# STUDIES ON THE MONTHLY VARIATION IN THE BODY AND NUTRITIONAL COMPOSITION OF *Labeo coubie* (Ruppel, 1832) IN SHIRORO DAM, NIGER STATE

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**Abstract**

*Proximate and mineral composition of Labeo coubie_was carried out, essential minerals and Micronutrients were determined using Spectrophotometer while, proximate composition was determined using the Association of Official Analytic Chemist Method. Result revealed that the fish is a good source of all the minerals and would provide recommended dietary allowance except for Calcium element. The monthly variation from April to August showed no significant differences (p>0.05) in the content of zinc (13.15-18.12mg/kg), Iron 70.13-106.18mg/, Copper 1.71-3.10mg/kg, Manganese 1.79-3.17mg/kg, Calcium 0.32-0.52mg/kg, Potassium was 19.58-24.12mg/kg and Sodium 18.01-20.89mg/kg. The monthly variation of the body parts of L. coubie from April to August showed moisture content range of 55.25-75.40mg/kg. The Crude Protein showed a significant difference (p<0.05) in the various body parts, Ash content ranged from 2.12-10.40%. The moisture content was highest in the skin 75.40% and lowest in bone 12.18%, while Lipid was highest in the fillet 8.15% and lowest in the bone 4.24%, Ash was highest in the head/fins 10.40% and lowest in the skin 3.06%. The fish L. coubie has an excellent composition of essential nutrients and minerals hence it is recommended as a culturable commercial fish species.*

**Keywords:** *Cyprinid fish*, Nutrient enrichment, variability, Indispensable minerals

## Introduction

In Nigeria, fish intake represents sixty percent of animal protein (Imevbore, 2016). The nutritional composition of fish differs significantly from one species to the other; hence the knowledge of fish composition is essential for its maximum utilization. Fish contributes to nutrition security and provides essential minerals such as Iodine, Selenium, Zinc, Iron, Calcium, Phosphorus and Potassium, with several Vitamins. The knowledge of proximate composition content in fishes such as moisture, ash, crude protein and lipids allows for the assessment of fish and the quality of nutrient that is made available to the consumers. Studies on the anatomical and proximate compositions of the various body are necessary for fish and fish products to be utilized resourcefully.

*Labeo coubie* belongs to the Cyprinidae family commonly known as the African Carp. It is widespread in Africa although due to lack of information on this species distribution, population size and threats, it has been categorized as data deficient for some regions in Africa (Skelton, 1993). It is a benthopelagic and potamodromous species that inhabits rivers and lakes (Skelton, 1993). It is a bottom feeder, feeding on mud, plant debris and diatoms. Shiroro dam is enriched with the fish and it is generally accepted by consumers in the local market and is viewed as a potential commercial fish of high importance.

## Location of Study Area:

Fish samples were gotten from Shiroro Dam which is a reservoir of valuable renewable resources in the semi-arid zone of Nigeria. The Dam covers an area of about 20,300km$^2$ in Niger State. It drains about 27% of the total land mass of the state, the reservoir created by the Dam has a surface area of about 306km$^2$ and elevation of 382m with a tremendous storage capacity of 605,000,000,000 cubic meters.

## Materials and Methods

### Fish Sampling:

A total of 200 *L. coubie* were collected from the fishermen at the landing site in Shiroro Dam from April to August, 2015. The fish specimens were kept in ice to avoid post mortem damage before laboratory analysis. The fishes collected were taken to the Laboratory of the Department of Water Resources, Aquaculture and Fisheries Technology, Federal University of Technology Minna, Niger State for further laboratory analysis.

### Laboratory Analysis

The materials used for the laboratory analysis include metre rule, sensitive weighing balance, mathematical set, Petri-dish, crucible, pipette, muffle furnace, soxhlet extractor, oven, conical flask, kjeldahl digestion apparatus.

### Proximate composition

Proximate composition of the fish was estimated using the Association of Official Analytic Chemist (AOAC) method (AOAC, 2001).

