

# EVALUATION OF QUALITY OF RAW FEED INGREDIENTS FOR ANIMAL FEED PRODUCTION

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## ABSTRACT

*Samples of feed ingredients were collected from the truck loads that arrived at feed processing unit located in Veterinary College and Research Institute, Orathanadu, Thanjavur, Tamil Nadu, India. Physical examination of collected samples was carried out prior to their chemical evaluation. Chemical evaluation of feed samples revealed that moisture content in maize grain ranged from 8.47% to 17.25% and high moisture was observed in samples received during the monsoon season (September to December). The crude protein content of protein supplements viz., soyabean meal, coconut oil cake, coconut deoiled cake (DOC), groundnut cake, groundnut deoiled cake, delinted decorticated cotton seed cake, sunflower deoiled cake and gingelly oil cake were 45.49, 25.11, 24.47, 36.92, 43.89, 35.36, 30.21 and 29.89 per cent on dry matter basis, respectively. The crude protein (% DMB) and crude fiber (% DMB) content of deoiled rice bran, rice bran and wheat bran were 15.47 and 16.13, 7.55 and 36.26, 14.26 and 9.47, respectively. Due to the high moisture content in maize grain 8.77% of the total truck loads of this ingredient received at the processing unit were rejected. Similarly, of the total truck loads of oil cakes received at the processing unit 20.93 % of soyabean meal, 12.5% of coconut oil cake, 20 % of coconut DOC, 22.22% of cotton seed cake and 33.33% of gingelly oil cake were rejected due to the lower crude protein and higher crude fiber contents. All truck loads of rice bran (100 %) were rejected due to their lower crude protein, higher crude fiber and Acid Insoluble Ash (AIA) content. The study thus revealed that quality control measures are essential to check the entry of poor quality raw materials before processing the feed.*

**Key words:** Feed ingredients - raw materials - quality control - chemical evaluation

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## INTRODUCTION

In India, the total livestock and poultry population is 535.8 million and 851.8 million respectively, as of Livestock Census - 20<sup>th</sup> (2019). Ruminants are fed mainly with dry and green fodder and only less quantity of concentrate feeds. The monogastric and livestock are fed with green fodder and concentrate feeds. Poultry species fully depend on the concentrate feeds as sole source of nutrients. The livestock sector contributed 5.2% of total Gross Domestic Product (GDP) during the year 2021. India ranks number one globally in milk production however, the quantity of milk produced per milch animal is lower than the world average. Most of the livestock is reared in rural areas and depend on the poor quality roughages and least amount of concentrate feeds. There is a shortage of concentrates, green fodder and dry roughages respectively to the tune of 64, 62 and 23% in India. The total compound feed produced in India is only 7.5 million tonnes as against the estimated requirement of 84 million tonnes. Good quality raw materials are required to produce good quality feed to livestock and poultry. In feed processing units, various physical and chemical evaluation methods are adopted to prevent the entry of poor - quality raw feed ingredients so as to maintain good quality of the finished feed. Hence, the this study was conducted where in the quality of various raw feed ingredients received from suppliers to the feed processing unit, was determined.

## MATERIALS AND METHODS

Totally 257 raw feed ingredient samples were collected over a period of two years. The sampling was done from the trucks bringing the feed ingredients to Feed processing unit, Veterinary College and Research Institute, Orathanadu, Thanjavur, Tamil Nadu, India. The raw feed ingredient samples collected were maize grain, soyabean meal, coconut oil cake, coconut DOC, groundnut cake, groundnut DOC, decorticated delinted cotton seed cake, deoiled rice bran, rice bran, wheat bran, sunflower DOC and gingelly oil cake. The majority of the ingredients supplied to the feed processing unit were from suppliers from the local market, except for soyabean meal, and groundnut DOC which were procured from northern states of India. Samples were taken from every truck load as per the procedure described by the BIS, (2009). Each sampling procedure three samples were collected and out of the three, one sample was given to the supplier, another sample was sent to feed analytical laboratory and one sample was kept as referee sample for future analytical purpose. In the feed analytical laboratory, physical evaluation for colour, size, homogeneity, smell, taste, touch and soundness of the ingredients were performed followed by chemical evaluation. The chemical evaluation included proximate principles (moisture, crude protein, crude fiber, and ether extract) and acid insoluble ash which were performed as per AOAC (2005). The data were statistically analysed as per Snedecor and Cochran (1989).

