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Effect of feeding promising unconventional oil cakes on blood parameters in cross-bred calves

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Abstract
There are many unconventional feed resources available in India. Among all, the most promising are mahua and karanj oil cakes which contain quality nutrients like that of conventional cakes. The effects of UOC combinations on rumen fermentation have not been tried so far. Moreover, studies are very scanty and little on the effects of feeding these UOC's on rumen fermentation. So, the study was conducted to evaluate the effect of karanj and mahua oil cakes at 75:25 combinations on blood profile in crossbred calves. The twenty-four growing male crossbred calves were selected and divided into four groups of six animals each for feeding cum growth trial for 120 days. The four groups were T_1 control, T_2 fed 5% UOC combination containing concentrate mixture, T_3 fed 7.5% UOC combination containing concentrate mixture and T_4 fed 10% UOC combination containing concentrate mixture. There was no effect of feeding the UOC mixture on the glucose, total protein, albumin, globulin, A: G ratio, AST, ALT, ALP, serum urea, BUN, Haemoglobin, PCV, total leucocyte count and differential leucocyte count. These unconventional oil cakes in lower level would be useful for the preparation of concentrate mixture of the ruminant animal as it is having high protein content and nutrients with a cheaper price.

Keywords: glucose, total protein, albumin, globulin, haemoglobin

Introduction
Ruminants are mainly fed on lignocellulosic agricultural by-products like cereal straws, stover, sugarcane bagasse etc. The rumen microbes convert these un-utilizable plant tissues into valuable animal products like meat and milk. The rumen microbial ecosystem is highly diversified which comprises bacteria, protozoa, fungi, and bacteriophages.
There are many unconventional feed resources available in India which can be included in the ration of ruminant animals [1]. Among all, the most promising are castor bean, mahua, neem and karanj oil cakes which contain quality nutrients like that of conventional cakes. These unconventional oil cakes (UOC) are rich sources of phytochemicals such as glycoside, saponins, tannins, essential oils and others [2]. Also, it has been reported that these cakes having various functions and beneficial effects for livestock production other than feed value. These unconventional oil cakes in lower level would be useful for the preparation of concentrate mixture of the ruminant animal as it is having high protein content and nutrients with a cheaper price [3]. So it would be an extra advantage to include these feeds in the concentrate mixture of ruminants. It is reported that inclusion of this type of feed ingredients with very low level is effective to manipulate the rumen fermentation towards the beneficial mode.

Materials and Methods
Experimental animals, feeding and sampling
To test the effect of unconventional oil cakes as a feed additive on animal performance, twenty four growing male crossbred of about 3 to 4 months of age was be used. After acclimatization, the animals were randomly divided into four groups of six animals each, following completely randomized design (CRD). The experiment was conducted for 120 days under similar management conditions in the animal shed of Animal Nutrition Division, Indian Veterinary Research Institute, Izatnagar. The animals were fed as per NRC (2001) feeding standards for 500g daily body weight gain. Prior to initiation of the experimental trial, animals were treated for ecto and endo-parasites as per the standard protocol.

Table 1: Grouping of experimental calves

Groups	Feeding
T_1 (Control)	Concentrate mixture + Roughage at 50:50 ratio
T_2	Concentrate mixture (Containing 5% UOC comb*.) + Roughage at 50:50 ratio
T_3	Concentrate mixture (Containing 7.5% UOC comb.) + Roughage at 50:50 ratio
T_4	Concentrate mixture (Containing 10% UOC comb.) + Roughage at 50:50 ratio

*Karanj and Mahua oil cake

Animals were fed as per NRC (2001) for maintenance requirement and the ration consisted of concentrate mixture and wheat straw in 1:1 ratio. The unconventional feed was mixed well with the concentrate mixture before offering to calves. The wheat straw was offered after the concentrate mixture was completely consumed by the animals.

Blood biochemical parameters

Blood samples were collected from all the animals on 0, 30, 60, 90 and 120 days of experimental feeding by jugular vein puncture into tubes containing anticoagulant (sodium heparin) or without anticoagulant for different analysis. The blood samples were transported in the laboratory in an ice bath. Serum was harvested from whole blood (from the tubes without sodium heparin) after clotting at 4 ^{o}C for 8 h followed by centrifugation at 500xg for 20 min. Serum was stored at -20 ^{o}C until further analysis. All the biochemical parameters were estimated by using span dianostics limited, India.