**Moisture Determination**

Moisture content was taken using the following procedure.

Petri-dish was cleaned and oven dried and the weight was taken ($W_1$) 5g of the sample was added and weighed ($W_2$). The Petri-dish and the content were transferred to the thermosetting oven at about $105^0$C for 24 hours. The dish was transferred from the oven to desiccator and coated for about an hour and weight was taken ($W_3$).

The moisture content was calculated using the formula below:

$$Percent\ moisture = \frac{w_2 - w_3}{w_2 - w_1} \times 100$$

**Ash Determination**

Empty crucible was Weighed ($W_1$) and 2g of fish sample was added in the crucible and weigh again ($W_2$). The crucible was placed inside the muffle furnace and the temperature was slowly increased from 200-450$^0$C to avoid incomplete ashing. The crucible was removed from the furnace to the desiccator to cool to room temperature.The weight of crucible and ash content was taken ($W_3$).

$$Percent\ moisture = \frac{w_3 - w_1}{w_2 - w_1} \times 100$$

**Crude Fat Determination**

The fat content of the fish tissue (muscle) was extracted using soxhlet extraction method. Two hundred and fifty milliliters (250ml) extraction flask (W4) was dried in the oven at 105-110$^0$C and was allowed to cool in the desiccator, extraction flask was weighed ($W_3$). Two gramme fish sample was weighed in a labeled porous thimble ($W_2$), whose moth was covered with white paper, 200ml of petroleum either was added to the dry 250ml detraction flask ($W_1$). The covered porous thimble was placed into the condenser and the apparatus was assembled and then extracted for a period of 5-6hours. The flask was allowed to cool in the desiccator and weighed. The percentage fat was calculated using the formula.

$$Percent\ fat = \frac{w_4 - w_3}{w_2 - w_1} \times 100$$

**Crude Protein Determination**

The estimation of crude protein involves the estimation of total nitrogen usually by the kjeldahl procedure. The percentage crude protein was obtained by multiplying the nitrogen content with a factor of 6.25.

$$Percent\ protein = \frac{TV \times NA \times 0.01 \times 100}{Weight\ of\ sample \times Vol.of\ aliquot} \times 6.25$$

**Where**

**TV=Titer value**

**NA=Normality of Acid**

**Mineral Elements Determination**

The mineral element analysis was carried out using Atomic Absorption Spectrophotometer (AAS) except Potassium that was carried out using Flame Photometry.

**Statistical Analysis**

Data collected were analyzed using one-way analysis of variance (ANOVA) using statistical 6.0 (stat-soft, Inc; USA) Differences between treatments were compared by Turkeys test. Level of significance was tested at P<0.05.

**Results**

The moisture and mineral content evaluation in *Labeo coubie* are presented in Table 1. The moisture content revealed a relatively high value in all the months and showed no significant difference in all the samples (P>0.05).

Zinc mineral showed no significant difference across the months (P>0.05). The results showed 13.15 ± 1.61, 18.12 ± 1.00, 16.32 ± 2.17, 16.42 ±2.18, 17.11 ± 2.01 (mg/kg). Iron unlike Zinc showed significant difference (P<0.05) across the month from April to August with 106.18±1.98, 106.01±7.14, 98.20±40.60, 70.13±20.31, 75.12±21.32, Copper did not reveal any significant difference (P>0.05) throughout the months. Manganese, Magnesium and Calcium revealed no significant difference (P>0.05) also Potassium and Sodium (Na) showed significant difference (P>0.05).

Results of monthly proximate composition of the whole body of *Labeo coubie* examined is showed in Table 2

There was no significant difference (P>0.05) in the monthly variation in lipid and moisture value of the specimens. Lipid from samples collected ranged from 9.14 to 10.95 and the month of august had the highest value of 10.95 ±1.02 and lowest in April, while moisture content of the samples ranged between 56.47% to 58.17% and was highest in April and lowest in July. The Crude Protein did not vary considerably over time. The values ranged between 17.24 and 17.73% and was not significantly difference (P>0.05) between April to August in all the samples analyzed. The ash content range from 4.06 to 4.15 and Crude Fiber ranged from 1.65 to 1.98 and there was no significant difference (P>0.05) between the treatments throughout the months.

