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INDIGENOUS FISH FEED RESOURCES IN NIGERIA *A REVIEW*

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ABSTRACT

Many unconventional sources are of very good nutrient profiles which when incorporated into feeds can meet parts of the protein and energy requirements of the fish. Most of these indigenous fish feed resources are non-competitive in terms of human consumption, their prices are relatively very low and sometimes are of no cost value. They are usually by-products or waste products from agricultural industries, domestic waste, and wild plants, thus their utilization as feed resources can help to reduce the cost of fish feeds and fish production in Nigeria.

Keywords: unconventional feed sources, fish feed, nutrient requirement, availability, cost.

Introduction:

Nigeria is blessed with an abundance of food resources, carbohydrates and protein alike that are consumed by man and animals. Those consumed only by man are often called conventional feed sources, while those consumed by his animals are termed unconventional feed sources. A wide range of unconventional and wild plants have been studied and are known to contain high protein and carbohydrate content which could be used as dietary ingredients for feeding fish. These alternative wild, unutilised products were also observed to reduce to a large extent the cost of formulating fish feed. These unconventional feed sources are usually not commonly found in the market places. They are of plant or animal origin. Though products of some of these wild plants might not be available all year round, care and strategy should be put in place for collection during the harvest season and proper storage facilities should be provided.

The need to meet the optimum demand for fish production had in earlier times opened the way for researchers to gear into the search for local feedstuff consumed by man that could adequately compete with fish meal. Over time, this did not seem to solve the problem of fish feed ingredients because of the constant rise in the price of the feedstuff and increasing demand for these same food products by the human population. This recent measure may reduce the high cost of feed ingredients which is the major problem of fish farmers in Nigeria, especially fish meal that is generally considered the most expensive cost item in intensive fish farming (Madu et al., 2003). Fish feed constitutes about 40-60% of the recurrent cost of most intensive fish farming ventures and sometimes negates the economic viability of a farm if suitable feeds are not used. However, fish feed is one of the essential factors needed to promote and develop modern fish culture. More so, the use of a local, wild and untapped variety of plant parts (seeds, leaves and pods) incorporated into the feed ingredients for feeding fish may be worthwhile and economically viable (Eyo, 2001).

Feed and food origins are rich in minerals namely; phosphorus, calcium, carbohydrates, proteins, oils, potassium, chlorides, iron, zinc magnesium, copper and amino acids: arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, valine and tryptophan. All these are necessary for the building and formation of tissues in the fish. In making formulation of fish diets care should be taken to make sure that the levels required by the fish of these growth factors are maintained (Eyo, 2003).

Aqua-culturists are constantly and persistently in the search for growth promoters that yield better feed conversion and faster growth in farmed fish which results in the lesser expense on feeds, short culture period and higher fish production.

These feed items are locally available, though most often not of international standards. The feed sources could be from:

Plant sources: groundnut, soya beans, bambara nuts, maize, millet

Animal sources: fish, maggots, poultry offals

Terrestrial: fruits and vegetables

Kitchen waste: yam peels, cassava peels, bread, biscuits rice, beans and meat or poultry parts

Aquatic sources: tadpoles, mudskippers, fish and shellfish.

Again, most importantly they are not in competition with human consumption and needs, however, their potential and utilization in fish feed are expected to meet the nutrient requirement (bearing in mind that the nutritional of fishes vary from specie to specie. Fishes like catfish are more in need of high protein diets compared to Tilapia and common carp). Their levels of inclusion in aquafeed vary and largely depend on their availability, nutrient level, processing technique, species of fish and cultural farming pattern prevalent in the locality (Nandeesha et al., 1991; Gabriel et al., 2007; Agbugui et al., 2010).

It is important to note that these feed sources should be processed and formulated to meet the nutrient requirements of the fish species in management. These methods vary from region to region and for the type of feed source used. The essence of processing and formulation is to provide adequate nutrients, feed acceptability, palatability and durability and maximize cost at its lowest level. It is therefore evident that sourcing for these ingredients should be at its lowest cost. Fish farmers and feed producers are expected to take advantage of the seasons of availability of ingredients at very cheap prices since the quality and quantity of the ingredients invariably determines the quality of the abundance and cost of the ingredients (Gabriel et al., 2007; Agbugui et al., 2010).

Despite breakthroughs recorded in these areas most farmers in Africa still rely heavily on imported feed ingredients and fish feeds from European countries, which makes fish farming expensive as fish feed account for at least 60% of the total cost of production (Eyo 2001; Agbugui et al., 2011). This high cost of feeding and culture of fish is to a large extent the reason for the slow and low measures to the slow pace at which aqua-culture is advancing in Africa and Nigeria in particular. This article is intended to review critically the potentials of locally manufactured fish feed in enhancing, improving and sustaining aquaculture development in Africa. Various successes and failure rates of methods of processing employed were discussed and suggestions were made on how aquaculture growth can reach its maximum potential in the production of fish through the utilization of locally available fish feed ingredients.

Materials and methods

Materials used to prepare this paper were obtained from researches, publications, proceedings and journals.

