 1980). Fish meat contains significantly low lipids and higher water than beef or chicken and is favoured over other white or red meats (Onyia*et al*., 2010). The nutritional value of fish meat comprises the contents of moisture, dry matter, protein, lipids, vitamins and minerals plus the caloric value of the fish (Elagba*et al*., *2010*).

The nutritional composition of fish varies greatly from one species and individual to another depending on age, feed intake, sex and sexual changes connected with spawning, the environment and seasonal factors. Nutrients are chemical substances for example protein and vitamin found in food that can be digested and absorbed and used to promote body functions. They are sources of nourishment that can be metabolized by an organism to give energy and build tissue. Macronutrients provide the bulk energy for an organism's metabolic system to function while micronutrients provide the necessary cofactors for metabolism to be carried out. The fish's chemical composition can be affected by many factors, including species, environmental condition, fish size, level of protein in the diet and feeding rate (Ogata and Shearer, 2000).

African cichlids formerly referred to as "tilapia" represents a paraphyletic species assemblage belonging to the haplotilapine lineage which is globally important for aquaculture. In the past, tilapia was a large genus of cichlid fishes including all species with the common name tilapia but today the vast majority is placed in other genera: Coptodon, Coelotilapia, Heterotilapia, Paracoptodon and Pelmatilapia (Dunz and Schliewen, 2013). *Coptodonzillii* is a common fish in most freshwater of the rivers, dams and ponds in Nigeria. The fish is of high commercial values and marketing trends indicates higher demand for this freshwater species (Balogun and Adebayo, 1996). The Redbelly tilapia, now known as *Coptodonzillii* is indigenous to the Northern hemisphere of the African Continent and Palestine According to Leo *et al*. (2013), it is found in the tropical and subtropical Africa, Near East and West Africa. Cichlid *(Coptodonzillii)* is one of the major freshwater fishes cultured in Ekiti State and it serves as the main fresh water fish protein source for the people hence, the need to have data on the nutrient composition of cichlids found in all the dams in Ekiti for the purpose of record keeping, policies and decision-making.

A new species should be recommended for human consumption only after assessing its nutritive value with regards to nutritional qualities especially the content of omega-3-fatty acid that helps to reduce the risk of cardiovascular disease (Ajayabhaskar *et al*., *2002*). The objectives of this study are to: analyze the physicochemical parameters, investigate the nutrient composition of *Coptodonzillii and* compare the nutrient composition of the four dams in Ekiti State

Materials and Method

Study area

Ekiti State is located between latitude 7° 15 ' and 8° 05'N and between longitudes 4° 51' and 5° 45'E The state enjoys tropical climate with two distinct seasons and these are rainy season (April-October) and the dry season (November-March). The temperature ranges between 21°and 28°C with high humidity. Tropical forest exists in the southern and central portions while derived savannah occupies the northern periphery.

Collection of samples:

Fresh and livefish samples were collected from the four dams in Ekiti State, Nigeria:Egbe dam (7.36- 7.61°N, 5.36-5.57°E) in Egbe-Ekiti,Gbonyin Local Government Area (LGA); Ero dam (7.99°N, 5.19°E) in Ikun-Ekiti, Moba LGA;Itapaji dam (7°55′-7°58′N, 5°25′-5°28′E) in Itapaji-Ekiti, Ikole LGA; and Ureje dam (7°37′N, 5°13′E) in Ado-Ekiti, Ado LGA. Forty (40) samples of *Coptodonzillii* samples, at 10 pieces from each dam, were collected. Water samples were taken and analyzed using the Claude (1979) method.

Plate 1: *Coptodon zillii*

Dissolved oxygen was determined using oxygen meter, pH was determined using pH meter and temperature was determined using thermometer.

The fish samples were thoroughly washed with tap water and distilled water and drained under folds of filter paper and dissected to remove the intestines, guts and bones. The head was discarded. The samples were homogenized with an electric food blender. The proximate composition of the fish fillets was determined according to the method described in AOAC(1990) for moisture, ash, crude protein, crude fat and carbohydrate.

Five (5) fish samples from each dam were oven-dried at 105°C for 24 h, finelypowdered and sieved for the determination of amino acid composition in acid hydrolysate (6 mol.l^{-1}HCl under reflux for 24 h at 110°C) using an automatic Amino Acid Analyser (LKB 4151 Plus, Biochrom Ltd., Cambridge, UK). Tryptophan was determined colorimetrically after hydrolysing the samples in 4.2 mol.l^{-1}NaOH (Fischl, 1960).

