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Implication of Organ and Tissue Weight to the Processing of Some Selected Fresh Water Fish Families

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Abstract: The implications of organ weight to body (tissue) weight to the consumers preservations and processors was studied using the following representative members of five selected fresh water fish families. They are family. Clariidae example used is *Clarias gariepinus*, Mochokidae example used is *Synodontis clarias*, Cichlidae example used is *Tilapia niloticus*, Bagridae example used is *Chrysicthys nigrodigitatus*, Channidae example used is *Channa obscure,* Four replicates (including 2 females and 2 males of fish were used in each case) were dissected after taking their initial total body weights. Each internal organ (the gonad, liver, heart, gall bladder, spleen, kidney and gut) were weighed using a sensitive accoulab weighing scale. The percentage organ weight of the total body weight was calculated for each representative member of the five families. Also the total organ weight was deducted from the total body weight to five the actual fleshy edible tissue weight for each family. From this the productive potential fish yield factor (PPFYF) was calculated. The productive potential fish yield factor was not significantly (p>0.05) different among the 5 fish families with the highest value of 0.9695 recorded for *Chrysichthys* (Bagndae), second is *Tilapia* (Chichlidae) with 0.9692, this is followed by *Channa* (channidae) 0.9639 fourth is *Synodontis* (Mochokidae) 0.9543, while the least PPFYF of 0.9422 was recorded in *Clarias* (Clariidae). The least total organ weight of 3.05% was recorded in *Chrysichthys*, while the highest total organ weight of 5.78% was recorded in *Clarias* also with the second highest values of 4.57% recorded in *Synodontis*. The lowest PPFYF (0.9422) recorded for *Clarias gariepinus* is as a result of the gonad weight (1.95%) and heart weight (0.11%) while the PPFYF value (0.9543) recorded for *Synodontis clarias* was as a result of the liver weight (1.09%), kidney weight (0.67%) and gut weight (2.33%) of total body weight. This implied total overall body weight does not determine fish yield (PPFYF) as in this study *Clarias gariepinus* had the highest total mean weight of 402.50 gm but the highest total organ weight of 23.28 gm (i.e., 5.78% of total body weight). Also a high proximate Crude Protein (C.P) composition of a fish does not necessarily imply a proportional or corresponding laying of fish flesh as shown in this study with *Clarias gariepinus* having the highest crude protein of 62.00% followed by *Syodontis clarias* with 53.38%.

Key words: 5 fresh water fish families, organ/tissue weight, Productive Potential Fish Yield Factor (PPFYF), proximate composition, processing

INTRODUCTION

This study is aimed at relating the organ and tissue (fresh) weight of typical representatives of five selected fresh water fish families to their body weight. Thi is in a bid to calculating the available fleshy (tissue) part of the fish for eating after discarding the viscerals (the internal organs).

The five selected fish families used for the study are:-

- Family Clariidae example is *Clarias gariepinus*
- Family Mochokidae example is *Synodontis clarias*
- Family Bagridae example is *chrysichthys nigrodigitatus*
- Family Cichlidae example is *Tilapia niloticus*
- Family Channidae example is *Channa obscura*

The calculation of the edible (fleshy tissue) portion after discarding the viscerals is defined in this study as the Productive Potential Fish Yield Factor (PPFYF). This helps in he determination of which fish specie will be vulnerable to fast processing, storage or preservation.

A large fish with a large percentage of organ weight compared to edible tissue weight will have a low productive potential fish yield factors and vice versa. This is of great implications to the fish processor because in fish handling and preparation (which involves degutting, filleting, boning etc) the visceral organs are usually discarded before freezing prior to further processing or preservation, hence the need for the calculation of the PPFYF as a means of forecasting profitability of the venture, moreso if the fish in consideration is a lean fish which attracts a low price in the market.

The chemical composition f fish varies from species to species and also from individual to individual depending on age sex, environment and season Huss,[1]. Also he asserted that the technological characteristics of fish are mainly influenced by the lipid content and for this reason it has been easy to classify fish as fatty, semi fatty and lean.

Variations in chemical composition of fish are closely related to feed intake. During the period of heavy feeding at first, the protein content of the muscle tissue will increase very slightly and then the lipid content will show a marked and rapid increase. But, during the fish starvation period especially due to shortage of food or physiological reasons (spawning or migration) variations in chemical constituents (i.e., fat, protein, ash, water etc) are not unlikely.

The relative weight of the visceral organs are quite variable in many fish because of the tendency to store fat during non reproductive periods. It is therefore useful to consider the relationship of these organs and tissue to the ole fish. Growth is isometric when there is proportional lationship between the organ weight and the body weight and allometric if the reverse is the study.

