The Pharma Innovation Journal 2023; 12(3): 4217-4219

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(3): 4217-4219

www.thepharmajournal.com
Received: 29-12-2022
Accepted: 31-01-2023

Dr. KM Rashmi
Ph.D. Scholar, Department of Animal Nutrition, Veterinary College, Hebbal, Bengaluru, Karnataka, India

Dr. KR Sriranga
Ph.D Scholar, Livestock Production Management Division, ICAR-NDRI, Karnal, Haryana, India

Dr. DS Kumara Wodeyar
Assistant Professor Department of Veterinary Physiology and Biochemistry Veterinary College Gadag, Karnataka, India

Dr. Ranganath GJ
Scientist-Animal Science ICAR-KVK, Uttara Kannada, Karnataka, India

Dr. Aparna Hebbar H
Senior Veterinary Officer Livestock Breeding and Training Center Koila, South Canara, Karnataka, India

Corresponding Author:
Dr. KM Rashmi
Ph.D. Scholar, Department of Animal Nutrition, Veterinary College, Hebbal, Bengaluru, Karnataka, India

Nutritive value of Simarouba oil cake

Dr. KM Rashmi, Dr. KR Sriranga, Dr. DS Kumara Wodeyar, Dr. Ranganath GJ and Dr. Aparna Hebbar H

Abstract
Simarouba oil cake (SOC) is a byproduct of the oilseed processing industry that has gained attention in recent years as a feed ingredient for livestock. This cake is a rich source of protein, fiber, minerals, and other essential nutrients that are crucial for animal growth and development. The nutritive value of SOC is comparable to that of other protein-rich feed ingredients, such as soybean meal and cottonseed meal, making it a cost-effective alternative for livestock producers. Furthermore, SOC has been found to possess some beneficial health properties, such as antioxidant and antimicrobial activity, which can improve animal health and reduce the risk of diseases. In addition, SOC contains high levels of non-starch polysaccharides, which can promote gut health and enhance the immune system of livestock. In conclusion, SOC is a promising feed ingredient for livestock that offers a range of benefits in terms of nutrition, health, and economic value. Its high protein content and favorable amino acid profile make it a valuable source of dietary protein for animals, while its fiber and mineral content contribute to their overall health and performance. As a byproduct of the oilseed processing industry, SOC represents a sustainable and eco-friendly option for livestock feed formulation, and its utilization can contribute to the development of a circular economy.

Keywords: Antinutritional factor, amino acids, metabolisable energy, quassinoids

Introduction
The cost of feed constitutes a major portion of the total cost of dairy production, accounting for more than half of it. However, due to a deficit of 44% in concentrates (Singh *et al*., 2022) [13], high prices of oil cakes and a decrease in the amount of land available for forage production, there is a severe shortage of feed resources for livestock. This has created a significant gap between the availability of concentrate ingredients and the requirements for feeding livestock. To address this challenge, it is essential to identify and make use of alternative and unconventional sources of feed, in addition to making judicious use of the available feed resources. The efficient utilization of such feed sources is crucial for feeding the millions of livestock in the country and safeguarding their nutritional and feed security. By doing so, we can hope to bridge the gap between the availability and requirement of feed resources for livestock, which is vital for the sustainable development of the dairy industry. The concern for depletion of fossil fuel and environment has increased the demand for biofuels in recent years. The biodiesel production from oil seeds yields residue known as oil cake or oil meal. These cake are rich source of lignocellulose, minerals and protein. However, these also contain toxic and antinutritional factors which limits their utilization as feed in livestock. The detoxification of these cake or meal could allow them to be used as an alternative protein source in livestock. In this context, seeds of *Simarouba glauca* is one such oil rich seeds which are extensively in use nowadays for biodiesel production.

Simarouba glauca tree belonging to the family Simaroubaceae, a native of Florida, South America and Caribbean. It grows well in temperature range of 10 to 40 °C and at 1000 m above the sea level. It is well adopted to grow in warm, humid and tropical region. During 1961, Indian Council of Agricultural Research (ICAR), New Delhi, first introduced *Simarouba glauca*, in India from El Salvador (EC-19701). Due to its wide range of adoptability for various soil and climatic condition it has been used for large-scale plantation both for soil conservation and reforestation programs. A large scale *Simarouba glauca* plantation has been done in Orissa, Karnataka, Andhra Pradesh and other states of India. Simarouba seeds are an important product of the tree. The seeds are oval-shaped and have a hard outer shell. When the seeds are crushed, they produce a high-quality oil that is similar in composition to olive oil. This oil is commonly used for cooking and as a cosmetic ingredient in soaps and lotions.