The data obtained from the study were analyzed using SPSS, version 21. Analysis of variance (ANOVA) table was used to check for statistical significant differences in means of crude protein, ash, moisture content and carbohydrates of *Coptodonzillii*tissue.

Results

The pH of water from Egbe, Ero and Ureje dams was similar and significantly different from Itapaji (Table 1). The water temperature at Itapaji dam was lower than the other three dams which had similar values. Dissolved oxygen was highest at Ero dam, but did not differ significantly from the other dams. The conductivity was highest at Ero and Ureje dams but water at Ureje dam was not significantly different from Itapaji dam.

Table 1: Water quality parameters of the dams in Ekiti State

	pH	Temperature	DO_2 (mg/l)	Conductivity
Egbe dam	7.91±0.03	27.53±0.01	7.73±0.05	1.57±0.01
Ero dam	7.94±0.05 [a]	27.43±0.03 [a]	8.27±0.07[a]	1.87±0.03 [a]
Ureje dam	7.93±0.07 [a]	27.53±0.04 [a]	7.93±0.04 [ab]	1.83 ±0.05[ab]
Itapaji dam	7.47±0.04 [b]	26.97±0.06[b]	7.63±0.02[b]	1.63±0.02 [bc]

Using DMRT, values with the same superscript (P<0.05) are not significantly different.

The protein content of *Coptodonzillii* was highest at Ureje dam (55.26±0.40) while the least was at Ero dam (51.05±0.00), but the values were not significantly different among the dams (Table 2). Fat content was highest at Itapaji and Egbe dams and differed significantly from Ero and Ureje dams. The ash content was highest at Ureje dam and differed significantly from the other dams which had similar values. The moisture content was the same for fish from the four dams.

Table 2: The proximate analysis of the tissue of *Coptodon zillii* samples from the dams in Ekiti State.

	%Fat	%Moisture	%Ash	%Protein
Egbe dam	20.89±0.51 [a]	25.33±0.00	8.30±0.30 [b]	53.02±0.32
Ero dam	16.25±0.16 [b]	25.65±0.03	6.93±0.00 [b]	51.05±0.00
Ureje dam	14.71±0.14 [b]	25.83±0.02	12.21±0.66[a]	55.26±0.40
Itapaji dam	20.18±0.99 [a]	25.95±0.99	8.53±0.38 [b]	53.30±0.40

Values with the same superscripts (P<0.05) are not significantly different.

In Table 3, arginine content did not differ among Egbe, Ero and Ureje dams but was significantly lower at Itapaji dam. Histidine was similar in the four dams. Isoleucine was highest in Ureje and did not differ between Egbe and Ero dams. Leucine was highest at Egbe dam. Methionine, Cystine and valine showed no significant differences among the fish samples from the four dams. Phenylalamine was significantly different between the dams while threonine was not significantly different between Egbe and Ero dams but differed in Ureje and Itapaji dams. Tryptophan was highest in Itapaji dam but the same in Egbe, Ero and Ureje dams.

Table 3: Essential amino acid composition of *Coptodon zillii* from the dams in Ekiti State.

Essential amino acid	Egbe dam	Ero dam	Ureje dam	Itapaji dam
Arginine	86±0.05[a]	84±0.03[a]	88±0.06[a]	80±0.04[b]
Histidine	35±0.06[a]	32±0.09[a]	28±0.07[a]	26±0.05[a]
Isoleucine	55±0.08[a]	54±0.04[a]	62±0.02[b]	58±0.06[c]
Leucine	97±0.01[a]	88±0.05[b]	90±0.03[b]	94±0.02[c]
Methionine	31±0.08[a]	29±0.09[a]	33±0.05[a]	35±0.07[a]
Cystine	45±0.03[a]	40±0.07[a]	38±0.06[a]	42±0.04[a]
Phenylalamine	69±0.02[a]	59±0.06[b]	62±0.04[b]	65±0.09[b]
Threonine	71±0.08[a]	73±0.02[a]	66±0.04[b]	70±0.01[c]
Tryptophan	15±0.02[a]	15±0.04[a]	13±0.01[a]	20±0.05[b]
Valine	68±0.06[a]	66±0.04[a]	70±0.08[a]	74±0.07[a]