Below is a brief of each of the five selected fish families:

Family clariidae (the catfish): Lewis *et al*.,[2,3] described *Clarias* as omnivorous. They also feed on plankton, weeds, insects, crustaceans, worms, snails, frog and small fishes. They are widely distributed throughout Africa.

In the natural environment, *Clarias* breeds generally during the rainy season. Elliot,[4] reported that female *Clarias* has large quantities of eggs from May to October. Although, some mature eggs are still found at all times.

They exhibit sexual dimorphism. The male has an elongated conical genital papilla while in the female, the vent is more rounded with a longitudinal cleft. At full maturity, a gravid female shows deeper and more rounded soft abdomen, prominence of blood vessels in the belly region and appearance of a few eggs up on slight manual pressure on the abdomen. Carreon *et al*.[3] Ripe males are characterized by a slightly vascularised genital papilla. Unlike the female the male do not respond to stripping of the milt on slight manual pressure on the abdomen Hogendoorn,[5].

Family bagridae *(Chrysichthys nigrodigitatus)*: The species is available in varying degree of abundance in the creeks and Lagoons, River Niger and Benue. Other areas include, Jebba, Kainji Lake, Makurdi and Lokoja Ezenwa[6].

Chrysichthys nigrodigitatus is discovered to be the dominant fish species in Asejire Lake (Dam). The fish specie is a warm water species which tolerate both fresh-water and brackish water condition. Fagade and Adebisi[7]. The fish thrives abundantly on soft muddy grounds usually at the mouth of mangrove belts where roots and tangles of plant exists Ezenwa[6].

The fish species feed on four bivalve genera which include *Iphigenia spp. Alloidis sp*p, are s more important in numerical abundance. Fagade and Adebiyi[7].

Chrysichthys nigrodigitatus is known to breed seasonally and often spawn during the rainy season. *C. nigrodigitatus* spawns between June and October in Kainji Lake, Nigeria and similarly, *C. nigrodigitatus* was noted to spawn in Asejire dam from June to July.Fagade and Adebisi[7].

Family cichlidae (*Tilapia* sp.): There are many species of Tilapia apart from *Tilapia niloticus* used in this study. *Tilapia melanotheron* and *Tilapia guinensis* fed on similar food items, which includes algal filaments, diatonas, unidentified organic matter, fragments of higher plants arthropods and some animal species.

Different species of *Tilapia* exhibit different spawning behaviour. For example, *Tilapia guinensis* spawns in water of salinity range of 11-20 part per thousand and temperature range of 26 to 34°C under artificial propagation *Tilapia guinensis* exhibit a firm pair bonding with prolonged association during breeding. the pair estabilished territory and both defend it. Inside the territory is a spawning nest consisting of series of holes. The eggs are laid in one of the holes. In the study of *Sarotherodon melanotheron* , the male makes a simple shallow depression about 10-40 cm diameter in the eggs in a few large batches and the male fertilizer them but does not pick the fertilizes eggs until all the eggs are shed by the female. If the male is slow in collecting the eggs the female may collect them and incubate them. *Tilapias* exhibit prodigious fecundity in most cases compensating proposed weight gain for egg production. An adult female *Tilipia guinensis* will produce between 20,000-1,000,000 eggs.

Family mochokidae (*synodontis* sp.): The commonest genus in this family is *Synodontis.* They are characterized by short, stumpy bodies and head shield of hard bone, that extends the whole of the head region as far as the basis of the dorsal and pectoral fins which are ossified ; the bone usually being rough and granular. Each of these fins has serrated spines which can be moved in an extended position, this forming a formidable defense mechanism which makes those fish difficult to handle.

The spine can inflict pain which is made worse by the serration in the spines running in both direction and therefore makes the spine difficult to remove. Fishermen always breaks the spine of these fish immediately they are caught.

They have large adipose fin which extends from the dorsal fin to the caudal. Nasal barbells are absent. Small *Synodontis* are often attractively molted and their colouring is always different from that of larger fish. Feeds on a wide variety of food ranging from small crystaceae fish worms and macro aquatic plants which they break and cut with their powerful array of mendibularteeth arranged in group in front of the lower jaw.

Family channidae (*Channa obscura*): There is only one specie of this family in West Africa, *Channa obscura* often referred to as snake head. In addition to its distinctive head, its colour is brownish olive with a series of large black blotches along the sides. It is found in vegetations and flood plains , but it is not common. It feeds on fish and grows to a length of around 500 mm. It is therefore the objective of this study.

- Determine the ratio of specific organ weight (Gonad, Liver, Heart, Gall bladder, Spleen, Kidney and Gut) to tissue body weight of the selected fresh water fish families.
- Determine the Productive Potential Fish Yield factor (PPFYF) (that is total body weight-Total weight of the visceral organs).
- Evaluate the implications of the Productive Potential Fish Yield Factor (PPFYF) to the handling, preservation and processing of the selected fish species.

