

EFFECT OF INCLUSION OF KARANJ SEED CAKE (*PONGAMIA GLABRA VENT*) ON DIGESTIBILITY OF NUTRIENTS IN GROWING GOAT KIDS#

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ABSTRACT

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A metabolic trial of six days duration was conducted after 51 days of experimental feeding in a 17-weeks experiment to observe the effect of feeding solvent extracted karanj (*Pongamia glabra vent*) seed cake (SKC) and alkali processed solvent extracted karanj seed cake (AKC) on the digestibility of various nutrients in goat kids. Twenty non-descript male kids were randomly divided into five treatment groups viz., T₁ (control), T₂, T₃, T₄ and T₅ consisting of four kids each, under completely randomized design to make the initial body weight uniform and non-significant. The T₁ group was offered groundnut cake (GNC) as a sole source of nitrogen whereas T₂ and T₃ group were offered SKC @ 8.09% and 16.18% of concentrate mixtures, respectively to replace 25% and 50% of GNC nitrogen. Similarly T₄ and T₅ were fed AKC @ 8.09% and 16.18% of concentrate mixtures, respectively to replace the 25% and 50% of GNC nitrogen. No significant effect of either SKC or AKC was observed on the digestibility of various nutrients. However, significant improvement in digestibility of ether extract was observed on inclusion of karanj seed cake. These results indicates that long term supplementation of SKC or AKC up to 50% replacement of conventional nitrogen source have no adverse effect on digestibility of concentrate mixture in goat kids.

Key words: Karanj cake, digestibility coefficient, kids

Introduction

The optimum growth of animals depends on the quality and level of protein feeding. The overall scarcity and escalating cost of conventional protein feed supplements such as ground nut cake (GNC) and soybean cake (SBC) is adversely affecting the growth of goat production system in India. Protein being an important macro nutrient of animal diet significantly affects the profitability of goat rearers. So utilization of various unconventional agro-forest based industrial byproducts for the formulation of low cost ration with quality protein is an important task for efficient and economic goat production. So utilization of various unconventional agro-forest based industrial byproducts for the formulation of low cost ration with quality protein is an important task for efficient and economic goat production.

Karanja (*Pongamia glabra*) seed cake is an unconventional protein rich source and was found to be a potential replacer of conventional protein cakes by several workers. Deoiled *Pongamia* cake is characteristically high in CP ~30% (Ravi *et al.*, 2000) and possesses a suitable Ca: P ratio (Soren and Sastry, 2009) compared to soybean meal and cottonseed meal. The use of raw seed cake was found to be limited due to anti-nutritional factors such as karanjin and pongamol in making them unpalatable and poorly digestible (Dinesh *et al.*, 2011). Various methods were adopted to improve palatability and nutritive value of detoxify karanja cake. Among all the methods, solvent extraction method suggested by Prabhu (2002) was found to be more efficient to remove karanjin and is most commonly used method to detoxify karanja cake. Panda *et al.* (2006) reported that the levels of various antinutritional factors like karanjin, tannin and trypsin inhibitors in solvent extracted karanj cake (SKC) can further be eliminated

through alkali treatment and is more useful in enhancing the level of feeding of SKC in lambs (Prabhu *et al.*, 2002; Thakur *et al.*, 2017) through improvement in palatability and digestibility of crude protein.

Goat, being ruminant in nature, has unique adaptability to variety of feed resources and higher tolerance to various toxins and anti-nutritional factors than any other livestock units. Srivastava *et al.* (1990) confirmed the relevance of using SKC at 6-9% level in goat without any adverse effect on performance. The studies conducted by many workers in goat (Thakur *et al.*, 2014, 2015, 2016) also confirmed the relevance of using solvent extracted *Pongamia* seed cake in concentrate mixtures on iso-nitrogenous and iso-calorigenous basis without any adverse effect on sero-biochemical parameters, health and performance. Very few reports are available concerning the effect of karanj seed cake on digestibility of different nutrients in goats, even though these are important parameters to assess the suitability of any unconventional feed for animal feeding. Thus the present study was undertaken to observe the effect of inclusion of two different level of either solvent extracted karanj seed cake (SKC) or alkali processed SKC (AKC), respectively on the digestibility of different nutrients in growing goat kids.

Materials and Methods

A feeding trial of 17 weeks was conducted on twenty 3-4 months old growing male goat kids in Animal Experiment Unit of Department of Animal Nutrition, Veterinary College, Bengaluru, India after approval from Animal Ethical Committee. The kids were randomly allotted to five treatment groups, T₁ (control) to T₅, of four animals each in a completely randomized design to make initial body weight uniform and non significant

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between treatments. The kids were maintained under standard management practices throughout the trial with proper vaccination and regular deworming.

