Journal of Agriculture and Environment Vol. 11 Nos. 1 and 2, 2015: 55-62
ISSN 1595465X

PROCESSING EFFECT ON THE PROXIMATE COMPOSITION OF SOME SELECTED NON-CONVENTIONAL FISH FEED INGREDIENTS SOURCED WITHIN SOKOTO METROPOLIS

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ABSTRACT

This study was carried out to determine the processing effect on the nutrient composition of rice bran, chicken feather and chicken viscera which were collected from different places in Sokoto state. The processing methods used were boiling, oven drying, sun drying, fermenting, and the combination with each other. The Proximate analysis was carried out before and after processing. The result of proximate composition of direct oven dried chicken viscera shows that it was significantly ($P<0.05$) higher in crude protein (30.30±0.12) and lipid (15.30±0.17) than boiled and oven dried chicken viscera crude protein (7.67±0.33) and lipid (4.80± 0.12). For fermented sun dried and fermented oven dried rice bran, both methods shows a significant increase in crude protein (12.43±0.03), (12.13±0.09) and decrease in crude fibre (2.50±0.12), (3.50±0.06) compared to the un-treated rice bran (11.17±0.07), (4.00±0.29). For the chicken feather both the processing methods applied shows a significant ($P<0.05$) decrease in crude protein (boiling and oven drying, (33.80±0.06); boiling, fermenting and oven dry, (33.72±0.41) and decrease in crude fibre (3.17±0.12), (1.83±0.17) compared to the fresh chicken feather (39.53±0.09), (3.80±0.06). The study concluded that direct oven dry method gives higher value of crude protein for chicken viscera. For rice bran, the fermenting and sundry method yielded a better result than the other method. The boiling, fermenting and oven dry recorded a lower value of crude fibre for chicken feather than the other methods. Thus, the study concluded that the ingredient analyzed could serve as both protein and energy source in fish feed formulation.

Keywords: Proximate composition; Non-conventional fish feed ingredients

INTRODUCTION

Fish has continued to be a hope toward solving global problem of malnutrition, due to its nutritive value which is above most other animal protein (Delgado *et al.*, 2003). The expansion and intensification of aquaculture production has been recommended toward ensuring increase in food production in order to meet up with global demand, since capture fisheries have continued to decline (Delgado *et al.*, 2003).

Nigerian feed stuffs have been in the decline in recent years because of the diminishing output of certain crops (FAO, 2008). Statistics revealed that the country relies on import to meet the need of an expanding livestock and aquaculture industry (FAO, 2008). This has culminated in the increase in the price of food and feed resources in the country which has aggravated the already high cost of fish feed which has been a major problem to fish farmers in Nigeria. The high cost constitute 40-60% of the re-current cost of most intensive fish farm ventures which negates the economic viability of the farm when cheaper alternatives are not available (Madu *et al*., 2003). However, the development of aquaculture systems depend on the use of available local ingredient which will reduce the feeding cost (Edwards and Allam, 2004).

Non-Conventional Feed Resources (NCFR^s) are feeds that are not usually common in the market and are not traditional ingredient used for commercial fish feed production (Devendra, 1988; Madu *et al*., 2003). These include all types of feed stuff from animal (silk worm, maggot, termite, earth worm, snail, tad poles, etc.), plant wastes (jack bean, cotton seed meal, soya bean meal, cajanus, chaya, duck weed, maize bran, rice bran, palm kernel cake, ground nut cake, brewer waste etc.) and waste from animal sources and processing of food for human consumption such as animal dung, chicken viscera, feather, fish silage, bone, and blood meal (Abowei and Ekubo, 2011). All these can be recycled to improve their value, if there are economically justifiable and technological means of converting them into their useable products. Nutrient value estimated from available conventional and non-conventional feed sources are high and would appear to justify continuous investigation and utilization of their nutritional potential to enhance an economic fish production (Okoye and Sule, 2001).

The nutrients available in feed ingredient is one of the major pre-requisite apart from availability (which sometimes a function of cost and season) for production of good quality feeds. The nutrient content of the feed stuffs are affected by processing methods (FAO, 2008).