It is estimated that *Simarouba glauca* can produce 5–6 tonnes of seeds per hectare per year which is equivalent to about 1tonne of oil (Rout *et al.*, 2014) [10]. However, under proper agricultural practices, that quantity of its seed and its subsequent oil yield (2 tonnes) per hectare would be doubled (Joshi and Hiremath, 2000) [6]. Simarouba seeds are rich in oil (60%) and its oil has been extracted both by mechanical expelling and solvent extraction. In addition to oil, the Simarouba tree produces a byproduct known as the SOC. This cake is made by pressing the remaining seed cake after oil extraction. The soil cake is rich in nitrogen and can be used as a natural fertilizer for crops. It is also used in animal feed and as a biopesticide to control pests and diseases. Overall, the Simarouba tree and its products have the potential to provide sustainable solutions for food security and rural development in many parts of the world.

Simarouba oil cake

Simarouba seeds is a valuable source of protein and essential nutrients, making it a potential feed ingredient for livestock. The seed cake contains approximately crude protein and crude fiber, which is comparable to other protein sources such as soybean meal and groundnut cake. The high fiber content of Simarouba oil cake makes it a good candidate for ruminant diets. The cake also contains essential amino acids like lysine, methionine, and tryptophan, which are important for the growth and development of livestock. In addition to protein, the cake is also a good source of energy, with a high level of metabolizable energy (ME) of around 2,800-3,000 kcal/kg. It also contains minerals such as calcium, phosphorus, and potassium, which are essential for the growth and development of livestock. Overall, the nutritive value of *Simarouba glauca* oil seed cake makes it a promising feed ingredient for livestock.

The Simarouba meal or cake obtained after oil extraction is rich source of protein of about 50 to 60% (Govindaraju *et al.*, 2009; Behura *et al.*, 2010) [5, 3] with high *in vitro* solubility of about 92% and biological value of 70.7 (Govindaraju *et al.*, 2009) [5]. Similar to other oil seeds, it has greater proportion of glutamic acid (23.43 g/100 g protein), arginine (10.75 g/100 g protein) and aspartic acid (10.50 g /100 g protein). Apart from, it is high in essential amino acids such as of leucine (7.76 g/100 g protein), lysine (5.62 g/100 g protein) and valine (6.12 g/100 g protein) but deficient in sulphur containing amino acids, methionine and cysteine (Govindaraju *et al.*, 2009) [5]. In addition, it contains high calcium (143.03 mg/100 g) and sodium (78.93 mg/100 g).

Although, SOC with excellent nutritive profile is still being disposed as manure rather being used in animal feed. This is due to presence of bitter toxin quassinoids (5% by weight) (Rao, 2003) [8] and its toxicity (Severen, 1953; Vaughan, 1970; Rath *et al.*, 1987) [11, 14, 9]. In addition, Govindraju *et al.* (2009) reported for other antinutritional factors such as saponin (3.7 g/ 100 g), alkaloids (1.01 g/100 g), phenolics (0.95 g/100 g) and phytic acid (0.73 g/100 g), which can affect feed intake, nutrient digestibility, and animal performance. These anti-nutritional factors can bind to dietary protein, reducing its availability to the animal, and can also affect the microbial population in the rumen. In past researchers have used various treatments to remove the toxins and make oil cakefit for use as animal feed. The different detoxification treatments includes boiling, roasting, autoclaving, soaking with water, methanol extraction, fermentation, acetic acid, sodium hydroxide, roasting + ammonia, hydrochloric acid (Shafiqi *et al.*, 2021; Behura*et al.*, 2008) [12, 1]. These treatments have reported to decrease the levels of toxic constituents and alter the crude protein and crude fibre, further increase the digestibility and availability of nutrients. Shafiqui *et al.*, (2021) [12] and Behura*et al.*, (2008) [1] reported that methanol and roasting + ammonia were most effective in detoxification of the cake without much altering the crude protein and crude fibre of the cake. While treatment with acid, alkali and water resulted in dry matter loss, reduction in protein content and increase crude fibre. The detoxification methods used and their maximum action on various antinutritional factor (ANF) and crude protein and crude fibre in literature are listed below (Table 1). Further no literature is available on complete detoxification of quassinoids in SOC.

