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Review Article

WAYS TO IMPROVE THE UTILIZATION OF DE-OILED RICE BRAN (DORB) IN FISH FEED.

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ABSTRACT

DORB is an agricultural residue in rice mill industries. It is obtained after extracting oil from rice bran. Rice bran contains about 14%-18% oil. Due to the presence of oil, rice bran spoils after a few days, so to keep rice bran for a long time, it is very necessary to extract its oil from it. Rice bran after oil extraction is called DORB which does not spoil for a long time. Due to its cheap price it is used as a feed ingredient in cattle, poultry and fish feed. If we use it in a sustainable way, it proves to be very helpful in reducing the cost of animal feed. If we are not able to do this then due to increased competition, there will be huge imbalance in demand and supply of this ingredient in coming years. DORB contains moderate protein, amino acids and vitamins, in addition to high fiber, anti-nutrients and non-starch polysaccharides, which lead to poor utilization, resulting in high Feed Conversion Ratio (FCR) in fish. Therefore, the present article is based on the various strategies used to enhance the utilization of DORB in fish feed.

Keywords: Rice bran, DORB (De-Oiled Rice Bran), Anti-nutritional factors, Enzymes, Material.

INTRODUCTION

Over the past ten years, the aquaculture industry in India has steadily grown at an annual rate of 8% (DOF GOI, 2020). Carp culture accounts for over 82% of the nation's production and about 97% of carp feeds used by Indian farmers are farm made. The most crucial element needed for faster growth and a better production of farmed fish is feeding. Oil cake is the primary conventional source of protein for aqua feed ingredients, while De-Oiled Rice Bran (DORB) serves as an energy source for the Asian subcontinent's carp culture. In practise, the most widely utilised feed component for carp production is DORB (De-Oiled Rice Bran). DORB is utilised in carp culture either as mash feed or combination with mash and pelleted feed. The year round cheapest agricultural by-product, DORB, is frequently combined with oil cakes in the preparation of fish feed and is well-liked by carps. DORB, which is fat free rice bran or rice polish, can effectively substitute other aqua feed products with low protein content (20%) as a source of energy. Higher DORB levels in aqua feed can significantly lower the cost of aqua feed. However, it has been noted in recent times that the cost of DORB has significantly grown [1]. Therefore, it is imperative to search for a DORB alternative ingredient that is likely to be readily available. Phytates, trypsin inhibitors, oxalates, saponins, tannins and alkaloids are a few anti-nutritional components that are present in the DORB that limit their use in rations for monogastric animals, despite the fact that they are abundant and can be purchased for very low rates. With the exception of phytate, the majority of ANFs are protein based and consequently heat labile. The bioavailability of minerals may be impacted by the high phytate concentration of rice bran, which ranges from 20 g/kg to 70 g/kg of the bran. According to Nwokoto and Bragg, consuming a diet high in fibre can reduce the availability of various minerals, including Ca, Cu, Mg, Mn, P and Zn. Therefore, by eliminating these anti-nutritional factors, we can increase its utilization in fish feed, because we cannot increase its production due to limited amount of land and water [2].

LITERATURE REVIEW

Rice bran *vs.* DORB

Rice Bran (RB) is a by-product of rice milling industry which converts into DORB when its oil content extracted in oil industry. Its composition varies according to the type of milling but it contains 15%-22% oil, 11%-17% protein, 6%-14%

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fibre, 10%-15% moisture and 8%-17% ash. It is an abundant source of antioxidant compounds such as tocopherols, γ-Oryzanol and other phenolics, which helps in health benefits including lowering blood cholesterol, decreasing platelet aggregation and anti-inflammation [3]. It is a good source of lysine and methionine. As such RB is considered a suitable feed ingredient for livestock and fish farming. During oil extraction chemical and heat treatments has given to RB. It seems reasonable to infer that, those treatments may change the quality of the nutrients presence in the bran that warrants investigations. On other hand, some nutrient profile would proportionately be higher in the DORB than RB due to oil extraction from RB. Other benefits include less susceptibility of DORB to the rancidity (Figure 1 and Table 1).

Economic importance

- Price of DORB is lower than rice bran.
- It contains more crude protein than rice bran.
- Does not spoil for a long time.

