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Nutritional analysis of maize bran and its *in vitro* dry matter digestibility

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Abstract

A study has been carried out to find out the chemical composition and *in vitro* dry matter digestibility characteristics of maize bran. Six maize bran feed samples were collected from different parts of Salem district. The samples were ground to pass through a 2-mm screen and then analyzed for their chemical analysis and *in vitro* dry matter digestibility. In the present study, the Crude protein, Crude fibre, Ether extract, Total ash, Sand and silica and Gross Energy content of Maize bran were 10.7%, 11.4%, 2.98%, 1.88%, 3.28% and 1435 Kcal/kg respectively. The aflatoxin B1 level was correlated with its moisture content and storage conditions. *In vitro* DM digestibility of Maize Bran at 48 hrs was 48.04%. The present study showed that maize bran had relatively high energy content and *in vitro* DMD and thus has the potential to be a good alternate feed source for livestock.

Keywords: Aflatoxin, maize bran, proximate analysis, nutritional value

Introduction

Due to tremendous hike in feed cost, cattle producers today, however, rely on an abundance of alternative or by-product feeds to supplement their cattle. Alternative feeds may provide nutrients needed by cattle at a lower cost than traditional feeds. One such alternative feed for livestock is Maize Bran. Maize bran is a by-product of various maize processing industries, including starch and ethanol production and the production of maize-based foods. While maize bran theoretically consists of the bran coating removed in the early steps of the process, the maize bran sold for livestock feeding is usually a mixture of the bran fraction and other byproducts and a very loosely defined product of highly variable composition. In the starch process, maize bran is usually mixed with steep liquor to produce corn gluten feed (Stock *et al.*, 1999)^[5]. Composition of maize bran has been of great interest to researchers in the area of animal science and especially to people in the feed industry as the majority of it has been sold as a feed ingredient for livestock. Hence the present research had been initiated to study the chemical composition of maize bran and its *in vitro* dry matter degradability potential.

Materials and Methods

Sample collection

Six maize bran feed samples were collected from different parts of Salem district. The samples were dried and ground to pass through a 2-mm screen and then analyzed for chemical analysis and *in vitro* dry matter digestibility.

Chemical analysis

Dry matter (DM) was determined by drying the samples at 105 °C overnight and ash by igniting the samples in a muffle furnace at 525 °C for 8 h. Content of nitrogen (N) was measured by the Kjeldahl method (AOAC 1990)^[1]. The CP was calculated as N X 6.25 and other proximate analyses were done as per the AOAC (1990)^[1].

Mineral analysis

Minerals were estimated using AAS (Perkin Elmer model 3110, 1994) following the procedure outlined in the cookbook.

Aflatoxin analysis

Around 20 samples of maize bran were analyzed for aflatoxin content by the method described by Romer (1975) [4].

In vitro dry matter digestibility (IVDMD)

Maize bran samples (1.0 gram) were subjected to 24 and 48 hour digestion periods with McDougall's buffer and rumen fluid mixture in sealed plastic bottles followed by 24 and 48 hour digestion with pepsin in weak acid (Tilley and Terry 1963) [6]. All incubations were carried out in triplicate. Three blank tubes (without sample) were used in each run.

IVDMD (%) = [(initial DM input - (Residue-Blank) / initial DM input) * 100]

Statistical analysis

Simple correlation and regression analyses were used to establish the relationship between chemical composition and *in vitro* DMD and the results were analyzed statistically.

Results and Discussion

Chemical composition and mineral profile

The chemical and mineral composition of maize bran is presented in the Table 1.

In the present study, the crude protein content (10.7%) of maize bran was as similar with the value reported by Cardenas *et al* (2002) [2] who reported that the crude protein content of maize bran was between 10-14%. The crude fibre

content was 11.4% observed in the test sample whereas Cardenas *et al* (2002) [2] reported that the crude fibre ranged between 5-20%, which tends to be higher than for other maize by-products and much more variable. One advantage of maize bran is that it provides energy without causing negative digestive interactions with other ingredients. The mineral profile of maize bran indicated that maize bran contains high levels of calcium (Larson *et al.*, 2007) [3].

Table 1: Chemical and mineral composition of maize bran

S. No	Nutrients	Level	Unit
1.	Moisture	65.0 ± 2.72	%
2.	Crude protein	10.7 ± 1.83	%
3.	Crude fibre	11.4 ± 1.54	%
4.	Ether extract	2.98 ± 0.94	%
5.	Total ash	1.88 ± 1.02	%
6.	Gross Energy	1437 ± 30.50	kcal/kg
7.	Calcium	45.8 ± 1.017	ppm
8.	Phosphorous	70.0 ± 1.85	ppm
9.	Sodium	21.2 ± 1.23	ppm
10.	Potassium	18.7 ± 2.01	ppm

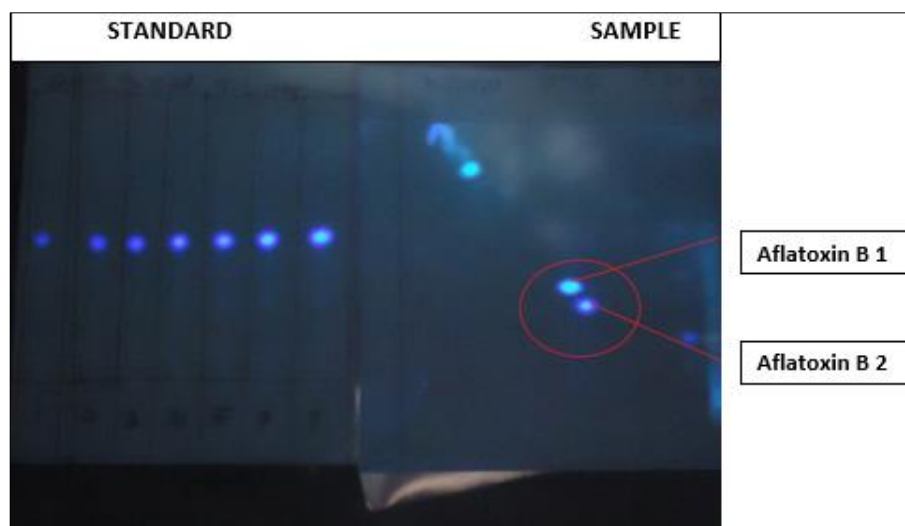
Mean ± SE of six samples

Aflatoxin analysis

The maize bran sample contains the highest level of Aflatoxin B1 and Aflatoxin B2 in the concentration of 400 ppb and 160 ppb respectively. This might be due to improper storage conditions at the field level.

Table 2: Level of Aflatoxin B1 (ppb) and B2 (ppb) and Moisture (%) in maize bran

S. No.	Number of samples	Percent incidence of aflatoxicosis	Aflatoxin B1 (ppb)	Moisture (%)	Aflatoxin B2 (ppb)
1	10	50.0	Traces	62.89 ± 0.60	Not-Detectable
2	8	40.0	40-50 ppb	60.17 ± 0.80	Not-Detectable
3	2	10.0	300-400 ppb	65.03 ± 0.50	10-160



In vitro dry matter digestibility (IVDMD) studies

The dry matter degradability at 48 hours was 48.04%. The rumen ammonia and total VFA at 48 hours of incubation were 12.55 mg/100 ml and 11.25 mmol respectively. The dry matter degradability at 48h was correlated.

Conclusion

In the present study, it can be concluded that maize bran has good energy content and *in vitro* DMD about 48% and thus

has the potential to be a good alternate feed source for ruminant animals during the scarcity periods.

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