Results of the variation in the various parts of the body of L. coubie are presented in Table 3. Results

revealed that the Crude Protein was highest in egg with a value of 27.28% which was followed by the skin with 24.26%, the fillets followed with a value of 18.95% and the head/fin 13.83%. The bone had the lowest crude protein content of 12.18%. The Lipid content of the fillet was the highest with a value of 8.15% followed by the skin 7.29%, egg had 6.24%, head 5.32% and the bone having the least, 4.24%. Moisture was highest in the skin with a value of 75.40%, followed by the fillet 73.49%, egg had a value of 59.40% and head/fin 56.67%. The lowest moisture content of 55.22% was seen in the bone. For the Ash content, the value of 10.40% was highest and in the head/fin, followed by the bone, 9.44%, skin 3.06%, fillet 2.12% and the least which is the egg with a value of 1.44%.

The Anatomical weight composition of *Labeo coubie* is presented in Table 4. The average mean weight of *L. coubie* is 478.67g. The head weighs 12.85%, scale weighs 3.59%, fin 2.82%, fillet 41.06%, skin 14.04%, bone 7.78%, egg 9.12% and gut weighs 8.28%.

**Table 1: Moisture and Mineral Contents in *Labeo coubie* from April-August**

| | Months | | | | |
|---|---|---|---|---|---|
| **Parameters** | **April** | **May** | **June** | **July** | **August** |
| **Moisture** | 64.15 ± 2.12$^{a}$ | 62.24 ±2.30$^{b}$ | 62.35 ±2.13$^{b}$ | 58.17 ±2.31$^{b}$ | 57.15 ±3.10$^{b}$ |
| **Zn** | 13.15 ±1.61$^{ab}$ | 18.12 ±1.00$^{a}$ | 16.32 ±2.17$^{ab}$ | 16.42 ±2.18$^{ab}$ | 17.11 ±2.01$^{a}$ |
| **Fe** | 106.18 ±1.98$^{a}$ | 106.01 ±7.14$^{a}$ | 98.20 ±40.60$^{a}$ | 70.13 ±20.31$^{a}$ | 75.12 ±21.32$^{a}$ |
| **Cu** | 3.10 ±0.11$^{a}$ | 2.17 ±0.12$^{a}$ | 1.89 ±0.71$^{b}$ | 1.71 ±0.62$^{b}$ | 1.87 ±0.13$^{b}$ |
| **Mn** | 3.17 ±0.22$^{a}$ | 2.16 ±0.02$^{b}$ | 1.98 ±1.21$^{b}$ | 2.13 ±0.21$^{b}$ | 1.79 ±0.34$^{b}$ |
| **Mg** | 2.35 ±0.05$^{a}$ | 2.59 ±0.08$^{a}$ | 2.42 ±0.09$^{a}$ | 2.22 ±0.04$^{a}$ | 2.41 ±0.02$^{a}$ |
| **Ca** | 0.32 ±0.02$^{a}$ | 0.52 ±0.03$^{a}$ | 0.49 ±0.02$^{a}$ | 0.41 ±0.01$^{ab}$ | 0.41 ±0.01$^{ab}$ |
| **K** | 144 ±0.01$^{a}$ | 194.01 ±0.04$^{a}$ | 520.01 ±1.12$^{b}$ | 296.02 ±1.12$^{a}$ | 140.03 ±1.11$^{a}$ |
| **Na** | 146.01 ±0.18$^{a}$ | 234.00 ±1.74$^{ab}$ | 176.00 ±2.14$^{a}$ | 230.89 ±1.69$^{ab}$ | 68.71 ±1.82$^{b}$ |