Statistical Analysis

The experimental data generated were analyzed using SPSS computer package (SPSS version 20.0, SPSS Inc., Chicago, USA) [4] adopting standard statistical procedures. The periodic alterations in blood parameters were analyzed using repeated measures design (General linear model; GLM, Multivariate). Other parameters were analyzed using one way ANOVA with Dunken's post hoc testing to compare experimental groups. For all statistical analyses, probability values less than 0.05 were considered as significant.

Results and Discussion

Blood biochemical, heamatological and enzymatic profile

Haematological parameters

Mean Hb (g/dl) and PCV (%) levels under different treatments ranged from 11.00 to 11.46 and 30.38 to 31.10 respectively. The values of total leucocyte count and differential count were within normal range in all the groups. No significant difference was evident in Hb, PCV, TLC and DC levels of experimental calves irrespective of dietary treatments and periods. The treatments and periods of interaction were also not significant. Findings of the present study were corroborated with that of Inamdar *et al.* (2015) [5] who also reported comparable Hb, PCV, TLC and DC by feeding mahua seed cake (saponins source) and harad (tannins source) to buffaloes. Similar findings were also reported by Thakur *et al.* (2015) [6] in kids. However, Anandan (2009) [7] reported, a higher level of blood Hb, PCV, TEC, reduction of blood TLC and eosinophils was observed in karanj cake fed lambs in comparison to control diet fed lambs. Agarwal (2011) [8] also reported a higher level of blood Hb and PCV was observed in karanj cake fed rams in comparison to control diet fed rams.

Table 2: Effect of feeding karanj and mahua cake combination at different levels on haematological parameters of growing crossbred calves

Attributes	Periods					Mean±SE	P value		
	0 days	30 days	60 days	90 days	120 days		T	P	T*P
Hb (g/dl)									
T_1	11.15±0.13	11.12±0.27	11.37±0.10	11.08±0.09	11.24±0.15	11.21±0.08	0.868	0.216	0.128
T_2	11.07±0.14	11.13±0.08	11.26±0.30	11.24±0.32	11.50±0.15	11.13±0.08			
T_3	10.78±0.11	11.02±0.16	11.15±0.11	11.54±0.11	10.92±0.26	11.17±0.08			
T_4	11.45±0.18	10.76±0.14	11.03±0.13	10.99±0.17	11.10±0.13	11.19±0.08			
Mean ±SE	11.13±0.05	11.05±0.06	11.00±0.10	11.07±0.12	11.46±0.07				
PCV (%)									
T_1	30.17±0.33	30.70±0.52	31.15±0.29	30.54±0.17	30.38±0.17	30.77±0.2	0.890	0.027	0.414
T_2	31.70±0.76	30.58±0.21	30.37±0.16	30.56±0.16	30.5±0.52	30.64±0.15			
T_3	30.53±0.21	30.59±0.19	30.17±0.33	30.50±0.27	30.82±0.45	30.59±0.15			
T_4	31.06±0.34	30.76±0.39	31.18±0.59	30.67±0.31	30.35±0.10	30.66±0.14			
Mean ±SE	30.38^{b}±0.18	30.50^{b}±0.13	30.50^{b}±0.08	30.84^{ab}±0.13	31.10^{a}±0.29				
TLC (/mm^3)									
T_1	8.97±0.04	9.00±0.02	8.99±0.02	9.00±0.02	9.00±0.03	8.97±0.02	0.594	0.291	0.325
T_2	8.89±0.05	8.97±0.03	8.98±0.01	8.98±0.02	9.01±0.01	8.99±0.01			
T_3	9.00±0.02	9.00±0.02	8.97±0.03	8.96±0.01	8.98±0.01	8.98±0.01			
T_4	8.98±0.02	9.00±0.01	9.00±0.02	8.97±0.01	8.97±0.03	8.98±0.01			
Mean ±SE	8.97±0.01	8.97±0.02	9.00±0.01	8.98±0.01	8.97±0.01				
Neutrophil (%)									
T_1	35.67±0.80	36.00±0.58	35.83±0.40	36.33±1.02	36.33±0.49	35.87±0.26	0.239	0.264	0.593
T_2	35.33±0.42	34.33±0.95	35.50±0.56	37.00±1.03	36.17±0.60	35.40±0.29			
T_3	36.50±0.56	36.50±0.56	35.83±0.87	36.00±0.58	35.5±0.81	36.27±0.35			
T_4	35.83±0.54	34.83±0.48	36.17±0.48	34.67±0.99	35.67±0.49	35.67±0.31			
Mean ±SE	35.13±0.44	36.08±0.25	35.96±0.35	36.04±0.36	35.79±0.26				
Lymphocyte (%)									
T_1	61.00±0.37	61.00±0.37	61.33±0.42	60.5±0.76	60.50±0.22	60.90±0.15	0.325	0.089	0.527
T_2	60.83±0.17	61.83±0.79	61.17±0.31	59.83±1.4	61.00±0.37	61.30±0.21			
T_3	60.50±0.43	60.67±0.21	61.50±0.43	61.17±0.4	60.83±0.48	60.73±0.34			
T_4	61.17±0.40	61.50±0.43	60.67±0.33	62.00±0.37	61.33±0.33	61.13±0.18			
Mean ±SE	61.58±0.25	60.67±0.12	60.88±0.26	60.79±0.39	61.17^{ab}±0.17				