Discussion

Coptodonzillii from the four dams in Ekiti State showed variations in nutrient composition. The moisture content (25.33-25.95%) is higher than 7.07-11.14% reported by Olele*et al*. (2012) in three species of fish. Also, Fawole*et al*. (2007) obtained lower moisture content (5.25-10.14%) for *Chrysichtysnigrodigitatus*, 5.80% for *Sarotherodongalilaeus,* 7.90% for *Heterotisniloticus* and 6.03-8.02% for *Auchenoglanisbiscutatus*. Effiong and Fakunle (2011) obtained a value of 8.80% for *Bagrusbayad* and 11.28% for *Latesniloticus.*

The crude fat content of fish in the four dams varied between 14.71 and 20.89% which is lower than 25.04-35.07%in *Gnathonemustamandua* (Olele*et al*., 2012) but the upper value is comparable with20.18–20.89% in*Cyprinusspecularis* and 16.07-20.07% in*Cyprinuscarpio* (Kerikoe*tal*., 2010). The crude fat contents were 17.16-39.06%in *Chrysichtysnigrodigitatus* and 18.30-37.02% in *Tilapia mossambicus (*Adefemi, 2011) while Effiong and Fakunle (2012) obtained 18.22 to 36.56% fat in*Latesniloticus.* The amount of fat observed from this study is high and this is very important because it contributes to the reduction in cardiovascular diseases and may also lead to improvement in learning ability (Nordov*etal.,* 2001).

The fish from Ureje dam has the highest ash content with a value of 12.21% which falls within the range of 6.26-26.26% in *Gnathonemustamandua*reported by Olele (2012). This is in close agreement with the report of Adefemi (2011) that *Tilapia mossambicus* and *Clarias gariepinus* contained 7.58-24.52% and 6.40-23.06% ash respectively. Onyia*et al.* (2010) and Olayemi*et al.* (2011) obtained the range of 5.0-21.41% and 6.09-23.06% in *Oreochromisniloticus* and *Auchenoglanisbiscutatus* respectively.

The protein content (51.05-55.26%) which did not differ among the fish from the four dams is higher than the values obtained in*Auchenoglanisbiscutatus whose highest contents at* 6.32 to 16.31% exceeded those of three other fish species. The protein content is also not comparable with 8.31-15.18% in *Chrysichtysnigrodigitatus (*Oyelese, 2006); 5.26-16.99% in *Ailiacoila* (Mazumber*etal.,* 2008) and 9.14-12.23%in *Tilapiamossambicus* (Adefemi, 2011). These differences may be attributed to fish size, differences in fish environment, their consumption or absorption capacities, their ability to metabolize and utilize essential nutrients (from their diet or from the local environment) and incorporate them into their body (Adewoye and Omotosho, 1997).

The high percentage of crude protein observed in this study could be attributed to the fact that the fishes from the dams are not underfed and have access to favorable and unpolluted environment. A new species should be recommended for human consumption only after assessing the nutritive value of the species with regards to its nutritional qualities therefore this study has helped in providing a little update in *Coptodonzilli*inutrient composition in Ekiti State which varied from location to location.

References

Abdullah, A.Y. (2007). Evaluation of Land-based Freshwater Fish Farming Potentials in Nigeria: An Approach through the Use of Geographic Information System (G.I.S.). PhD Thesis in Zoology (Fisheries), Department of Biological Sciences, Faculty of Science University of Abuja, Nigeria.

Adefemi, O.S. (2011). Chemical composition of *Tilapia mossambicus* from major dams in Ekiti State, Nigeria. *African Journal of Food Science* 5(10): 550-554.

Adewoye, S.O., Fawole, O.O. and Omotosho, J.S. (2003). Concentration of some selected elements in some freshwater fishes in Nigeria. *Science Focus* 4: 106-108.

Ajayabhaskar, D. (2002). Nutritional Evaluation

of Molluscan Sea Food. PhD Thesis, Annamalai University, India. 129pp.

AOAC (1990). Official Methods of Analysis of the Association of Analytical Chemists (15th edition). Airlington: Association of Official Analytical Chemists. Section 969. 33pp.

Claude, E. (1979). Water Quality in Warm Water Fish Ponds: 20-72.