## RESULTS AND DISCUSSION

The results of the physical and chemical evaluation of feed ingredients is presented ingredient wise in this section. The proximate principles and acid insoluble ash of feed ingredients analysed in this study in comparison to BIS specifications is presented in table 1. Table. 2 gives details of feed ingredients rejected at feed processing unit.

### Maize grain

Maize grain was evaluated for the presence of immature grains, broken grains, maize cob dust and fungal infestation. The grain passed the physical evaluation and was allowed for the estimation of moisture. The average moisture was 10.86% and it was within the BIS specifications (2009). The moisture content ranged from 8.47% to 17.25 % and higher moisture content in the samples received during September to December due to north east monsoon in the maize growing area in Tamil Nadu (Ravikesavan *et al.*, 2017). Maize grain (8.77% of total received) were rejected due to high moisture content and presence of immature, broken and fungal infected grains.

### Soyabean meal

Soyabean meal samples were examined for adulterant (soyabean hulls) and brownish discolouration and they were found normal. The moisture content varied from 6.93% to 16.32% and 23% of the soyabean meal received had high moisture content (above 12 %) where as the average moisture content was

10.51± 0.35%. The high moisture content was attributed to difference in soyabean processing methods (Wang and Johnson, 2001). The average crude protein content was 45.49 % and was found within the BIS specification (2009). The crude fiber and AIA content were 6.04% and 1.45% respectively. Soyabean meal (20.93% of total received) were rejected due to low protein and high crude fiber content which was attributed to high content of hulls in the samples (Ravindran and Blair, 1992).

### Coconut oil cake and coconut deoiled cake

The average moisture content of the coconut oil cake (8.56%) and coconut DOC (9.83%) were within the acceptable level of BIS specifications (2009). The coconut oil cakes (12.5 % of total received) were rejected due to high moisture and high crude fiber content and coconut DOC (20% of total received) were rejected due to higher crude fiber and AIA contents. High moisture content in coconut oil cake was attributed to processing method and type of packaging materials used by the suppliers (Sahdev, 2015). Oil cakes are normally packed in gunny bags instead of polypropylene bags to avoid the materials deterioration during storage (Ansari *et al.*, 2015). Variation in crude protein content of coconut oil cake and coconut DOC could be attributed to maturity of the coconut kernel used for processing. The mature coconut kernel has high crude fiber and low crude protein content and vice versa (Regar *et al.*, 2019) similar finding was evident in the present study. The coconut oil cakes (12.5% of the total received) were having higher than

the specified level of crude fiber content. The ether extract values varied from 7.04% to 12.50 % in coconut oil cake which was attributed to the expeller processing method (Khan and Hanna, 1983). The AIA content in coconut oil cake and coconut DOC (1.35% and 1.77 %) were within the BIS specifications (2009) and indicated that there was no adulteration during the processing.

### **Groundnut cake and groundnut deoiled cake**

The average moisture content of the oil cake was 10.90% and this ingredient was supplied from the local market and was processed by mechanical method. The groundnut DOC moisture content (8.39%) was within the BIS specifications (2009). The crude protein content of groundnut oil cake and groundnut DOC were 36.92 % and 43.89%, respectively and they were lower than the BIS specifications (2009). The differences in the crude protein content could be attributed to the poor quality kernel used in the oil extraction process after utilising good quality kernels for direct human consumption (Carr, 1997). The crude fiber and AIA contents of both cakes were within the BIS specifications (2009). The aflatoxin B1 levels of the groundnut DOC varied from 30 ppb to 239 ppb which might be attributed to the harvesting and storage methods adopted prior to oil production (Waliyar *et al.*, 2003).