Monocyte (%)									
T_1	2.17±0.31	2.00±0.37	1.67±0.33	2.17±0.4	1.83±0.31	2.00±0.14	0.997	0.977	0.907
T_2	2.17±0.31	2.17±0.48	2.17±0.48	2.00±0.37	1.50±0.22	2.05±0.17			
T_3	1.67±0.33	1.67±0.33	1.83±0.31	1.67±0.33	2.5±0.22	1.97±0.15			
T_4	2.00±0.37	2.33±0.21	2.17±0.31	2.00±0.37	2.00±0.26	1.97±0.13			
Mean ±SE	2.04±0.18	1.96±0.15	1.92±0.16	2.04±0.16	1.96±0.18				
Eosinophil (%)									
T_1	1.17±0.31	1.00±0.26	1.17±0.31	1.00±0.26	1.33±0.21	1.23±0.14	0.496	0.819	0.954
T_2	1.67±0.33	1.67±0.42	1.17±0.31	1.17±0.31	1.33±0.21	1.30±0.14			
T_3	1.33±0.42	1.17±0.31	0.83±0.31	1.17±0.17	1.17±0.31	1.03±0.11			
T_4	1.00±0.26	1.33±0.21	1.00±0.26	1.33±0.42	1.00±0.26	1.23±0.12			
Mean ±SE	1.25±0.18	1.29±0.14	1.25±0.14	1.13±0.14	1.08±0.12				
N/L ratio									
T_1	0.59±0.02	0.59±0.01	0.59±0.01	0.60±0.02	0.60±0.01	0.59±0.01	0.207	0.203	0.528
T_2	0.58±0.01	0.56±0.02	0.58±0.01	0.62±0.03	0.59±0.01	0.58±0.01			
T_3	0.60±0.01	0.60±0.01	0.58±0.02	0.59±0.01	0.59±0.02	0.60±0.01			
T_4	0.59±0.01	0.57±0.01	0.60±0.01	0.56±0.02	0.58±0.01	0.58±0.01			
Mean ±SE	0.57±0.01	0.59±0.00	0.59±0.01	0.59±0.01	0.59±0.01				

Means bearing superscript (a, b) in a row differ significantly (p<0.05)

Serum biochemical parameters

Blood biochemical profile gives important information concerning clinical status, deficit condition, treatment monitoring and also nutritional balance. There was no significant (P>0.05) difference was observed among the groups in glucose, total protein, albumin, globulin, A: G ratio and BUN. All the blood parameters were within their normal range Kaneko *et al*, (1997) [9]. The observation regarding comparable serum biochemical in the present investigation is in agreement with Inamdar *et al*. (2015) [5] who also reported comparable glucose, total protein, albumin, globulin, A: G ratio and BUN by feeding mahua seed cake (saponins source) and harad (tannins source) to buffaloes. Patil *et al.* (2013) [10] conducted a study to assess the effect of the feeding compressed complete feed block (CCFB) containing 5% de-oiled mahua seed cake on the serum biochemical profile in the crossbred calves and observed that the inclusion of de-oiled mahua seed cake at 5% in CCFB has no adverse effect on the serum biochemical profile in the calves in long-term feeding. Ojha *et al.* (2012) [11] reported comparable blood biochemical profile being within the normal physiological range in male crossbred calves fed deoiled mahua seed cake and guar meal at 10 % inclusion level. Thakur *et al.* (2015) [6] observed that feeding of either solvent extracted karanj cake (SKC) or alkali processed solvent extracted karanj cake (AKC) had no adverse effect on blood glucose, blood urea nitrogen, serum total protein, serum albumin and serum globulin. These results indicate that long-term supplementation of SKC or AKC up to 50% replacement of conventional nitrogen source has no adverse effect on health as revealed by body weight gain and various hematological values. Prabhu (2002) [12] also did not find any adverse effect on blood glucose, total protein, globulin, albumin, urea nitrogen in lambs fed SKC and Alkali processed SKC in comparison to the control group that was fed soybean meal as a sole source of protein. However results regarding serum total protein, serum albumin and A: G ratio differs marginally from Anandan (2009) [7] and Agarwal (2011) [8] who reported a significant increase in the value during the experimental periods of calves. Ravi *et al*. (2000) [13] did not find any adverse effect of feeding SKC on serum glucose but urea nitrogen was significantly increased when EKC was incorporated up to 24% in diets of lambs.