**Values in the same row with different superscript letters are significantly different (P<0.05) from each other (n=3).**

**Table 2: Monthly Variations in Proximate Composition of whole *Labeo coubie***

| Months | Moisture | Lipid | Protein | Ash | Crude Fiber |
|---|---|---|---|---|---|
| pril | 58.17±2.13$^{b}$ | 9.14±0.34$^{b}$ | 17.41±1.32 | 4.06±0.06 | 1.98±0.08 |
| May | 57.06±2.16$^{c}$ | 9.56±0.22$^{b}$ | 17.24±1.03 | 4.11±0.12 | 1.81±0.12 |
| June | 57.44±1.13$^{c}$ | 10.57±0.31$^{a}$ | 17.35±0.45 | 4.15±0.24 | 1.65±0.24 |
| July | 56.47±2.35$^{d}$ | 10.86±0.42$^{a}$ | 17.56±1.25 | 4.09±0.05 | 1.69±0.05 |
| August | 56.55±2.46$^{d}$ | 10.95±1.02$^{a}$ | 17.73±2.05 | 4.06±0.56 | 1.66±0.56 |

**Values in the same column with different superscript letters are significantly different (P<0.05) from each other (n=3).**

**Table 3: Variation in various body parts of L Coubie**

| | Body Components (%) | | | | |
|---|---|---|---|---|---|
| **Parameters** | **Head/fin** | **Fillet** | **Skin** | **Bone** | **Egg** |
| Moisture | 56.67±0.41$^{d}$ | 73.49±0.49$^{b}$ | 75.4±0.55$^{a}$ | 55.22±1.67$^{e}$ | 59.40±0.67$^{c}$ |
| Crude Protein | 13.83±0.20$^{d}$ | 18.95±0.69$^{c}$ | 24.26±0.39$^{b}$ | 12.18±1.48$^{e}$ | 27.28±0.48$^{a}$ |
| Lipid | 5.32±0.45$^{d}$ | 8.15±0.34$^{a}$ | 7.29±1.29$^{b}$ | 4.24±0.21$^{e}$ | 6.24±0/21$^{c}$ |
| Ash | 10.40±0.01$^{a}$ | 2.12±0.05$^{d}$ | 3.06±0.02$^{c}$ | 9.44±0.05$^{b}$ | 1.44±0.05$^{e}$ |

**Values in the same row with different superscript letters are significantly different (P<0.05) from each other (n=3).**

**Table 4: Anatomical Yield Weight of *L.coubie***

| **TOTAL WEIGHT** | **478.67±4.39** |
|---|---|
| **Head as % of body weight** | 12.85± 3.24 |
| **Scale as % of body weight** | 3.59±0.26 |
| **Fin as % of body weight** | 2.82±0.05 |
| **Fillet as % of body weight** | 41.06±2.56 |
| **Skin as % of body weight** | 14.04±3.16 |
| **Bone as % of body weight** | 7.78±1.22 |
| **Egg as % of body weight** | 9.12±1.25 |

| | |
|---|---|
| **Gut as % of body weight** | 8.28±1.45 |

**Discussion**

From the results obtained, the nutritional significance of *Labeo coubie in* relation to proximate composition differs significantly between April-August. (Stansby, 1985); (Azim *et al*., 2012) reported that variation in proximate composition of fresh fish may differ with species variation, age,feeding habit and season of the fish.

The result of the present study showed that there was instability in muscle and Lipid value of Labeo coubie from April-August, this variation in moisture and Lipid contents of the samples showed that with a gradual decline in moisture content, fat content gradually increased (Saoud *et al*., 2008) reported that fat content had shown inverse proportionality to water content in some semi fatty fish species muscle, this may be attributed to the seasonal differences in availability of food and changes in the reproductive cycle having considerable effect on the tissue biochemistry of the fish particularly changes in the Lipid and water content of their body system.