Adejinmi *et al.*, (2000) reported that, it is essential that existing data on the chemical composition of feed ingredients are utilized or proximate analysis be carried out before in corporation. The aim of this study was to determine the effect of processing on the proximate composition of some selected non-conventional fish feed ingredients.

MATERIALS AND METHODS

Study Area

The study was carried out at Agric chemical laboratory of the Department of Forestry and Fisheries, Usmanu Danfodiyo University, Sokoto. Sokoto state falls within latitudes 12^0N and $13^0$58N and longitude 4^0E and $6^0$54E. Chicken viscera (intestine only) and feather were collected from Sokoto Central Market where chicken are processed. Rice bran was collected from the rice millers at Girabshi area, Wamakko Local Government Area, Sokoto State.

Sampling Techniques and Processing Methods

Chicken Viscera (intestine only**):**1800g of emptied viscera of chicken was divided into two parts. Each part was subjected to two different processing methods. The procedures are as follows:

1. Boiling and Oven drying**:** 900g of the viscera was boiled in three batches of 300g for 30 minutes at 100^0C. It was then drained of water together with some fat content and then oven dried at 65^0C for 48 hours according to the procedure in (Isika *et al.*, 1999).
2. Direct Oven Drying**:** 900g of the viscera was oven dried in three batches of 300g for 24 hours at 65^0C.

Rice Bran**:** 1800g of rice bran was divided into two parts; each part was subjected to different method of processing. The procedures are as follows:

1. Fermenting and Oven Drying**:** 900g of rice bran was divided into three batches of 300g, each batch was mixed with 10g of bakery yeast and small quantity of water was added to form a homogenous mixture. Each batch was put into a plastic container and it cover was perforated for the yeast to respire. The batches were then be fermented for 24 hours and after fermentation the batches was oven dried for 24 hours at 65^0C.
2. Fermenting and Sun Drying**:** 900g of rice bran was divided into three batches of 300g. Each batch was mixed with 10g of bakery yeast and small quantity of water was added to form a homogenous mixture. Each batch was put into a plastic container and it cover was perforated for the yeast to respire. The batches were then fermented for 24 hours at room temperature. After fermentation the batches were oven dried until a constant weight was achieved.

Chicken Feather**:** 1800g of chicken feather was divided into two parts; each part was subjected to different processing method. The procedures are as follows;

1. Boiling and Oven Drying**:** 900g of chicken feather was boiled in three batches of 300g for 75 minutes. After being boiled, the batches were drained of water. Each batch was oven dried at 100^0C for 48 hours.
2. Boiling, Fermenting and Oven Drying**:** 900g of chicken feather was boiled in three batches of 300g for 75 minutes. After being boiled, the batches were drained of water and were oven dried for 24hour at 100^0C, after which it was ground into small particles. Each batch was mixed 10g of bakery yeast and small quantity of water was added to form a homogenous mixture. Each batch was put in plastic container and it cover was covered perforated for the yeast to respire and was fermented for 24 hours. After fermentation the batches were oven dried at 100^0C for 24 hours.

Data Analysis

The proximate composition of the non-conventional fish feed ingredients was analyzed before and after processing, following the procedure of AOAC (1996). Completely Randomized Design (CRD) was used as the experimental design. Data collected were subjected to one-way analysis of variance (ANOVA) and significant difference among the treatment means were separated using Duncan's multiple range test

(Duncan, 1995). Statistical Package for Social Science (SPSS), Version 16.0 Software was used for the analysis.

RESULTS AND DISCUSSION

Proximate Composition of Chicken Viscera (intestine only)