MATERIALS AND METHODS

The adult fresh fish of 5 selected fresh water fish families were procured from Alesinloye market, Ibadan, Nigeria and trans ported live in a plastic container filled with water to the Departmental laboratory (Department of Wildlife and Fisheries Management).

The wet body weight of representatives of each of the 5 families were taken. These (body weight) and other organ weight readings; that is of the visceral organs in each case (Gonad, Liver, Heart gall bladder, spleen, kidney and gut) were replicated four times using 2 females and 2 males in each case) each of the five fish representatives were also analysed for proximate composition.

Each of the fish specimen was dissected (after weighing the whole fish) and weights of the internal visceral organs (Gonad, Liver, heart, Gall bladder spleen, kidney, gut0 were taken using a sensitive Accoulab weighing scale. The weight reading were replicated four times and mean readings were used for further calculations.

These weight ratio (percentage) of the organs were added together and deducted from the total percentage body weight for each fish specie to give the productive potential fish yield factor (PPFYF) which is the weight (or ratio) of the edible portion of he fish specimen for each of the fish families.

The layout of the experiment is as given below.

- Family clariidae (*Clarias gariepinus*)
  A_1- (for proximate analysis), A_2-A_5 (Dissected)
- Family Bagridae (*Chrysichthys nigrodigitatus*)
  B_1- (for proximate analysis), B_2-B_5 (Dissected)
- Family Cichlidae (*Tilapia niloticus*)
  C_1- (for proximate analysis), C_2-C_5 (Dissected)
- Family Mochokidae (*Synodontis clarias*)
  D_1- (for proximate analysis), D_2-D_5 (Dissected)
- Family Channidae (*Channa obscura*)
  E_1- (for proximate analysis), E_2-E_5 (Dissected)

Statistical analysis: All data collected in this study were subjected to analysis of variance (ANOVA) regression and correlation analysis.

RESULTS

As shown in Table 1 *Clarias gariepinus* (Clariidae) had the highest crude protein of 62.00%, second is *Synodontis clarias* (Mocholodae) with 53.38%, third is *Chrysichthys nigrodigitatus* (Bagridae) with 50.00% fourth is *Channa obscura* (Channidae) with 47.36% and the least crude protein of 39.61% was recorded in *Tilapia niloticus* (Cichlidae) 3.08% organ weight and lastly *Chrysichthys nigrodigitatus* 3.05%.

In all the five families *Clarias gariepinus* had the highest Gonad weight 1.95% and heart weight 0.11% of total body weight; while *Synodontis clarias* had the highest liver weight 1.09%, kidney weight 0.67% and gut weight 2.33%. Also *Tilapia niloticus* had the highest gall bladder weight 0.19% and *Chrysichthys nigrodigitatus* had the highest spleen weight 0.44% of total body weight.

While Table 2 also shows that there is no significant difference ($p>0.05$) in the total tissue weight among the selected fish families which ranged from 94.22% in *Clarias gariepinus* to 96.95% in *Chrysichthys nigrodigitatus.* Table 3 further confirmed that the Productive Potential Fish Yield Factor (PPFYF) is highest in *Chrysichthys* (0.9695), second In *Tilapia niloticus* (0.9692) third in

Table 1: Proximate composition of five selected freshwater fish families

	Clarias gariepinus	*Channa obscura*	*Chrysichthys nigrodigitatus*	*Tilapia niloticus*	*Sgnodontis clarias*
Moisture	17.48	20.76	20.52	17.58	18.13
Ash	10.10	10.77	12.93	14.34	12.65
Fat	5.80	4.43	6.36	4.58	6.50
Fibre	0.62	6.47	5.84	15.24	5.50
Crude protein	62.00	47.36	50.00	39.61	53.38
Nitrogen free extract	4.00	10.21	4.35	8.65	3.84

Table 2: Percentage mean organ (GM)/body weight ratio (%)

Species	Body weight %	Gonad weight %	Liver weight %	Heart weight %	Gall bladder weight %	Spleen weight %	Kidney weight %	Gut weight %	Total organ weight %	Total Tissue weight %
1. *Clarias gariepinus*	402.50	7.83 (1.95%)	3.48 (0.87%)	0.45 (0.11%)	0.40 (0.10%)	0.82 (0.20%)	1.80 (0.45%)	8.50 (2.11%)	23.28 (5.78%)	379.22 (94.22%)
2. *Channa obscura*	165.20	1.98 (1.20%)	0.98 (0.59%)	0.10 (0.06%)	0.20 (0.12%)	0.25 (0.15%)	0.15 (0.09%)	2.30 (1.39%)	5.96 (3.61%)	159.24 (96.39%)
3. *Chrysichthys nigrodigitatus*	293.68	0.58 (0.20%)	2.58 (0.88%)	0.15 (0.05%)	0.18 (0.06%)	1.30 (0.44%)	0.73 (0.25%)	3.45 (1.18%)	8.97 (3.05%)	284.71 (96.95%)
4. *Tilapia niloticus*	96.50	1.21 (1.25%)	0.90 (0.93%)	0.10 (0.10%)	0.18 (0.19%)	0.23 (0.24%)	0.10 (0.10%)	0.25 (0.26%)	2.97 (3.08%)	93.53 (96.92%)

