COMPARATIVE FLOATABILITY RATE OF EXTRUDED AND ON-FARM FLOATING FEEDS

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ABSTRACT
The comparative floatability rate of extruded and on-farm feeds was evaluated in order to produce a higher quality nutritious locally made feed that can compete favourably with the imported extruded feeds at low cost. The on-farm floating feeds were formulated, to contain 35 and 42% crude protein. The feeds were then subjected to floatation test. The results of the test revealed no significant ($p>0.05$) differences in the ability of the formulated diets to float up to 90 minutes. However, significant ($p<0.05$) differences were observed in their floatation rates as from 120-270 minutes post soaking. Among the feeds, Eco float and Aqualis had similar ($p>0.05$) mean floatability rate which was found to be better than the rest of the feeds. The on-farm formulated feeds had similar ($p>0.05$) mean floatation rate compared to Skretting which is an imported extruded feed. Amongst the imported feed, Skretting had the least floatability rate (70%). Based on the findings of this study, it was concluded that the floatability of fish feed is influence by particle size of the ingredients used, inclusion of a floating catalyst such as yeast, oil, binders and other plant materials.

KEYWORDS: On-farm, feed, floatability, catalyst, extruded.

INTRODUCTION
Fish is very important to humans because it contain protein of very high quality and sufficient amounts of all the essential amino acids required by the human body for growth and development, as well as efficient and effective functioning of the muscular tissues (Ayoola, 2011). However, Fish feed production is an important factor to be considered in both subsistence and commercial fish farming as it has direct effect on the growth potential of the sector (Tsevis and Azzaydi, 2000). Fish feed have significant effect on the cost of production as its account for 60-80% of management costs Olomola (1990) while Ali and Jauncey (2004) stated that the critical challenge faced by aquaculture is the high cost of fish feeds and that more than 50% of the total cost of production is intensified in culture system. Fish farmers are delighted in feeding their fishes with floating feed as it enables them observe fish; feeding condition and response to feeding. Floating feed also reduces wastages during feeding. However, its high cost takes significant part of the profit from the production (Olomola, 1990). In addition, the imported floating feed takes a significant toll on the nation's foreign exchange that would have been spent on other critical area of developments.

In an attempt to reduce cost of feeding fish, farmers produce on-farm feed which always sink and pollute water thereby, leading to disease outbreak and eventual losses (Lopez-Alverado *et al.*, 1994; Falayi *et al.*, 2003). However, researchers have developed floating fish feed using thermal method (Suleiman *et al.*, 2008), Mellon shell (Obi *et al.*, 2011), inclusion of Bakers' yeast and Baking powder (Adekunle *et al.*, 2012). Orire *et al.* (2015) reported 85% floating rate in on-farm pelleted feed using locally sourced floating catalysts; the feed floated for about 35 minutes. This however, is not good enough for aquaculture feed industry as it cannot compete efficiently with the extruded imported feed that floats for 100% and for more than 60 minutes (Obi *et al.*, 2011). The on-farm production of fish feeds of same or better quality from locally available sources and that can float for at least 1 hour and at the least competitive price and of international standard would help to boost our foreign exchange and help to conserve the excessive money that would have been spent by farmers who would now patronize the locally produced feeds within Nigeria.

MATERIALS AND METHODS

The study was carried at the laboratory of the Department of Water Resources, Aquaculture and Fisheries Technology of the Federal University of Technology, Gidan Kwanu campus, Niger State. Gidan Kwanu is located between latitude 9^0 32' N and longitude 6^0 27' E. Based on the nutritional requirements of catfish fingerlings (NRC, 1993), the on-farm floating feeds were formulated using Pearson Square to contain 35 and 42% CP (crude protein), respectively. The major ingredients used in compounding the on-farm feeds were fish meal and flour meal while the floating catalyst and premix used were kept constant at 5 and 3% in both on-farm feeds. The feeds were mixed with 62 and 78mls of water to form good homogenous gelatinized doughs. Thereafter, the doughs were pelletized with an on-farm pelletizing machine of 4mm die and sundried. The pelletized on-farm feeds and the imported extruded feeds (Aqualis, Skretting and Eco float) were then subjected to buoyancy test carried out on 10 pellets/feed. The pellets were each placed in water contained in five 500ml beakers. Readings on the floating ability of the pellets were taken at 30 minutes interval. Data collected and expressed in percentages were subjected to analysis of variance using SPSS software.