The result of the proximate composition of fresh sample of chicken viscera on direct oven dried and boiled and oven dried sample of chicken viscera are presented in Table 4.1. The result showed that there was significant ($P<0.05$) difference between the moisture content of fresh chicken viscera (77.70±0.06), direct oven dried sample (10.70±0.20). The value recorded in the result of boiled and oven dried and direct oven dried sample moisture content were significantly ($P<0.05$) higher compared to value of 10.00% as reported in (Isika *et al.*, 1999). While the result of fresh chicken viscera sample was significantly ($p<0.05$) higher compared to the value of 73.70% as reported by (New, 1992) and this could have been due to the nature of the product after processing. The ash of boiled and oven dried sample 3.5% was significantly $p<0.05$ lower than what was reported 5.92% in (Isika *et al.*, 2009). The lipid of direct oven dried sample was higher than what was recorded (8.00%) in fish meal (clupeid) (Sogbesan and Ugwumba, 2008). The lipid content differed ($p<0.05$) significantly between fresh chicken viscera sample (1.50±0.29), boiled and oven dried sample (7.67±0.33) and direct oven dried sample (15.30±0.17). The higher content of lipid could probably affect the shelf life of the product during storage. The lipid of boiled and oven dried sample was low because water was drained with some quantity of lipid before oven drying. The crude fibre of both boiled and oven dried sample and direct oven dried sample results were lower than what was recorded (4.6%) by (Isika *et al.*, 2009). The values recorded in nitrogen free extract were higher in (Isika *et al.*, 2009). The crude protein differed ($p<0.05$) significantly between fresh chicken viscera sample (16.90 ±0.09), direct oven dried sample (30.30±0.12) and boiled oven dried sample (4.80±0.12). The low crude protein of boiled and oven dried sample was attributed to the fact that high temperature was used during boiling and lengthy duration of the drying. Sadiku and Jauncey, (1997) reported that when heat is applied below or above the required level, protein availability will be adversely affected. Hence the value recorded in the present can be incorporated into fish feed to substitute for conventional ingredient.

Table 1: Proximate composition of Chicken Viscera (%Dry Weight) subjected to different processing methods

Processing method	Moisture%	Ash%	Lipid %	Crude protein%	Crude Fibre%	NFE%
Fresh	77.70±0.06^a	0.33±0.03^b	1.50±0.29^c	16.90±0.09^b	0.0± 0.00^b	81.20±0.38^b
Oven dry	12.83±0.17^b	4.17±0.17^a	15.30±0.17^a	30.30±0.12^a	1.33±0.17^a	48.90±0.57^c
Boiling and dry	10.70±0.20^c	3.50±0.76^a	7.67±0.33^a	4.80± 0.12^c	1.17±0.17^a	83.20±0.53^a

Means in a column denoted by the same letter are not significantly different ($P>0.05$)

Proximate Composition of Rice Bran

Rice bran is a by-product of rice milling industry and the results presented in Table 4.2 shows that There was significant ($p<0.05$) difference between the moisture content of fresh rice bran (2.50± 0.12), fermented and sun dried (11.57±0.07) and fermented and oven dried (10.27±0.03) sample. The moisture was lower in fresh rice bran than fermented sun dried and fermented oven dried sample. This is due the fact that the processing methods were not long enough to remove more moisture. The ash content (within the range of 27.50-29.27%) is in the order of accumulation; fresh rice bran sample, fermented oven dried sample and fermented sun dried sample. The ash of fresh rice bran was higher compared to what was recorded 16.19% in Philippine Society of Animal Nutritionist (1990). This was attributed to the fact that the fresh rice bran contains some percentage of rice hulls. There was no significant ($p>0.05$) difference between the crude fibre of fresh rice bran (4.00±0.29) and fermented and oven dried sample (3.50±0.06) but fermented and sun dried sample (2.50±0.12) differed ($p<0.05$) significantly from fresh rice bran and fermented and oven dried sample. The crude fibre of the fermented sun dried and fermented oven dried sample was lower compared to what was recorded by Bidura *et al.* (2009). The low crude fiber achieved was attributed to the lengthy duration of fermentation. Both fermented sun dried and fermented oven dried samples that were treated were higher in crude protein compared to fresh rice bran which was not treated. Hardini (2010) reported that fermented feed contain higher nutrient compared to raw material. The composition of nitrogen free extract exhibit significant ($p<0.05$) difference between the crude protein of fresh rice bran (11.17±0.07), fermented and sun dried sample (12.43±0.03) and fermented and oven dried sample (12.13±0.09). The crude protein of fresh rice bran was lower compared to what was recorded (12.30%) (Bidura *et al.,* 2009) and so also for both treated samples as recorded. This is attributed to the fact that fermentation can increase the digestibility of dry matter as well as crude protein as reported in Hong *et al.* (2004). Hence the values obtained of Nitrogen Free Extract in the present study can substitute energy feed ingredient in fish feed.