Half part of SKC was treated with 2.5% solution of sodium hydroxide for overnight and then dried and powdered to prepare AKC. The proximate analysis was done as per standard methods of analysis (AOAC, 1995) (Table 1). Five different isonitrogenous and isocaloric concentrate mixtures were prepared using groundnut cake alone or in combination with SKC or AKC in such a way to meet the crude protein requirement of individual kid to the extent of 80% level of NRC (1985) specified values. The control group (T_1) was fed groundnut cake as sole source of nitrogen while T_2 and T_3 groups and T_4 and T_5 groups fed with same type of feed with variable quantities of either SKC (T_2 and T_3) or AKC (T_4 and T_5) along with groundnut cake. 25% nitrogen of groundnut cake was replaced by SKC and AKC in T_2 and T_4 groups, respectively. Similarly 50% nitrogen of groundnut cake was replaced by SKC and AKC in T_3 and T_5 groups, respectively. The T_2 and T_3 group were offered SKC @ 8.09% and 16.18% of concentrate mixtures, respectively. Similarly T_4 and T_5 were fed AKC @ 8.09% and 16.18% of concentrate mixtures, respectively. The kids were offered daily weighed quantities of the respective concentrate mixtures to meet their protein requirements (NRC, 1985) for maintenance and growth. Dry matter requirements were met through *ad libitum* supply of finger millet straw.

After 51 days of experimental feeding, six day metabolic trial was conducted. Daily intake of concentrates, ragi straw and Napier grass on individual basis was calculated. Faecal collection bags were used for the collection of the faeces from each animal on daily basis and mixed thoroughly for sampling. Similarly urine collection bags were used for the collection of urine excreted by each animal on daily basis. The proximate analysis of feed, faeces and urine were carried out as per standard methods of analysis (AOAC, 1995). The experimental data were subjected to statistical analysis using analysis of variance technique as described by Snedecor and Cochran (1989) and accordingly the results were interpreted. The apparent digestibility coefficient of any given nutrient was calculated as the percent difference in its intake and its output through faeces as a proportion of intake.

Results and Discussion

The digestibility coefficients for various nutrients are represented in Table 2. The digestibility coefficient is an important indicator to assess the nutritive quality of feed and reflects the overall suitability and integration of any unconventional feed in the feeding regime. The treatment wise average dry matter (DM) digestibility coefficients of T_1 , T_2 , T_3 , T_4 and T_5 groups were 66.24, 70.14, 71.61, 67.41 and 69.43 per cent, respectively. The non-significant ($p \geq 0.05$) variation in the digestibility coefficients of DM of various dietary groups indicates that the inclusion of deoiled SKC and AKC up to 50 per cent level in the concentrate mixture of the kids has no untoward effect on digestibility of DM. Non significantly highest dry matter digestibility was observed at 50 per cent level of inclusion of SKC. In the mixed diets, the DM digestibility varies according to the amount of grain (concentrate) present in the diet consumed by the animals. No significant ($p < 0.05$) differences in DM digestibility among kids on different diets

was observed in the present study, since the proportion of concentrate among the rations consumed by kids were 55.00, 51.72, 48.53, 51.65 and 57.29 % in T_1 through T_5 groups, respectively (McDonald *et al.*, 2002).

The organic matter digestibility was also maximum in T_3 (73.52%) followed by T_2 (71.80%), T_5 (71.24%), T_4 (69.40%) and was least in control kids (68.98 %). The differences among the groups were statistically non-significant ($p > 0.05$) implying that the karanj seed cake has no effect on the digestibility of organic matter.

The digestibility coefficients of crude protein (CP) for T_1 , T_2 , T_3 , T_4 and T_5 groups were 78.0, 77.07, 70.40, 73.55, and 69.64 per cent, respectively. The digestibility values observed were non-significantly higher for control followed by treatments containing SKC. The per cent digestibility coefficient of CP of the treatment containing low level of SKC (T_2) is quite comparable to that of control diet- T_1 . Contrary to the higher CP digestibility obtained in the present study, Konwar *et al.* (1987), Srivastava *et al.* (1990) and Prabhu (2002) however, observed lower values of 62.51 ± 1.34 , 57.67 ± 1.77 and 55.14 ± 1.25 per cent CP digestibility in male calves, kids and lambs, respectively.

Statistically significant ($p \leq 0.05$) differences in the EE digestibility among different treatments were observed in the present study. The ether extract digestibility coefficient for T_1 , T_2 , T_3 , T_4 and T_5 was found to be 70.0, 84.52, 78.54, 82.52 and 82.38 per cent, respectively. The kids groups fed alkali processed karanj cake and SKC at 25% level revealed marked improvement in digestibility of ether extract as compared to control. Gupta *et al.* (1981) reported EE digestibility coefficient of 51.12% in cross-bred adult male cattle fed 24% deoiled karanj cake incorporation in concentrate mixture, while a value of 79.7% was reported in sheep receiving a concentrate mixture containing 94g karanj cake (Chandrasekaran *et al.*, 1989).