Table 1: List of detoxification methods used and their action on ANF and crude protein and crude fibre content of SOC

Detoxification methods	Reduction in toxic factors	Crude protein	Crude fibre
Methanol extraction	Alkaloids (0.01%)	59	12.45
Roasting+ammonia	Alkaloids (0.01%), Phenolics (0.002), Saponin (16.25%)	62.8	7.83
Alkali treatment	Efficiency of reduction of ANF low	40.20	12.12
Acetic acid	Phytic acid (0.88%)	46	19.23
HCL	Saponin (100%)	42	18.51
Autoclaving	Efficiency of ANF reduction low	62.34	7.34
Roasting	Saponin (92.8%)	61.98	7.59
Boiling	Saponin (66.90%)	48.02	16.49
Fermentation	Phenolics (0.002%)	47	18.85
Soaking	Efficiency of reduction of ANF low	49.5	18.45

Feeding value of Simarouba oil cake

SOC is a protein rich agro industrial by-product obtained after oil extraction can be used as a feed ingredient for poultry. However, the inclusion level of Simarouba oil cake or meal in the diet should be carefully considered, as high levels may lead to negative effects on performance and health of poultry.

Patro *et al.* (2002) [7] conducted a study to determine the safe inclusion level of SOC in broiler diets. The researchers found that defatted methanol extracted SOC could be safely included up to 7.5% in broiler diets without affecting growth, while reduced growth was observed at the 10% SOC inclusion level. This indicates that SOC can be used as a protein source in broiler diets at reasonable levels without compromising growth performance. Similarly, Behura *et al.* (2010) [3] investigated the effect of ammonia-treated and roasted SOC on the growth performance of broilers. The study found that SOC could be successfully included in broiler diets at 2.5%, 5%, and 7.5% without affecting average daily gain and feed conversion efficiency. The absence of cytotoxicity at these inclusion levels indicates that SOC is safe for broilers at these levels. However, the study also found that the apparent metabolizable energy (AME) of SOC was

lower compared to conventional protein sources. Additionally, there was a decrease in AME value with an increase in the inclusion level of ammonia-treated and roasted SOC. This suggests that SOC may not be as efficient as conventional protein sources in providing energy to broilers. To address this issue, the study also reported the apparent nitrogen corrected metabolizable energy (AMEn) of ammonia-treated and roasted SOC to be 1771 Kcal/kg. This indicates that the AMEn of SOC can be improved with processing methods such as ammonia treatment and roasting.

In a study conducted by Behura *et al.* (2009) [2], the feeding value of untreated expeller pressed SOC was evaluated in broiler chicks. The study investigated the effect of SOC at various inclusion levels of 2.5%, 5%, 7.5%, and 10% on the growth performance, blood biochemical parameters, and histopathological lesions of broiler chicks. The results showed that birds fed SOC had higher body weight gain and feed conversion ratio compared to the control group, indicating that SOC can be used as a protein source in poultry diets. However, the study also revealed that the birds fed SOC had significantly higher levels of blood biochemical parameters, indicating the presence of some toxic substances in the SOC. Additionally, the SOC-fed birds showed histopathological lesions such as severe vacuolar degeneration, extensive hepatic necrosis, and moderate vascular degeneration of the liver, indicating that the raw SOC was unfit as a protein source for the diet of chicks. The presence of these toxic substances in the raw SOC such as tannins and saponins, which can interfere with nutrient absorption and utilization in poultry. In conclusion, the study conducted by Behura *et al.* (2009) [2] indicates that untreated expeller pressed SOC is unfit as a protein source for the diet of chicks due to its potential toxic effects on growth performance and health. However, with proper processing, SOC can be used as a protein source in poultry diets, but its inclusion level should be limited to avoid negative effects on performance and health.