Table 3: Effect of feeding karanj and mahua cake combination at different levels on serum biochemical profile of growing crossbred calves

Attributes	Periods					Mean ±SE	P value		
	0 days	30 days	60 days	90 days	120 days		T	P	T*P
Glucose (mg/dl)									
T_1	60.20±0.19	60.53±0.09	61.28±0.39	60.72±1.87	60.20±0.19	60.53±0.15	0.294	0.263	0.933
T_2	60.84±0.35	59.73±0.27	61.46±0.50	61.88±2.29	60.84±0.35	60.80±0.20			
T_3	60.71±0.65	60.67±0.31	60.40±0.30	61.94±1.79	60.71±0.65	61.42±0.26			
T_4	60.38±0.13	60.84±0.47	61.71±0.50	61.96±1.30	60.38±0.13	61.38±0.70			
Mean ±SE	60.19±0.14	60.98±0.47	61.20±0.58	61.33±0.47	61.47±0.41				
Total Protein (g/dl)									
T_1	7.21±0.17	7.33±0.14	7.24±0.05	7.04±0.06	7.01±0.18	7.19±0.06	0.433	0.534	0.979
T_2	7.21±0.12	7.03±0.15	7.18±0.14	7.16±0.17	7.02±0.13	7.11±0.06			
T_3	7.12±0.15	7.02±0.17	7.08±0.21	7.29±0.13	7.09±0.20	7.15±0.06			
T_4	7.11±0.04	7.06±0.10	7.20±0.10	7.09±0.11	7.09±0.14	7.06±0.07			
Mean ±SE	7.10±0.08	7.11±0.07	7.06±0.05	7.15±0.06	7.22±0.07				
Albumin (g/dl)									
T_1	3.45±0.17	3.58±0.13	3.55±0.12	3.50±0.14	3.44±0.12	3.51±0.06	0.277	0.267	0.639
T_2	3.55±0.13	3.29±0.09	3.26±0.06	3.60±0.12	3.48±0.11	3.38±0.06			
T_3	3.51±0.08	3.27±0.13	3.40±0.13	3.33±0.15	3.34±0.10	3.45±0.06			
T_4	3.46±0.16	3.54±0.17	3.42±0.11	3.21±0.12	3.40±0.08	3.37±0.05			
Mean ±SE	3.34±0.06	3.42±0.06	3.51±0.06	3.49±0.06	3.39±0.06	3.34±0.06			
Globulin (g/dl)									
T_1	3.76±0.22	3.75±0.25	3.69±0.12	3.54±0.19	3.58±0.11	3.69±0.09	0.988	0.290	0.986
T_2	3.66±0.24	3.75±0.17	3.92±0.18	3.56±0.12	3.54±0.10	3.72±0.09			

T_3	3.62±0.20	3.74±0.24	3.68±0.31	3.96±0.25	3.75±0.23	3.70±0.09			
T_4	3.65±0.15	3.52±0.25	3.78±0.13	3.89±0.21	3.69±0.13	3.69±0.07			
Mean ±SE	3.77±0.11	3.69±0.09	3.55±0.09	3.66±0.08	3.83±0.10				
A:G Ratio									
T_1	0.95±0.10	0.99±0.10	0.97±0.05	1.01±0.09	0.97±0.04	0.98±0.04	0.710	0.355	0.953
T_2	1.01±0.11	0.89±0.06	0.84±0.05	1.02±0.05	0.99±0.05	0.93±0.04			
T_3	0.99±0.07	0.90±0.10	0.98±0.14	0.87±0.10	0.91±0.07	0.96±0.04			
T_4	0.97±0.08	1.05±0.12	0.92±0.06	0.85±0.07	0.93±0.04	0.93±0.02			
Mean ±SE	0.92±0.05	0.95±0.04	1.01±0.04	0.97±0.03	0.91±0.04				
BUN (mg/dl)									
T_1	13.34±1.00	12.97±0.16	13.28±0.52	12.67±0.45	13.81±0.50	13.62±0.34	0.724	0.855	0.986
T_2	13.34±1.00	13.14±0.47	13.43±0.99	13.79±0.29	13.56±1.08	13.24±0.32			
T_3	14.31±0.97	13.14±0.47	13.95±0.86	12.75±0.42	13.59±0.20	13.42±0.28			
T_4	14.15±0.37	13.22±1.11	13.95±0.86	13.81±0.50	13.59±0.25	13.67±0.25			
Mean ±SE	13.56±0.35	13.56±0.35	13.44±0.46	13.70±0.18	13.18±0.27				