From the mineral content observed in this study, Zinc presence showed similar amount as the months Progressed indicating that the same value of mineral will be gained when specie of the fish is consumed. The recommended dietary allowance (RDA) OF Zinc is 15 – 19mg (HWN, 2005) thus, *Labeo coubie* is a good source of obtaining dietary, zinc; which is an important mineral that forms the integral component of enzymes including RNA and DNA polymerases (Rosa *et al*., 2007) also important in growth control (Chesters, 1991).

Minerals are highly important and required for normal life biological and physiological processes. They are essential in the formation and maintenance of skeletal system, colloidal systems maintenance, acid-base equilibrium and regulation of compounds such as hormones and enzymes(Watanabe *et al*.,1997) Iron is among the micronutrients that carries oxygen and also forms part of the oxygen carrying proteins (Rosa *et al*., 2007). This study showed that the samples studied are good source of Iron, the RDA of Fe is 15mg (HWN, 2005) Feeds from animal sources (fishmeal and meat meal) have shown to be rich sources of Iron (Watanabe *et al*.,1997) Copper is known as a trace element that is required as a component of many enzymes (Rosa *et al*., 2007). The RDA of Cu is 1.5-3mg (HWN, 2005). This corresponds with the outcome of this study on *L.coubie* being a good source of Cu.The requirement of Copper in Fish is dependent on the physiological condition of the animal and also on the Copper content of the water(if it is an aquatic animal) (Watanabe *et al*., 1997). It is an essential mineral that is important in the enzyme activities such as Cytochrome, Oxidase, Superoxide dismutase,Lysyl oxidase,Dopamine hydroxylase and Tyrosinase (Watanabe *et al*., 1997) Consumers will get good content of Copper from *Labeo coubie.*

Manganese is essential in growth and development especially in the formation of bones and cartilages, also in Glucose metabolism. It serves as a co-factor for enzymes that form metal enzymes complexes and an essential part of metalloenzymes (Clark *et al*., 1987). The RDA is 2-5mg (HWN, 2005) revealing that L.coubie is a good source of the mineral. Deficiency of Manganese leads to reduction in food intake, loss of equilibrium and poor growth and development.

Sodium, Calcium and Potassium are exchangeable cations with proven record of reducing blood pressure, helping to reduce risk of hypertension and stroke, the RDA for Calcium is 120mg (HWN, 2005) from the studies conducted with L coubie, it indicates the fish is a poor source of the Calcium element. The RDA for Sodium and Potassium is 400mg and 3500mg respectively potassium has in addition to other importance the ability of preventing Osteoporosis by maintaining the bone mineral density (New *et al.*, 2000).Sodium is responsible for balancing acid to base relationship and helps also in the transmission of nerve impulses.

Aside the mineral contents of the studied fish, the proximate composition i.e. Protein, Lipid, Ash, are important constituents in estimating and understanding the nutritional significance of the specie studied. The proximate composition of *Labeo coubie* body parts differs significantly between April-August. (Stansby, 1985; Azim *et al.*, 2012) reported that variation in proximate composition of fresh fish may differ with specie variations, age, feeding habit and season of the fish.

From this study, the skin had the highest significant value in crude protein; this may likely be as a result of some digestible and indigestible properties of protein attributed to the skin of fishes.

The high concentration of Ash content in the head region can be attributed to the concentration of inorganic materials present in the head region, this agrees with the report of( Steffens, 2006) who stated that the head region of a fish is mostly bones which are very rich in inorganic materials. The moisture of the skin recorded the highest value.

Fishes containing high value of Lipid have less water and more protein, this is in accordance with the report of (Steffens, 2006) that moisture makes up the principal amount of the wet weight in fish; the high ash content of the head region could be attributed to the concentration of inorganic material present in it: also the high concentration of

crude protein in the skin and the fillet may be as a result of the presence of Melanin and Keratin.