Behru *et al.* (2012) [4] conducted a study to determine the safe inclusion level of ammonia-treated and roasted SOC in the diet of egg-type grower chicks. The researchers fed egg-type grower chicks SOC at 5%, 7.5%, 10%, 12.5%, and 15% inclusion levels and observed their body weight and feed conversion ratios. The study found that egg-type grower chicks fed ammonia-treated and roasted SOC at 5%, 7.5%, and 10% inclusion levels had similar body weights and feed conversion ratios as the control group without any ill effects. However, the groups supplemented with 12.5% and 15% SOC showed reduced growth performance. This indicates that ammonia-treated and roasted SOC can be safely included up to 10% in the diet of egg-type grower chicks without any ill effects on their growth performance. However, it is important to note that higher inclusion levels of SOC may lead to reduced growth performance in egg-type grower chicks. Overall, the study conducted by Behru *et al.* (2012) [4] suggests that ammonia-treated and roasted SOC can be used as a safe protein source in the diet of egg-type grower chicks at reasonable levels without compromising their growth performance. However, it is important to carefully consider the inclusion level of SOC to avoid any negative effects on growth performance.

Conclusion

In conclusion, SOC is a valuable byproduct of Simabrouba oilseed processing, which has numerous benefits and uses. This cake is high in protein, fiber, and other essential nutrients, making it a nutritious feed for livestock and poultry. SOC can also be used as an organic fertilizer due to its high nitrogen content, which improves soil fertility and crop yield. Additionally, it can be used as a feedstock for the production of biogas or biofuels. Overall, the nutritive value of *Simarouba glauca* oil seed cake makes it a promising feed ingredient for livestock. However, further research is needed to determine its optimal inclusion level in animal diets and its effects on animal performance and health. Proper processing can also be used to improve its feeding value.

References

1. Behura NC, Dehuri PK, Mishra SK, Samal PC. Processing of simarouba (*Simarouba glauca*) oil cake for detoxification and its evaluation in broiler chicken. Animal Nutrition and Feed Technology. 2008;8(2):245-252.
2. Behura NC, Dehuri PK, Mishra SK, Mohapatra AK. Scope of Utilizing Simaruba (*Simarouba glauca*) Oil Cake in Broilers. Animal Nutrition and Feed Technology. 2009;9:195-202.
3. Behura NC, Dehuri PK, Mishra SK, Das S. Feeding value of detoxified (ammonia treated and roasted) simaruba (*Simarouba glauca*) oilcake in broilers. Indian Journal of Animal Sciences. 2010;80:916-920.
4. Behura NC, Dehuri PK, Mishra SK, MohapatraAK. Feeding value of detoxified simaruba (*Simarouba glauca*) oil cake in egg type growers. Animal Nutrition and Feed Technology. 2012;12:121-126.
5. Govindaraju K, Darukeshwara J, Srivastava AK. Studies on protein characteristics and toxic constituents of *Simarouba glauca* oilseed meal. Food and Chemistry Toxicology. 2009;47(6):1327-1332.
6. Joshi S, Hiremath S Simarouba. A potential oilseed tree. Current Science. 2000;78:694-697.
7. Patro US, Dehuri PK, Rao AG, Rao YR, Jena SK. Effects of inclusion of Simarouba oil cake in broiler ration. Indian Journal of Poultry Science. 2002;37(1):54-58.
8. Rao YR. *Simarouba glauca*-A futuristic tree borne oilseed for rural development. Paper presented in the International Seminar on Downsizing Technology for Rural Development held at Regional Research Laboratory, Bhubaneshwar from 7–9th Oct. 2003.
9. Rath SP, Srinivasulu C, Mahapatra SN. Investigations on *Simarouba glauca*: A new oilseed of Indian origin. Journal Oil Technologists Association of India. 1987;19:64-65.
10. Rout PK, Rao YR, Jena KS, Sahoo D, Ali S. Safety evaluation of *Simarouba glauca* seed fat. Journal of food science and technology. 2014;51(7):1349-1355.
11. Severen MarioLewy-Van. Aceituno seed fat. Journal of the American Oil Chemists Society. 1953;30:124-126.
12. Shafiqi S, Abad Q, Ryan Q. Toxicity levels in treated oil cakes of *Simarouba glauca* DC. IJO - International Journal of Agriculture and Research. 2021;4(09):01-08.
13. Singh DN, Bohra JS, Tyagi V, Singh T, Banjara TR, Gupta G. A review of India's fodder production status and opportunities. Grass and Forage Science. 2022;77:1-10.
14. Vaughan JG. The Structure and Utilization of Oilseeds. Chapman and Hall Ltd., London; c1970.