Serum enzyme profile

The concentration of ALP, AST and ALT were within the normal range for all the groups. There was no effect of feeding unconventional oil cakes on serum enzyme level in crossbred calves. The present results supported by Ravi *et al*. (2000) [13] who also reported that there is no significant differences in AST (SGOT), ALT (SGPT) and LDH. Soren (2006) [14] reported that there was no significant difference in SGOT and SGPT in lamb fed with processed SKC diets. Inamdar *et al*. (2015) [5] who also reported comparable AST, ALT and ALP values by feeding mahua seed cake either alone or in combination with harad to buffaloes. Ojha *et al.* (2012) [11] observed that there was no change in ALT, AST and ALP values and did not differ significantly among different groups of male crossbred calves fed with concentrate mixture containing deoiled mahua seed cake and guar meal at 10 per cent inclusion level. However, Anandan (2009) [7] reported that reduction of blood SGPT, SGOT and ALP level was observed in karanj cake fed rams in comparison to control diet fed rams. Agarwal (2011) [8] also reported the lower value of blood SGPT, SGOT and ALP level in karanj cake fed rams in comparison to control diet-fed rams. Increased ALT activity has been reported by feeding of unconventional feeds (solvent extracted Mahua cake) in sheep Singh, (1987) [15] and deoiled sal seed meal in lambs Garg *et al.* (1984) [16].

Table 4: Effect of feeding karanj and mahua cake combination at different levels on serum enzymatic profile of growing crossbred calves

Attributes	Periods					Mean ±SE	P value		
	0 days	30 days	60 days	90 days	120 days		T	P	T*P
ALP (IU/L)									
T_1	127.68±2.01	126.79±1.57	129.97±1.45	133.14±10.08	128.19±1.90	129.13±1.53	0.930	0.24	0.992
T_2	128.55±3.40	129.66±4.39	128.12±3.06	128.27±2.82	133.27±5.08	130.91±1.74			
T_3	136.54±5.61	132.48±5.70	128.56±6.09	129.60±0.89	130.28±2.12	129.82±2.75			
T_4	126.10±1.97	134.31±4.47	129.52±8.26	127.71±1.12	130.85±2.53	130.06±1.25			
Mean ±SE	128.40±1.84	129.68±2.53	134.31±3.13	128.66±1.06	128.84±1.07				
AST (IU/L)									
T_1	98.63±0.76	98.34±0.46	98.60±0.84	97.05±0.87	98.42±4.23	98.19±0.42	0.91	0.969	1.0
T_2	97.80±0.83	99.38±1.07	98.79±0.97	98.96±0.18	99.55±1.42	98.74±0.78			
T_3	97.09±1.41	98.21±3.63	97.55±1.39	98.04±0.71	98.63±0.34	98.29±0.55			
T_4	99.12±1.09	98.71±1.21	99.88±2.12	99.01±1.79	98.15±0.40	98.75±0.90			
Mean ±SE	98.64±0.63	98.58±1.41	98.10±0.62	98.83±0.34	98.33±0.32				
ALT (IU/L)									
T_1	25.05±0.72	26.98±0.48	25.70±1.08	24.59±1.10	25.33±1.41	25.57±0.37	0.976	0.413	0.983
T_2	24.85±1.10	26.00±0.56	25.73±1.04	26.19±1.17	25.62±0.55	25.48±0.41			
T_3	25.57±0.91	24.85±1.12	25.77±1.11	26.34±0.46	24.47±0.56	25.62±0.47			
T_4	25.40±0.81	25.10±0.96	25.23±1.36	25.62±1.03	25.86±0.46	25.38±0.38			
Mean ±SE	25.61±0.42	25.06±0.59	25.22±0.43	25.44±0.46	26.22±0.32				

Conclusion

Feeding of karanj and mahua oil cakes in the ratio of 75:25 at 10% inclusion level was found no effect on glucose, total protein, albumin, globulin, A: G ratio, AST, ALT, ALP, serum urea, BUN, Haemoglobin, PCV, total leucocyte count and differential leucocyte count. So, the karanj and mahua oil cakes in lower level would be useful for the preparation of concentrate mixture of the ruminant animal.

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