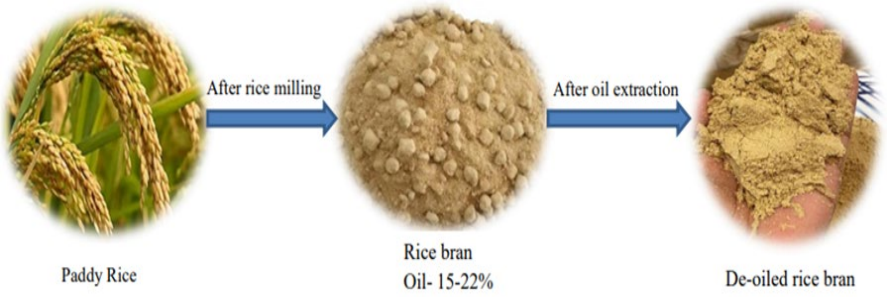

Figure 1. Making process of DORB.

Table 1. Nutrient composition of rice bran and de-oiled rice bran.

Proximate composition (%)	DORB	Rice bran
Dry matter	89.00	90.00
Crude protein	17.85	14.61
Crude fibre	14.80	11.05
Ether extract	1.60	17.20
Ash	14.30	9.90
Nitrogen free extract	51.45	47.24

DISCUSSION

Ways to improve the utilization of DORB

- Solid state fermentation
- Exogenous enzyme supplementation
- Supplementation of deficient nutrient

Solid state fermentation: Ideal substrates for Solid State Fermentation (SSF) operations are generally considered to be wastes from the agro industrial sector. SSF is used to make the raw material more valuable [4]. The nutritional values of agro industrial materials that can be employed in the animal and aqua feed industries have reportedly been improved by SSF. SSF technology also helps in increasing the protein quality and nutrient digestibility. Apart from this, this technique has proved to be very helpful and ideal in increasing the levels of nutrients and their bioavailability. This technology increases the value of agricultural products lying waste and opens up new possibilities for their use [5-7]. Hazardous nutrients can be eliminated or reduced by using microorganisms with SSF technology. The USFDA has Generally Recognized as Safe (GRAS) Rhizopus oryzae, a fast growing fungus that reproduces by means of hydrophobic sporangiospores that expand rapidly after maturation. Therefore Rhizopus oryzae is usually chosen to ferment DORB. It is clear from the above explanation that SSF technology is very efficient and economically viable method in enhancing the nutrient profile and reducing toxic anti-nutrients present in DORB.

Exogenous enzyme supplementation: The majority of the ANFs in DORB are protein based and heat labile except for phytate. The Non-Starch Polysaccharide (NSP) content of DORB is likewise relatively high, with arabinose and xylose predominating [8]. Some nutritional components may not be digested properly as a result of this. Many plant materials contain phytic acid, an ANF that chelates with different macro and micronutrients and impairs the digestion of those nutrients. In various fish species, dietary microbial phytase supplementation has been found to be very promising for reducing the harmful effects of phytate and improving the fish's ability to absorb nutrients and thrive. Fish lack the NSP digestion enzymes; hence Non-Starch Polysaccharide (NSP) is regarded as an unusable energy source for them. By interfering with digestion and absorption, NSP lowers the energy concentration of the feeds and decreases the digestibility/bioavailability of nutrients [9]. Additionally,

NSP obstructs the ability of digestive enzymes to reach their substrates. The addition of dietary NSPase to plant based feed stocks enhances nutrient utilisation and lowers faecal waste discharge into the environment. It has been demonstrated that NSPase improves fish growth performance, feed conversion and protein utilisation efficiency. Exogenous Non-Starch Polysaccharidases (NSPase) may have advantageous effects due to the hydroxylation of NSP, which enhances carbohydrate digestibility or because it enhances the digestibility of other nutrients. As was mentioned above, DORB contains a number of ANFs and NSPs that prevent rice bran from being utilised as a source of nutrients. Thus enzyme supplementation is crucial to increasing the use of DORB in fish diet [10].

