

Antinutritional Factors and Antimetabolites in Aquaculture

Rajesh Chudasama* and Pinak Bambhaniya
 College of Fisheries Science, Kamdhenu University, Veraval-362265

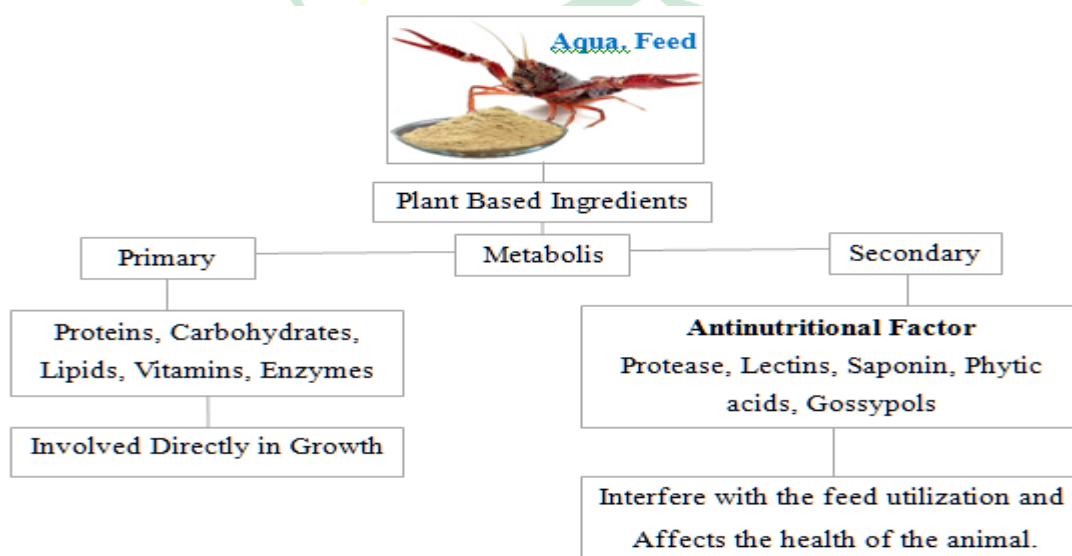
ARTICLE ID: 05

Abstract

Aquaculture is a fastest growing industry. That industry in main operation cost is feed approximately 60% total cost. Farmers getting good quality feed for the high profit level and increase production rate is important factor that fully dependent on the feed quality. In feed ingredient certainty type of the antinutritional factor and antimetabolites are present that affects nutrients composition of the feed so animal do not get sufficient nutrients from the food. In this article explanation on serration antinutritional factors and antimetabolites effects and its's removable process.

Introduction

Fish diets may contain a variety of antinutrients and antimetabolites toxins. These ingredients may be natural pollutants, incidental contaminants produced from anthropogenic excreta, or essential resources of a foodstuff. The efficiency of the diet may be harmed or the diet may contravene some substance prohibitions when these substances are present in adequate concentrations (Hajra *et al.*, 2013).



What is Antinutritional Factors and Antimetabolites?

- Defined as those ingredients in the diet that, by themselves or by the metabolic byproducts they produce in the body, interfere with the utilization of the feed, slower growth, or have an adverse effect on the health of the animal.
- They are known as anti-nutritional factors and are a substance that has harmful effects. Additionally known as antimetabolites.
- Anti-Nutritional Factors (ANFs) are substances produced from natural plant feeds that have a negative, harmful effect.
- It also occurs naturally in plant materials and has a significant impact on the metabolic process. The majority of ANFs are heat labile.
- The results include growth inhibition, a decrease in the efficiency of food conversion, pancreatic enlargement, liver damage, and other pathological damages (Vikas *et al.*, 2012).

Classification of Anti-Nutritional Factors (or)Antimetabolites

According to how nutrients are impacted and how fish respond biologically, the toxic factors are classified as follows:

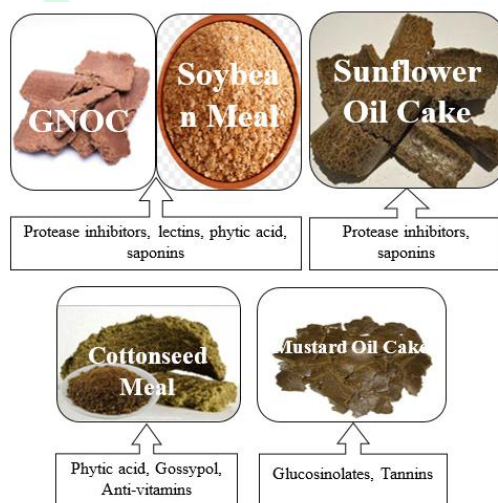
1. Substances depressing digestion (or) metabolic utilization are Protease inhibitors (PI's), Lectins (Haemagglutinins), Saponins, Polyphenolic compounds (Tannins),
2. Substances reducing the solubility of nutrients are Phytic acids, Oxalic acids, Glucosinolates, Gossypols
3. Substances which inactivating vitamins and hormones (Antivitamin A D E K and Pyridoxine) (Hardy and Kaushik, 2021)

Source of Antinutritional Factors in Aquaculture Feed

Table No. 1: Classification of major anti-nutritional factors commonly present in plant-derived feedstuffs used in aquafeed (Gopan *et al.*, 2020).