**Conclusions**

The findings of the present study on *Labeo coubie* shows that the specie is a good source of minerals that are indispensable for normal body growth and development. The fish as a whole showed good composition of the highly essential nutrients needed for the prevention of diseases, promotion of good health needed for all human especially the delicate groups such as pregnant mothers, nursing mothers, infants and children; therefore, mineral contents should be a major basis for the choice of assured quality, food products among other factors such as taste, size and freshness in order to improve consumers nutrition status.

**Recommendation**

The fish product showed an excellent composition in essential nutrients that promotes nutrients enrichment. Therefore, the determinant of quality edible fish should be its mineral contents, hence the fish is recommended as culturable commercial fish species in Nigeria and Africa at large.

**References**

AOAC (2001) Association of Official Analytical Chemist Official Method of Analyst.17thEdition.Hortuntzed (Ed), Washington, D.C.,U.S.A.

Azim, M. A., M.R. Islam, M.B. Hussain and M.H. Minar, (2012) Seasonal Variations in the Proximate Composition of GangeticSillago, *Sillaginopsis Panijus* (Perciformes; Sillaginidae) Middle-East *Journal of science*, Res, 11: 559-562.

Clark, J., Mac Donald, N.L. and Stark, J.R. (1987).Leucine Amino peptidase in the Digestive Tract of *Dover* soleasolea (L) *Aquaculture*, 61.231-239.

Froese, R. and Pauly,D. (2012). Species of Labeo in *Fish Base* December, 2012, Version.

Huss, H.H., Quality and Quality Changes in Fresh Fish, FAO, Rome, 1995,6:67-70

HWN(2005).Minerals–Nutrientand Health/Disease Associationshttp://www.healingwithnutrition.com/mineral.htm

.Imevbore, A. M.A. Fisheries Development in Nigeria. The Past, the Present and the Future , paper presented at the 14th Fellowship Investment Award Ceremony, Abuja, 29th July, 2016. FISON,. Pp. 4

Love, R. M. 1997.Biochemical Dynamics and the Quality of Fresh and Frozen Fish. Pg. 1-31 in G.M. Hall; ed; Fish Processing Technology, 2nd ed. Chapman and Hall. Blackie Academic and Professional, London.

New,S.A.,Robin,S.P.,Campbell,M.K.,Martin,J.C.,Garton,M.J.,PBolton-Smith,C.,Grubb,D.A.,Lee,S.J.,and Reid,D.M.(2000).Dietary influences on bone metabolism; further evidence of a positive link between fruit and vegetable consumption and bone health. *The American Journal of Clinical Nutrition,71:142-151*

Rosa, R., Bandarra, N.M., and Nunes, M. L (2007). Nutritional Quality of African Catfish *Clarias gariepinus* (Burchell 822): A Positive Criterion for the Future development of the European Production of Siluroidei. *International Journal of Food Science and Technology*. 42:342-351.

Sadiku, SOE, Oladimeji. A. A.(1991) Relationship of Proximate Composition of *Lates niloticus, synodontis schall*. *Research Communication*. 3:29-40.

Saoud, I. P., Batal, M; Ghanawi, J; Lebbos, N.(2008) Seasonal Evaluation of Nutritional Benefits of two fish species in the eastern Mediterranean sea. *International Journal of Food Science and Technology . 43 (3): 538-542*.

Silva J. J. and Chamul, R.S.,( 2000) Composition of Marine and Fresh Water Finfish and Shellfish Species and their products, In : R. E. Mortin, E.P., Carter, E.J., Flick and L.M., Davis, Marine and Fresh Water Products handbook, Lancaster, Pennsylvania, U.S.A. Technomic Publishing Company, PP. 31-46.

Stansby, M.E. (1985). Composition of Certain Species of Fresh Water Fish.*J.Food Science;* 19:231-234.

Steffens, W., (2006).Freshwater Fish- Wholesome Foodstuffs. Bulg. *Journal of Agricultural Science, 12:320-328.*

Watanabe, T., Kiron, V., and Satoh, S. (1997). Trace Minerals in Fish Nutrition *Aquaculture,* 151: 185-207