Table 1 is a compilation of unconventional feed sources used in Nigeria in fish feed preparation, their crude protein value, test fish and the success rate. Success as represented on the table relates to the experiment yielding growth and appreciable weight gain at the cheapest cost of raw materials as when compared to imported fish feeds. Unsuccessful means the test material did not produce portable weight gain.

This review is a survey of principally research carried out in Nigeria. Prices of raw materials used are approximately the same in all regions/ states of the country though prices of raw materials are not fixed because prices change from year to year.

Table 1. UNCONVENTIONAL FISH FEED SOURCES IN NIGERIA

S/N	FEED STUFF	CRUDE PROTEIN (%)	TEST FISH	SUCCESS RATE	REFERENCE
1	*Albizia lebbeck*	38.04	*Clarias gariepinus*	Successful	Anwa *et al*., (2007).
2	Azolla meal	28.00	*Clarias gariepinus*	Successful	Fasakin *et al*., (1998).
3	Bambara groundnut (*Vigna Subterranes Verde* (L.)	30.08	Cat fish juveniles	Successful	Banyigyi *et al*., (2001).
4	Benne seed *Sesamum indicum*	89.4	*Oreochromis niloticus*	Successful	Davis *et al*., (1999).
5	Bread fruit seeds (*Artocarpus altilis*)	5.80	Tilapia	Successful at 30% inclusion	Abdel-Hakeem *et al*., (2008).
6	Brewers waste	20 - 30	*Oreochromis niloticus* *Oreochromis niloticus* *Clarias gariepinus*	@50% @10%	Adikwu, (1991) Zerai et al., (2008) Ugbor et al., (2018)
7	Cassava peel *Manihot esculentum*	12.1 17%	*Oreochromis niloticus* *Oreochromis niloticus* *Oreochromis niloticus* *Nile tilapia and Clarias gariepinus*	Not successful @10%	Oresegun and Alegbeleye, (2001) Ubalua and Ezeronye, (2008) Nnaji et al., (2010) Bichi and Ahmad, (2010)
8	Castor oil seed diet (*Ricinnus communis*)	40.00	*Clarias gariepinus* and *Oreochromis niloticus*	Successful fermented @12.5% inclusion	Agboola et al., (2004) Balogun et al., (2005) Agboola et al., (2019) Agboola et al., (2020)
	Cocoa husk *Theobroma cocoa*		*Oroechromis niloticus*		Falaye, (1988)

9	Coconut cake (*Cocus nucifera*)	19 – 24	*Orechromis niloticus*	successful	Adikwu, (2003)
10	Cotton seed cake (*Gossypium sp*)	41.4	*Clarias gariepinus*	Successful	N.R.C., (1993).
11	Cotton seed cake	38.90	*Common carp, heterotis sp, Tillapis sp, Claria lazera, heterobranchus Oreochromis niloticus Oreochromis niloticus*	Success @ 15-20% for *Heterotis sp* &*Tillapia sp*. @20% @15-20%	Kolawole, (1983) Arowosoge (1987), Eyo (2001), Okoye and Sule , (2001) Anyu et al., (2012) Meric et al., (2012)
12	*Delonix regia*		*Clarias gariepinus* *Oreochromis niloticus*	Successful Successful	Ogunlade, (2004). Balogun et al., (2004)
13	Duck weed *Lemna minor*	45.5	*Oreochromis niloticus* *Common carp* *Silver carp* *Sarotherodon galilaeus*	Successful @20% Successful	Kabir et al., (2009) Mbagwu and Okoye (1988)
14	Earthworm meal *Lumbricus terrestris*	56.4			Tacon (1994), Bekibele et al., (2000)
15	Garden Snail *Limicolaria aurora*	66.7	*Clarias gariepinus* *Clarias gariepinus*	@25% @25%	Sogbesan et al., (2008) Ovie and Adejayan (2010)
16	Jack Bean meal (*Canavalia ensiformis*)	26.44	*Oreochromis mossambicus*	Successful @ 25%	Carlos *et al*., (1988).
17					
18	Lablab bean (*Lablab purpure*us)		*Cyprinus carpio*	Successful	Adeparusi and Eleyinmi (2004).
19	Lima Bean meal (*Phaseolus lunatus*)	27.2	*Clarias gariepinus*	Successful	Oyenuga, (1968).
20	Locust bean seed (*Parkia biglobosa*)	30.00	*Clarias gariepinus*	Successful	Duniya, (2006).
21	Maggot	43.8	*Clarias sp*		Ugwumba and Abumoye (1998), Madu and Ufodike (2003)