Table 3: Production potential fish yield factor (PPFYF)

Species	Body weight (GM)	Total organ weight /% of body wt	Total tissue weight /% of body wt	Productive potential fish yield factor (PPFYF)
1. *Clarias gariepinus*	402.50	23.28 gm 5.78%	379.22 gm 94.22%	0.9422
2. *Channa obscura*	165.20	5.96 gm 3.61%	159.24 gm 96.39%	0.9639
3. *Chrysichthys nigrodigitatus*	293.68	8.97 gm 3.05%	284.71 gm 96.95%	0.9695
4. *Tilapia niloticus*	96.50	2.97 gm 3.08%	93.53 gm 96.92%	0.9692
5. *Synodontis clarias*	149.93	6.85 gm 4.57%	143.08 gm 95.43%	0.9543

Channa obscura (0.9639), fourth in *Synodontis clarias* (0.9543) and the least PPFYF of (0.9422) in *Clarias gariepinus.*

DISCUSSION

The quantity of edible fish flesh available to the consumer is of utmost importance just as it is to the processor. The organ weight of a fish determines what fish flesh is available for the consumer to eat.

A fish with a large organ weight lives a little portion of the edible tissue for consumption hence a low Potential Productive Five Yield Factor (PPFYF) as it is the case in this study with *Clarias gariepinus* having the lowest PPFYF factor of 0.9422 out of the five fish families studied. However the highest fish yield factor of 0.9695 was recorded for *Chrysichthys nigrodogitatus,* with the lowest organ weight of 3.05%.

This also implies from the study that the total weight of a fish does not determine the fish yield to the consumer and the processor; as it is clearly shown *Clarias gariepinus* with the highest mean body weight of 402.50 gm had the lowest fish yield factor (PPFYF) after removing the visceral organs. Although it may be of a higher protein values (i.e., more protaineceous) than the other fish families because it had the highest crude protein of 62.00% in its proximate composition compared to *Chrysichthys nigrodigitatus* with 53.38% crude protein as shown in Table 1.

The gonad weight 1.95% and the heart weight 0.11% of total body weight of *Clarias gariepinus* possibly resulted in the lowest fish yield factor. Also *Synodontis clarias* which had the second lowest fish yield factor of 0.9543 (PPFYF) is probably so because of the liver weight 1.09%, the kidney weight 0.67% and the gut weight 2.33%.

From the ongoing it simply implies that certain visceral organs may tend to add excessive weight to the total body weight of the fish because of the specialized role they perform. As it is in this case the gonad of *Clarias gariepinus* tends to be enlarged and distended with both ripe and unripe eggs especially during the breeding season and this also requires a big enlarged heart to actively pump blood to the richly highly vascularised gonads.

As it is also the case of *Synodontis clarias* which also recorded the second lowest fish yield factor of 0.9543 has the highest gut weight 2.33% which is probably a reflection of its feeding habits which ranged from small crustaceans, fish; macro aquatic plant worm etc thus resulting in the laying of fat around the liver and kidney hence the highest organ weight values of 1.09 and 0.67% (among the five fish families) recorded respectively coincidentally in this study as shown in Table 1 *Synodontis clarias* (Mochokcdae) had the highest fat content of 6.50% in its proximate composition.

CONCLUSION

The weight of the visceral organs determines the quantity of edible fish flesh available to the consumer and processor. The lower the organ weight the higher the tissue weight and hence the higher the Potential Productive Fish Yield Factor (PPFYF). In this study *Chrysichthys nigrodigitatus* with the lowest organ weight of 3.05% compacted to total body weight had the highest fish yield factor (0.9695).

The specialization and constant use of some visceral organs such as the gonads in *Clarias gariepinus* (Clariidae) and in *Synodontis clarias* (Mochokidae) the guts may result in their excessive gaining of weight 1.95% gonad weight for *Clarias* and 2.33% gut weight in Synodontis), this making the actual total fleshy tissue body weight deceptive, since this organs appreciates a considerable influence on the overall total weight of the fish. Also a high crude protein composition of a fish does not necessarily imply a proportional or corresponding laying of fish flesh as shown in this study in *Clarias gariepinus* with the least PPFYF of 0.9422 but the highest crude protein (C.P) of 62.00%.

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