Plant-derived nutrient source	Anti-nutritional factors
a) Groundnut oil cake	Protease inhibitors, lectins, phytic acid, saponins, phytoestrogens, NSP
b) Mustard oil cake	Glucosinolates, tannins
c) Sunflower oil cake	Protease inhibitors, saponins, arginase inhibitor

d) Soybean meal	Protease inhibitors, lectins, phytic acid, saponins, phytoestrogens, anti-vitamins, allergens
e) Cottonseed meal	Phytic acid, phytoestrogens, gossypol, anti-vitamins, cyclopropenoic acid
f) Anti-vitamin B ₁₂	Raw soybean



g) Antivitamins	Alfalfa leaf meal, cottonseed meal, pea seed meal, soybean meal
-----------------	---

Fig. 1. Feed ingredients

Important Antinutritional factors

A. Interaction with protein nutrition

Harmful Effects	Amelioration Techniques
I. Protease Inhibitors: Groundnut oil cake, Sunflower oil cake, Soybean meal	
i. Reduced protein digestion and amino acid utilization ii. Reduced growth	Heat, Autoclaving
II. Lectins: Groundnut oil cake, Soybean meal	
Agglutination of RBC Reduction in the absorption moist heat treatment of nutrients from the gut	Autoclaving
III. Tannins (Polyphenols): Mustard oil cake, rape seed	
i. Due to undesirable bitter taste, they reduce palatability and feed intake ii. Reduced feed efficiency & growth iii. Damage of liver and kidney lead to death.	Autoclaving, Treatment with alkali
IV. Saponins: Ground nut oil cake, Sunflower oil cake, Soybean meal	
i. Reduce palatability and feed intake ii. Reduced feed efficiency growth & reproductive performances. iii. Respiratory distress	Soaking in water for 24 hrs will eliminate this substance

B. Interaction with mineral availability

Harmful Effects	Amelioration Techniques
I. Phytic Acid: Groundnut oil cake, Soybean meal, Cottonseed meal	
i. Reduced carbohydrate and minerals utilisation. ii. Skeletal deformity iii. Promotion of cataract formation	Moist heating (120°C for 2h) Milling of outer layer
II. Gossypol: Cottonseed meal	
Gossypol exhibited through reduction of haematocrit, haemoglobin, reproductive	Heat treatment: roasting, extrusion

capacity as well as lesions in the liver, kidney, spleen and gonads may develop	
III. Glucosinolates: Mustard oil cake	
i. Reduced feed intake	Heat treatment (extrusion cooking & wet pressure cooking)
ii. Depressed growth	

C. Antivitamin Factors

Raw soybeans and raw kidney beans are both known to have antivitamin D and antivitamin E components, respectively. Heat degrades these antinutritive elements.

I. Antivitamin B₁

Thiaminase is present in fresh fish, mussels, herrings, clams, and shrimp (B₀). Lipoxygenase, an enzyme found in raw soybean, catalyses of carotenoids (Precursor of vitamin A). The content will be minimized by autoclaving.

II. Antivitamin D

Raw soybeans are reported to contain antivitamin D. Soy protein isolates have rachitogenic potential. Heat destroys vitamin D, which can be partially eliminated by increasing vitamin D levels in the diet by 8 to 10 fold.

Conclusion

The availability of various antinutritional components inhibits the use of plant-derived materials such as legume seeds, various oilseed cakes, leaf meals, leaf protein concentrates, and root tuber meals as fish feed ingredients. factors that are antinutritional, such as tannins, phytic acid, lectins, tannins, saponins, antivitamins, and oxalate. They are regarded as antinutritional factors because they decrease the availability and digestibility of protein. Effectiveness of typical processing methods such solvent extraction, dry and wet heating, and enzyme treatment in eradicating the negative effects of antinutrients from feed materials.

References

Gopan, A., Lalappan, S., Varghese, T., Kumar M.M. and Peter, R. M. (2020). Anti-Nutritional Factors in Plant-Based Aquafeed Ingredients: Effects on Fish and Amelioration Strategies. *Bioscience Biotechnology Research Communications*, **13**(12): 01-09.



- Hajra, A., Mazumder, A., Verma, A., Ganguly, D.P., Mohanty, B.P. and Sharma, A.P. (2013). Antinutritional factors in plant origin fish feed ingredients: the problems and probable remedies. *Advances in Fish Research*, **5**: 193-202.
- Hardy, R. W. and Kaushik, S.J. (Eds.). (2021). *Fish nutrition*. Academic press.
- Vikas, K., Debtanu, B., Kundan, K., Vikash, K., Mandal, S.C. and Clercq, E.D. (2012). Antinutritional factors in plant feedstuffs used in aquafeeds. *World aquaculture*, **43**(3): 64-68.