Table 2: Proximate composition of Rice Bran (%Dry Weight) subjected to different processing methods

processing method	Moisture %	Ash %	Lipid%	Crude Protein%	Crude Fibre%	NFE%
Rice bran	2.50 ± 0.12^{c}	29.27 ± 0.15^{a}	2.50 ± 0.12^{a}	11.17 ± 0.07^{c}	4.00 ± 0.29^{a}	53.27 ± 0.09^{c}
Fermenting and Sundry	11.57 ± 0.07^{a}	27.50 ± 0.12^{b}	1.07 ± 0.07^{c}	12.43 ± 0.03^{a}	2.50 ± 0.12^{b}	56.57 ± 0.09^{a}
Fermenting and Oven dry	10.27 ± 0.03^{b}	27.57 ± 0.15^{b}	1.50 ± 0.06^{b}	$12.13\pm0.09^{\mathbf{b}}$	3.50 ± 0.06^{a}	55.40 ± 0.06^{b}

Means in a column denoted by the same letter are not significantly different ($P>0.05$)

Proximate Composition of Feather

Table 3 shows the proximate composition of fresh feather, boiling and oven dried and boiled, fermented and oven dried sample and There was no significant (p>0.05) difference between the moisture content of boiled and oven dried sample (5.50±0.17) and boiled, fermented and oven dried sample (5.80±0.15) but fresh feather (3.20±0.15) differed (p<0.05) significantly from other treatment. the result showed that the moisture was lower for boiled oven dried and (boiled, fermented and oven dried) sample were higher than what was recorded (2.4%) in Philippine society of animal nutritionist (1990). The lipid of boiled oven dried was lower compared to what was recorded (2.45%) in Philippine society of animal nutritionist (1990). This is due to the fact that lipid can be loss during boiling of sample. There was significant (p<0.05) difference between the crude fibre of fresh feather (3.80±0.06), boiled and oven dried sample (3.17±0.12) and boiled, fermented and oven dried sample (1.83±0.17).Boiled fermented oven dried sample has the lowest crude fiber compared to boiled oven dried sample. This is due to the fact that fermentation causes the breakdown of larger molecule into simpler ones. The nitrogen free extract of boiled oven dried sample was higher than what was recorded 15.61% in Philippine society of animal nutritionist (1990). This was attributed to the fact that heat can destroy carbohydrate during processing. There was no significant (p>0.05) difference between the crude protein of boiled and oven dried sample (33.80±0.06) and boiled, fermented and oven dried sample (33.7±20.41) but fresh feather (39.53±0.09) differed (p<0.05) significantly from other treatment. The crude protein of boiled oven dried sample was lower compared to what was reported (91.31%) in (Hardini, 2010). This could be due to genetic make-up of the chicken from which the feather was collected.

Table 3: Proximate composition of Chicken Feather sample (%Dry Weight) subjected to different processing method

processing method	Moisture %	Ash %	Lipid%	Crude Protein%	Crude Fibre%	NFE%
Raw feather	3.20±0.15[b]	9.90±0.21[a]	1.17±0.17[a]	39.53±0.09[a]	3.80±0.06[a]	46.27±0.09[b]
Boiled and Oven dried	5.50±0.17[a]	8.50±0.12[a]	0.00±0.00[b]	33.80±0.06[b]	3.17±0.12[b]	54.73±0.15[a]
boiled, Fermented and Oven dried	5.80±0.15[a]	10.17±1.7[a]	1.33±0.17[a]	33.72±0.41[**b**]	1.83±0.17[c]	52.92±2.24[a]

Means in a column denoted by the same letter are not significantly different (P>0.05)

CONCLUSION

The selected non-conventional fish feed ingredient that were processed are chicken viscera, chicken feather and chicken viscera. After processing the result of proximate composition of direct of direct oven dried chicken viscera shows that it was significantly (P<0.05) higher in crude protein and lipid than boiled and oven dried chicken viscera. For fermented sun dried and fermented oven dried rice bran, both method shows a significant (P<0.05) increase in crude protein and decrease in crude fibre compared to the un-treated rice bran. For the chicken feather both the processing method applied shows a decrease in crude protein and decrease in crude fiber compared to the fresh chicken feather. Thus, the study concluded that the ingredient analyzed could serve as both protein and energy source in fish feed formulation.

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