### **Decorticated and delinted cotton seed cake**

Average crude protein contents of cotton seed DOC varied between 33.58% to

36.72 % with mean value of 35.36%. The crude protein, crude fiber and AIA contents were within the acceptable limits of BIS specification (2009) similar to the reports of Kumar *et al.* (2015). The ether extract content was 0.92 % and it was attributed to the solvent extraction method to remove oil. Due to high crude fiber and AIA content 22.22% of truck loads received in the processing unit were rejected.

### **Deoiled rice bran (DORB) and rice bran**

The average moisture content of DORB and rice bran were 9.52% and 7.94% respectively, and the levels were within the acceptable limits of BIS specification (2009). The crude protein, crude fiber and AIA contents of DORB were 15.47, 16.13 and 6.02 (% DMB) respectively. The moisture, crude protein, crude fiber and AIA contents of the samples received (5, 14, 29 and 36% respectively) were higher than BIS specifications (2009). The higher crude fiber content could be due to the processing method and variety of the paddy used (Sharif *et al.*, 2014). The rice bran samples were lower in crude protein (7.55%), higher in crude fiber (36.26 %) and AIA (14.05% ) than the BIS specifications. This could have been the result of more husk portion in the samples (Bodie *et al.*, 2019). The rice bran received at processing unit (100% ) were completely rejected due to low crude protein, high crude fiber and AIA contents. Due to high crude fiber and AIA in DORB, 36.06% of truck loads received was rejected.

**Table 1. Proximate principles and acid insoluble ash (% DMB) content of feed ingredients in comparison to BIS specifications**

Sample name	Parameters	No. of samples	Mean $\pm$ SE (% DMB)	BIS specifications (% DMB)
<b>Maize</b> (IS:9629:2004)	Moisture	57	10.86 $\pm$ 0.29	13.0
<b>Soyabean meal</b> (IS:1374:2004)	Moisture		10.51 $\pm$ 0.35	10.0
	Crude protein	43	45.49 $\pm$ 0.24	45.0
	Crude fiber		6.04 $\pm$ 0.28	4.0
	AIA		1.45 $\pm$ 0.13	-
<b>Coconut oil cake</b> (IS: 2154:1986)	Moisture		8.56 $\pm$ 0.37	10.0
	Crude protein		25.11 $\pm$ 0.95	22.0
	Crude fiber	16	17.5 $\pm$ 1.68	12.0
	AIA		1.35 $\pm$ 0.18	1.5
	EE		9.97 $\pm$ 0.41	6.5
<b>Coconut DOC</b> (IS:3591:1985)	Moisture		9.83 $\pm$ 0.42	10.0
	Crude protein		24.47 $\pm$ 0.59	23.0
	Crude fiber	10	12.91 $\pm$ 0.25	14.0
	AIA		1.77 $\pm$ 0.24	1.5
	EE		1.52 $\pm$ 0.09	-
<b>Groundnut cake</b> (IS:1713:1986)	Moisture		10.90 $\pm$ 0.26	8.0
	Crude protein	10	36.92 $\pm$ 0.21	43.0
	Crude fiber		9.40 $\pm$ 0.21	12.0
	AIA		1.57 $\pm$ 0.18	2.5
	<b>Groundnut DOC</b> (IS:3441:1982)	Moisture		8.09 $\pm$ 0.20
	Crude protein		43.89 $\pm$ 0.35	47.0
	Crude fiber	14	9.77 $\pm$ 0.26	10.0
	AIA		1.68 $\pm$ 0.16	2.5
	Aflatoxin B1		102.71 $\pm$ 16.72	-