Supplementation of deficient nutrient: It is well known that plant based components always contain some Anti-Nutritional Factors (ANFs) and typically lack several crucial amino acids and fatty acid [11]. High levels of plant proteins in aqua feed lead to an imbalance in essential amino acids, which impairs growth, reduces feed consumption and raises feeding costs. According to reports, adding extra amino acids and fatty acids to fish diet can help them grow and stay healthy. Lysine and methionine supplements dramatically increased the growth rate, feed effectiveness and protein digestibility of fish fed a plant based diet [12]. The addition of commercially available feed grade lysine to plant protein based aqua feed dramatically lowers the dietary crude protein need of the fish. Ranjan, et al. found that adding L-lysine at a rate of 1.4% and L-methionine at a rate of 0.4% in DORB based diet greatly improved Labeo rohita growth performance. In order to increase the use of the DORB based diet, it may be effective to supplement any essential amino acids that are low in it. The marginal farmers who only utilise DORB to feed carps will find this method to be of great benefit. According to reports, growth of fishes can be enhanced by adding n-3 fatty acids (EPA and DHA at a rate of 0.5%) in a diet based on DORB. Eicosapentaenoic acid (EPA, 20:5n-3), Docosahexaenoic acid (DHA, 22-6n-3) and other important fatty acids are needed to enhance fish growth, immunity and stress tolerance [13].

CONCLUSION

De-Oiled Rice Bran (DORB) is an agro industrial residue, which is most commonly used ingredient in the diets of cattle, poultry and fish. Along with this, they are also used in making fiber rich biscuits and extraction of an antioxidant compound like oryzanol and other industrial uses. Due to the increased competition, there will be a huge imbalance in the demand and supply for this ingredient in the years to come. DORB is associated with high fiber content, anti-nutrients and non-starch polysaccharides which lead to its poor utilization resulting in a higher Feed Conversion Ratio (FCR) in fish. Therefore, some strategies such as solid state fermentation, exogenous enzyme supplementation and supplementation of missing nutrients such as amino acids and fatty acids have to be used to increase the utility of this element.

REFERENCES

1. Annison, G., Moughan, P., and Thomas, D., (1995). Nutritive activity of soluble rice bran arabinoxylans in broiler diets. *Br. Poult. Sci*., 36:479-488.
2. Juliano, B.O., (1985). Criteria and tests for rice grain qualities. In: Rice chemistry and technology. 2nd Edition, The American Association of Cereal Chemists, Inc. St. Paul, Minnesota, USA. 647-688.
3. Limbu, S.M., Shoko, A.P., and Lamtane, H.A., (2016). Supplemental effects of mixed ingredients and rice bran on the growth performance, survival and yield of Nile tilapia, Oreochromis niloticus reared in fertilized earthen ponds. *Springerplus*. 5: 5.
4. Mai, K., Zhang, L., and Ai, Q., (2006). Dietary lysine requirement of juvenile Japanese seabass, Lateolabrax japonicus. *Aquaculture*. 258:535-542.
5. Nwokoto, E., and Bragg, D., (1977). Influence of phytic acid and crude fibre on the availability of minerals from four protein supplements in growing chicks. *Can. J. Anim. Sci*. 57: 475-477.
6. Ranjan, A., Sahu, N.P., and Deo, A.D., (2018). Comparative growth performance, in vivo digestibility and enzyme activities of Labeo rohita fed with DORB based formulated diet and commercial carp feed. *Turk. J. Fish. Aquat. Sci*. 18: 1025-36.
7. Tocher, D.R., (2003). Metabolism and functions of lipids and fatty acids in teleost fish. *Rev. Fish. Sci*. 11: 107-184.
8. Turchini, G.M., Torstensen, B.E., and Ng, W.K., (2009). Fish oil replacement in finfish nutrition. *Rev. Aquac*. 1: 10-57.
9. Warren, B.E., and Farrell, D.J., (1991). The nutritive value of full fat and defatted Australian rice bran. V. The apparent retention of minerals and apparent digestibility of amino acids in chickens and adult cockerels fitted with ileal cannulae. *Anim. Feed. Sci. Technol*. 34: 323-342.
10. Aguilar-Garcia, C., Gavino, G., and Baragano-Mosqueda, M., (2007). Correlation of tocopherol, tocotrienol, γ-oryzanol and total polyphenol content in rice bran with different antioxidant capacity assays. *Food. Chem*. 102: 1228-1232.
11. Sharif, M.K., Butt, M.S., and Anjum, F.M., (2014). Rice bran: A novel functional ingredient. *Crit. Rev. Food. Sci. Nutr*. 54: 807-816.
12. Dale, N., and Batal, A., (1997). Feedstuffs ingredient analysis table. Watt Publication. Rockford, United States. 48-52.
13. Lai, P., Li, K.Y., and Lu, S., (2009). Phytochemicals and antioxidant properties of solvent extracts from Japonica rice bran. *Food. Chem*. 117:538-544.