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Impact of Fermentation on Enhancing the Nutritional Value of Soybean Meal

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SUMMARY

The best alternative to FM is soybean meal (SBM), the greatest source of protein with a balanced amino acid profile, affordable cost, and reliable supply. About 41% of the dry matter in soybeans is protein, and 20% is ether extract. SBM, however, contains some ANFs, including phytates, tannins, trypsin inhibitors, and oligosaccharides, along with low palatability and a low EAA concentration. Numerous investigations have demonstrated that a high percentage of SBM in aquafeed impacts the growth, digestion, absorption, and antioxidant capability of aquatic animals and harms their guts. SBM can be fermented to improve probiotics and increase palatability, reducing these side effects. Additionally, it stimulates certain elements that enhance the gut flora of fish, promoting better digestion and nutritional absorption.

INTRODUCTION

The legume known as soybean (SB) is indigenous to Asia. It is widely cultivated for its use in both fermented (miso, sufu, natto, etc.) and nonfermented (soymilk, tofu, soy nuts, etc.) goods. According to Frias et al. (2008), the low cost and high nutritional value of SB protein products, along with their good amino acid (AA) balance, have led to an increase in their use as animal feed. However, the high concentration of trypsin inhibitors (TI) or serine protease inhibitors means that raw SB harms non-ruminants (Dunsford et al., 1989; Li et al., 1990). Many beneficial compounds, including meal, oil, lecithin, and others, are produced during the processing of SB. The substance left over after the oil is extracted from SB flakes is called soybean meal (SBM), and it contains approximately 48 percent crude protein (CP).

Although SBM is a high-protein product, it also contains some anti-nutritional elements that must be removed to improve its acceptability (Dunsford et al., 1989; Li et al., 1990). SBM is converted into fermented SBM (FSBM) by employing bacterial and fungus strains, primarily *Lactobacillus subtilis* and *Aspergillus oryzae*, respectively. According to Hong et al. (2004), the fermentation procedure effectively removes antinutritive substances and enhances the nutritional content of SBM.

The process of producing fermented soybean meal (FSM) involves adding specific microorganisms to soybean meal (SBM) for a predetermined amount of time. This fermentation breaks down ANFs and produces particular bioactive substances like short peptides, probiotics, flavonoids, and organic acids that enhance the growth and well-being of aquatic animals

Chemical composition of SBM and FSBM (g/kg dry matter basis) Jannathulla et al.,2018

Items	SBM	FSBM
Crude protein	524.04	598.51
Ether extract	10.91	7.77
Crude fiber	69.57	67.74
Anti-nutritional		
Trypsin inhibitor	2.41	0.14
Phytic acid	13.36	6.53
Tannin	nd	nd
Saponin	10.03	2.10

Fermented using the fungus, *Aspergillus niger*	Concentration 1 × 107 spores/ml	Temperature 35 °C	Duration of fermentation 5 days

Advantages of Incorporating Fermented Soybean Meal in Aquatic Animal Diets

In fingerling rainbow trouts, FSBM causes significantly fewer morphological variations including the removal of granulated pinocytotic vacuoles and the disintegration of microvilli (Yamamoto et al.,2010).While the fish given FSBM exhibit a significant rise in body weight and specific growth rate, there are no discernible changes in ash, CP, or whole-body moisture content (Yamamoto et al., 2010; Kader et al., 2012). When rainbow trouts are fed both FM and FSBM, their haemoglobin levels are greater and their total plasma cholesterol levels are lower than when they are fed only FM (Yamamoto et al., 2010). This suggests that FM can be partially substituted with FSBM for fish feed, which would reduce costs. A considerable decrease in bacterial activity (measured by the number of bacteria in the blood) and an increase in total serum protein content are observed in young Japanese flounder fish fed a diet containing FSBM (Kader et al., 2012). Additionally, there is no negative impact on haematocrit or blood chemical characteristics that indicate the physiological state of fish, such as total albumin, total bilirubin, etc. According to these data, feeding FSBM leads to healthier animals and greater growth performance, which can be linked to the enhancements in SBM caused by fermentation. Numerous animals demonstrate the benefits of utilising FSBM as an alternative since it gets rid of several concerns related to feeding SBM, such as immunoreactivity, low development parameters, and other health problems.

CONCLUSION

FSBM is a suitable substitute for SBM in animal feed applications. Fermentation improves the bioavailability of nutrients, free AA content, small-sized peptides, and CP content. It also makes SBM more acceptable by breaking down anti-nutrients such as oligosaccharides, TI, and phytate. Both the fermentation process itself and the microbe employed for this reason are responsible for these effects. When non-ruminants are fed FSBM, many positive effects are seen, such as an increase in average daily gain, enhanced growth performance, improved protein digestibility, decreased immunological reactivity, and undesired morphological changes.

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