RESULTS

Table 1 depict the results of the comparative floatability test of extruded and on-farm feed at various durations. No significant ($p>0.05$) difference was observed between the imported extruded feed, and the on-farm feeds. Both of the on-farm feed floated 100% for one hour while the 35% CP floated for up to 90 minutes. From 120 minutes up to 270 minutes however, differences ($p<0.05$) were observed in the floatability of the feeds; the on-farm feeds were observed to be consistently poor up to 240 minutes. By 270 minutes however, Skretting and the on-farm feed with 42% CP were similar in their poorness. Among the feed, Eco float gave the best mean floatability rate of 100% after 270 minutes; this was followed by Aqualis (94%). Skretting and the on-farm feeds showed similar mean floatability.

Table 1: Comparative floatability of extruded feed and on farm formulated feed (%)

Time	Aqualis	Skretting	Eco float	On-farm Feed			
(min)	4mm (45% CP)	4mm (45% CP)	4mm (38% CP)	4mm (42% CP)	4mm (35% CP)	SE	LS
0	100	100	100	100	100	4.65	ns
30	100	80	100	100	100	4.65	ns
60	100	80	100	100	100	4.64	ns
90	100	80	100	80	100	4.32	ns
120	100^a	80^c	100^a	60^d	90^b	4.12	*
150	100^a	80^b	100^a	50^c	60^c	5.32	*
180	100^a	80^b	100^a	50^c	60^c	5.79	*
210	100^a	60^b	100^a	20^d	50^c	8.26	*
240	70^b	50^c	100^a	20^d	30^d	7.79	*
270	70^b	10^d	100^a	10^d	30^c	9.57	*
Mean	94^a	70^b	100^a	59^b	72^b	3.93	*

LS = level of significance, ns = not significant ($p>0.05$), * = significant at $p<0.05$.

DISCUSSION

The bulk density of the on-farm feed formulated must have been less than 640g/cm^3 at least for the first 90 minutes where no significant difference was observed between the extruded imported and on-farm formulated diets. This tally with the findings of Hardy (1989) that diets containing wheat and yeast had the best floatation than diets devoid of them, and that floatability of fish diets is greatly influenced by the bulk density of their pellets. It seems diets with the least bulk density had the best floatation and vice versa. The findings of this study agrees with the report of Riaz (2009) who claim that objects must have bulk densities less than that of water (1g/cm3) in order to float. Rokey and Plattner (2006) also suggests that pellets will sink very fast when immersed in water if their bulk density is greater than 640g/cm^3. In this study, floating catalyst was used to produce 35 and 42% crude protein diets in which 100% floatability rate was achieved at one hour for the 42% CP diet, and 90 minutes for the 35% CP diet. The percentage obtained is greater than the 85% floatation rate reported by Orire *et al.* (2015) in on-farm pelleted feed produced using locally sourced floating catalysts. The on-farm feeds floated probably due to the addition of yeast in them. Falayi and Sadiku (2013) revealed in their research that when yeast is included as a floating additive to wheat in the production of 30% CP diet, variation was observed in the floatability rate of the diets. They attributed the subsequent differences in floatation rate to the high inclusion of heavy plant protein ingredients in the diets. The result of this study revealed that the inclusion of 5% floating catalyst to 35 and 42% CP on-farm diets led to 100% floatation rate being achieved for one hour (42% CP diet) and 90 minutes (35% CP diet), respectively. This is in conformity with the findings of Momoh *et al.* (2016) who reported that when 40% CP diets were produced with the inclusion of yeast as a floating catalyst in them, the yeast influenced the diets to float for 6-10 minutes; achieving 76.76% floatation in the first 5 minutes of their test. The floatability of the on-farm formulated diets could also be attributed to the uniform particle size of the feedstuff used in the study. Momoh *et al.* (2016) had earlier also attributed the floatability rate they observed in their study to the uniform particle size (<0.5mm) of ingredients used.

CONCLUSION

Based on the finding of this study, it can be concluded that the floatability of fish feed is influence by the uniform particle size of the ingredients used, inclusion of floating catalyst such as bee wax, yeast, oil, binders and others plant materials.

RECOMMENDATIONS

To achieve floatability of fish feed, aqua culturists should endeavour to use feedstuff with uniform particle size, include floating catalyst such as bee wax, yeast, oil of low viscousity, binder and other plant materials in formulating fish feed.

The fish farmers should ensure that their formulated on-farm feed does not have high bulk density >640g/cm^3 in order to achieve desirable floatability.

Only 5% inclusion level of floating catalysts was used in this study; more research should be done using higher inclusion levels of floating catalyst; more study should also be conducted on the use of other plant and synthetic materials that can aid floatability of fish feed.

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