<b>Cotton seed cake (decorticated and delinted) (IS:1712:1982)</b>	Moisture		9.37 ± 0.30	8.0
	Crude protein	9	35.36 ± 0.31	35.0
	Crude fiber		15.56 ± 0.32	15.0
	AIA		1.55 ± 0.21	2.5
	EE		0.92 ± 0.12	6.0
<b>Deoiled rice bran (IS:3593:1979)</b>	Moisture		9.52 ± 0.21	10.0
	Crude protein	61	15.47 ± 0.16	14.0
	Crude fiber		16.13 ± 0.39	16.0
	AIA		6.02 ± 0.27	6.0
<b>Rice bran (IS:3648:1975)</b>	Moisture		7.94 ± 0.21	10.0
	Crude protein		7.55 ± 0.24	13.0
	Crude fiber	11	36.26 ± 0.98	10.0
	AIA		14.05 ± 0.37	5.0
	EE		7.20 ± 0.96	15.0
<b>Wheat bran (IS:2239:1971)</b>	Moisture		8.45 ± 0.47	12.5
	Crude protein		14.26 ± 0.46	13.0
	Crude fiber	9	9.47 ± 0.64	12.0
	AIA		1.56 ± 0.29	0.25
	EE		2.93 ± 0.18	-
<b>Sunflower DOC (IS:14702:1999)</b>	Moisture		9.37 ± 0.19	10.0
	Crude protein	8	30.21 ± 0.30	28.0
	Crude fiber		19.45 ± 0.31	32.0
	AIA		1.49 ± 0.11	1.0
<b>Gingelly oil cake (IS:1934:1982)</b>	Moisture		10.54 ± 0.24	8.0
	Crude protein	9	29.89 ± 0.61	40.0
	Crude fiber		9.39 ± 1.20	7.0
	AIA		1.17 ± 0.23	1.5

**Table 2. Feed ingredients rejected at feed processing unit**

Feed samples	Total number received	Number rejected	Per cent rejection	Reasons for rejection
Maize	57	5	8.77	Moisture above 14%, broken grain above 5%, fungal infested
Soyabean meal	43	9	20.93	Crude protein below 42 %, Crude fiber above 4 %
Coconut oil cake	16	2	12.50	Moisture and crude fiber above 14%, AIA above 2.0%
Coconut DOC	10	2	20.00	Crude fiber above 12%, AIA above 2.0%
Groundnut oil cake	10	0	0	Crude fiber above 14%, AIA above 2.0%
Groundnut DOC	14	0	0	Crude fiber above 12%, AIA above 2.5%
Cotton seed cake (decorticated and delinted)	9	2	22.22	Crude fiber above 16%, AIA above 3.0%
Deoiled rice bran	61	22	36.06	Crude fiber above 18%, AIA above 6.0%
Rice bran	11	11	100	Crude protein below 12% Crude fiber above 20%, AIA above 6.0%
Wheat bran	9	2	22.22	Crude fiber above 14%, AIA above 3.0%
Sunflower oil cake	8	0	0	Crude fiber above 32%, AIA above 2.0%
Gingelly oil cake	9	3	33.33	Crude fiber above 12%, AIA above 2.5%

**Wheat bran**

The average crude protein, crude fiber and AIA contents of wheat bran were 14.26, 9.47 and 1.56% respectively, and values were within the acceptable level of BIS specifications (2009) and that reported by Kumar *et al.* (2015). Out of nine loads received, two had lower crude protein content (less than 13

%) than the accepted levels hence they were rejected.

**Sunflower deoiled cake**

The crude protein and crude fiber contents were ranged from 29.24% to 31.53% and from 18.24% to 20.82%, respectively, and values were within the acceptable level of BIS specifications and were similar to that reported

by Alagawany *et al.* (2015) and Rama Rao *et al.* (2016).

### Gingelly oil cake

The raw materials were supplied from the local market near Thanjavur and the moisture, crude protein, crude fiber and AIA contents were 10.54, 29.89, 9.39 and 1.17% respectively, which were lower than BIS specifications but comparable with that reported by Yasothai *et al.* (2010).

### CONCLUSION

The proximate composition of cereal grain, plant protein sources and deoiled rice bran were within the acceptable level of BIS specifications (2009). The maize grain showed high moisture content during the monsoon season of September to December. The crude protein and crude fiber content of oil cakes varied depending on the processing methods of oil extraction. The acid insoluble ash content of oil cakes and brans revealed the level of contamination during the harvesting and processing of raw materials. The quality of the finished feed depends on the quality of raw feed ingredients hence, they should be analysed by physical and chemical methods before processing the feed to ensure safety and quality of the finished feeds.

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