DuffusJ.H. (1980). Environmental Toxicology. Published by Edward Arnold, London. 164pp

Dunz, A.R. and Schliewen, U.K. (2013). Molecular phylogeny and revised classification of the haplotilapiine cichlid fishes formerly referred to as tilapia. *Science Direct Molecular Phylogenetics and Evolution Journal* 68 (1): 64-86.

Balogun, M.A. and Adebayo, F.E. (1996). Flesh yield and aspects of chemical composition of theflesh of some commercially important fresh water fish species in Nigeria. *Journal of Agricultural Technology* 4(1):33-40

Effiong, B.N, Fakunle, J.O. (2011). Proximate and mineral composition of some commercially important fishes in Lake Kainji, Nigeria. *Journal of Basic Applied Science Resources* 1(12): 2497-2500.

Elagba, M.H.A., Al-Maqbaly, R. and Mohamed, M.H. (2010). Proximate composition, amino acid and nutrient contents of five commercial Nile fishes in Sudan. *African Journal of Food Science* 4(10): 650-654.

FAO (1994). Programme for Intergrated Development for Artisanal Fisheries in West Africa. Technical Report, Food and Agriculture Organisation of the United Nation, Rome: 3-39.

Fawole, O.O. Ogundiran, M.A., Ayandiran, T.A. and Olagunju, O.F. (2007). Mineral composition in some selected fresh water fishes in Nigeria. *Journal of Food Safety* 9: 52-55.

Fischl, O.O.(1960). Mammalian Protein Metabolism. Volume 3, Edited by Murro, H.N.: 505-506.

Keriko, J.M, Chege, C.W, Magu, M.M. Mwachiro, E.C., Murigi, A.N., Githua, M.N. and Kareru, P. G. (2010). Fish lipid contents and classes of selected fish species found in Lake Naivasha (Kenya) and the fish feeding habits of the lake inhabitants. *African Journal of Pharmacy and Pharmacology* 4(10): 745-753.

Leo, N. and Matt, N. (2013). *Tilapia mariae* Boulenger, 1899: U.S. Geological Survey, Non-indigenous Aquatic Species Database, Gainesville, FL: 1-15

Louka, N., Juhel, F., Fazileau, V. and Loonis, P. (2004). A novel colorimetry analysis used to compare different drying fish processes. *Food Control* 15: 327-334.

Mazumder, M.S.A., Rahman, M.M., Ahmed, A.T.A., Begum, M. and Hossain, M.A. (2008). Proximate composition of some indigenous fish species in Bangladesh. *International Journal of SustainainableCrop Production***3**(4): 18-23.

Naglis, T.H., Mayer, W.E., Samonte, I.E., McAndrew, B.J. and Klein, J. (2011). Classification and phytogenetic relationships of African Tilapine fishes inferred from mitochondrial DNA sequencies. *Molecular Phylogenesis and Evolution* 20(3): 361-374.

Nordov, A.R., Marchioli, H.A and Videbaek, J.(2001). N-3 poly-unsaturated fatty acids and cardiovascular diseases. *Lipids* 36: 21-29.

Ogata, H.Y. and Shearer, K.D. (2000). Influence of dietary fat and adiposity on feed intake of juvenile red sea bream *Pargus major. Aquaculture, Amsterdam* 189: 237-249.

Olayemi FF, Adedayo M R, Bamishaiye E I, AwaguEF (2011). Proximate composition of catfish (*Clarias gariepinus)* smoked in Nigerian stored products research institute (NSPRI): Developed kiln. Int. J. Fisheries and Aquaculture. Vol. 3(5), pp. 95-97, Available online at http://www.academicjournals.org/IJFA

Olele. N.F. (2012). Nutrient composition of *Gnathonemustamandua, Chrysichtysnigrodigitatus and Auchenoglanisbiscutatus caught from River Niger. Nigerian Journal of Agriculture, Food and Environment 8(2): 21-27*

Onyia, L.U., Millam, C., Manu J.M. and Allison,

D.S. (2010). Proximate and mineral composition of some freshwater fish in Upper River Benue, Yola, Nigeria. *Continental Journal of Food Science and Technology* 4: 1-6

Oyelese, O.A. (2006). Implication of carcass quality and condition factor to the processing of some selected freshwater fish family. *Journal of Fisheries International* 1(2-4): 132-135.