			Oreochromis niloticus *Oreochromis niloticus* *Clarias gariepinus* *Oreochromis niloticus*	Successful	Agani et al., (2004) Ogunji et al., (2008) Aniebo et al., (2009) Ezenwudo et al., (2015)
22	Mango kernel meal *Mangifera indica*	7.5 – 13.0	*Oeochromis niloticus* *Labe senegalensus*	Successful No sig. growth	Joseph and Abolaji (1997) Omojowo et al., (2010) Omoregie, (2008)
23	Microalgae	19.00	*Rainbow trout*	Successful depending on the market price	Arnason et al., (2015)
24	Moringa and leaf meal (*Moringa oleifera*)	24.70	*Clarias gariepinus*	Successful @ 30% inclusion	Ayotunde et al., (2016)
25	Mucuna seed meal	32.10	*Heterobranchus longifilis* *Clarias gariepinus* *Oreochromis niloticus*	success @12% success @5%	Sid dhuraju and Becker (2001), Faturoti and Akinbute (1986) Ebeniro and Orji, (2012) Aderolu and Akpabio, (2010) Woke et al., (2013)
26	Mussel meal (*Mytilus edulis*)	66.00	*Rainbow trout*	Successful	Arnason et al., (2015)
	Neem plant (mesocarp) *Azadiracta indica*		*Heteroclarias*	Successful	Hassan et al., 2015
27	*Pauletia monandra* seed meal	33.00	*Clarias gariepinus*	Successful @ 27%	Agbugui *et al.*, (2011)
28	Palm kernel meal	18.0	*Clarias macrocephalus and Clarias gariepinus*	successful@ 10%	Wungkeong and Chem. (2002)
29	Pawpaw leaf meal *Carica papaya*	23.0	*Haliotis asinine* *Clarias gariepinus* *Clarias gariepinus*	Success @50% Success	Reyes and Fermin (2003) Akinwade et al., (2007) Olaniyi and Salau (2013)

				@20%	
30	Pigean pea meal *Cajanus cajan*	24.09	Nile Tilapia and *Oreochromis niloticus*	Successful	Obasa *et al*., (2003).
31	Pigeon pea *Cajanus cajan*	23.00	*Oreochromis niloticus*	not Successful	Alegbeleye *et al*., (2003).
32	Poultry feather meal	40 – 50	*Oreochromis niloticus* *Oreochromis niloticus*	Not successful	Tacon (1994) Bishop et al., (1995)
33	Pusarium flower petal meal		Orange koi carp *Cyprinus carpio*	Successful	Ipinjolu and Faturoti (1999).
34	Rubber seed cake (*Hevea brasiliensis*)	34.10	*Oreochromis niloticus*	Successful @ 30%	Alegbeleye *et al*., (2001).
35	Sea weed *(Laminaria digitata)*	10.00	Rainbow trout	Successful @35%	Arnason et al., (2015)
36	Sesame oil seed cake (*Sesame indicum*)	44.00	*Oreochromis niloticus*	Successful @ 30%	Ufojekwu and Kigbu (2002)
37	Soya bean meal (*Glycine max*)	43.22	*Clarias gariepinus*	Successful	Fafioye *et al*., (2005).
38	Soya Bean meal (*Glycine max*)	44.80	Gilt head bream fingerlings	Successful	Fountoulaki *et al,*. (2003)
39	Soya bean meal (*Glycine max*)	41.77	Salmon juveniles	Successful	Smith, (1977).
40	Soya bean meal (*Glycine max* Merr)	44.08	Tilapia	Successful	Oyenuga, (1968).
41	Toasted Jackbean *Cnavalia ensiformis* *Toasted jackbean*	26.5 35.00	*Clarias gariepinus* *Clarias gariepinus*	Not successful	Alegbeleye *et al*., (2001) Solomon *et al*., (2016)
42	Winged bean meal (*Psophocarpus sp*)	22.00	*Clarias gariepinus*	Successful	Fagbenro *et al*. (2003).

Note

*** Success as represented on the table relates to the experiment yielding growth and appreciable weight gain at the cheapest cost of raw materials as when compared to imported fish feeds.

**Not successful means the test material did not produce profitable weight gain.

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CONCLUSION

Fishery practices in Nigeria are gaining more and more grounds in the use of locally made feed among the rural populace. This does not rule out the need for increase in aquaculture production through better farm practices and management. Locally produced feed using locally available ingredients will reduce the cost of production and hence, cheaper fish to meet the protein needs of the populace (Agbugui et al., 2011; Ogunlade, 2004). Fish farmers and fish millers should look outwards to explore and utilize to the maximum, these non-conventional feed resources so as to make fish farming more economically viable, attractive and sustainable. These feed resources are available, cheap, do not compete with human consumption and can provide all the essential nutrients needed for fish growth and production. In the use of aquatic food such as microalgae and seaweed, though heavy metals were present, the levels of concentration were lower than the upper limits for the feed material. The aquatic feeds performed very well with regards to digestion, growth feed conversion and nutrient retention. Furthermore, the use of these aquatic feeds is dependent on the availability and market price which is directly related to the success rate of such a feed (Arnason et al., 2015). The future growth of the aquaculture industry depends upon the availability of suitable and economical feeds although, the cost of feeding is a major factor affecting the development of aquaculture. In Nigeria, the adequate application and utilization of any type of local fish feed which could range from single ingredients i.e the use of only one ingredient for example trash fish, maggots, grains, grasshoppers to simple or compound mixtures such as rice bran and coconut cakes to make complex formulated diets has beneficial effect in aquaculture production in Nigeria and beyond.

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