The digestibility coefficient of NFE for different treatments was found to be statistically ($p \leq 0.05$) similar indicating that the digestibility of soluble sugars was not affected by incorporation of SKC. The digestibility coefficient of NFE for T_1 , T_2 , T_3 , T_4 and T_5 groups were found to be 75.39, 76.29, 79.07, 74.58, and 77.09 per cent, respectively. Srivastava *et al.* (1990) also reported 78.83% digestibility of NFE in kids fed 12% de-oiled karanj cake based ration with *ad libitum* green (maize fodder).

The study is in agreement with the findings of Temjennungsang *et al.* (2016) who observed similar metabolizability of various nutrients and nitrogen, calcium and phosphorus balances among different treatment groups of goat kids in a long term study to assess the effect of SKC and AKC in the diet on nutrient utilization. Rao *et al.* (2016) also observed non significant effect of inclusion of 5.85 per cent detoxified karanj cake in total mixed ration of dairy cattle and found digestibility value of 68.79, 70.26, 60.12 and 75.24 per cent for DM, organic matter, CP and EE, respectively. Thakur *et al.* (2015) in a study on goat kids observed no adverse effect on health as revealed by various haematological parameters on long term supplementation of SKC or AKC up to 50% replacement of conventional nitrogen source. The present study corroborated the findings of Thakur *et al.* (2014, 2016) who observed non significant effect of inclusion of karanj seed cake on dry matter intake, body weight gain and sero-biochemical enzyme status.

Therefore, the present study concluded that inclusion of solvent extracted karanj seed cake in concentrate mixtures of

Table 1: Per cent chemical composition of concentrate mixtures and roughages (DM basis) used during feeding trial

Particulars	Ragi straw	Concentrate Mixtures				
		T ₁ control	T ₂ 25% SKC	T ₃ 50 %SKC	T ₄ 25% AKC	T ₅ 50%AKC
Proximate principles (%)						
DM	93.00	97.40	97.40	97.55	97.55	97.60
CP	2.88	18.03	17.97	17.94	17.97	17.94
EE	1.20	6.60	7.60	7.60	7.30	5.86
CF	34.04	5.94	6.37	6.61	5.96	6.35
TA	7.41	6.60	8.10	6.88	7.64	7.90
NFE	54.47	62.83	59.96	60.97	61.13	61.95
AIA	2.50	4.25	5.52	5.17	5.72	5.63
Fibre fractions (%)						
NDF	64.84	37.41	34.59	39.28	36.58	39.71
ADF	38.34	25.70	22.73	28.32	26.33	29.56
AD-Lignin	6.72	4.30	4.57	4.66	4.10	3.31
Mineral composition (%)						
Ca	0.80	1.50	1.55	1.60	1.58	1.67
P	0.62	0.65	0.83	0.64	0.93	0.86

Average of the values determined on samples compounded on three occasions

Table 2: Per cent digestibility coefficients of nutrients in the total ration of different groups of experimental goats

Tr.No.	Animal No.	DMD ^{NS}	OMD ^{NS}	CPD ^{NS}	EED*	NFED ^{NS}
1 -control	1	61.81	64.90	69.14	75.58	73.85
	2	73.27	75.95	85.16	66.82	81.62
	3	64.40	67.13	87.76	73.63	70.60
	4	65.47	67.93	69.94	63.95	75.48
	Mean±SE	66.24±2.47	68.98±2.41	78.00±4.90	70.00±2.75 ^a	75.39±2.31
2-25%SHSM	5	72.70	74.29	72.45	87.93	79.67
	6	71.49	73.54	82.77	78.76	76.46
	7	68.53	70.24	74.68	85.52	75.16
	8	67.82	69.13	78.39	85.84	73.86
	Mean±SE	70.14±1.16	71.80±1.25	77.07±2.26	84.51±1.99 ^b	76.29±1.25
3-50%SHSM	9	65.24	67.73	70.36	70.50	72.91
	10	69.91	72.39	72.86	82.11	78.31
	11	67.35	69.06	69.76	86.70	73.07
	12	83.94	84.88	68.63	74.83	91.98
	Mean±SE	71.61±4.21	73.52±3.91	70.40±0.89	78.54±3.62 ^{ab}	79.07±4.48
4-25%AHSM	13	68.96	71.29	71.79	87.00	76.92
	14	68.22	70.27	77.20	78.90	75.84
	15	71.74	73.53	78.15	84.67	77.86
	16	60.74	62.49	67.05	79.52	67.69
	Mean±SE	67.41±2.35	69.40±2.40	73.55±2.58	82.52±1.97 ^b	74.58±2.33
5-50%AHSM	17	71.61	72.74	72.93	84.17	78.35
	18	70.02	72.01	75.89	86.60	77.37
	19	70.24	72.32	68.52	82.01	78.75
	20	65.84	67.90	61.22	76.67	73.89
	Mean±SE	69.43±1.24	71.24±1.12	69.64±3.19	82.36±2.11 ^b	77.09±1.10

NS-Non-significant

* With in a column, means values bearing at least one common superscript are statistically (P<0.05) similar.

goat kids do not significantly affects the digestibility of various nutrients and could be effectively used as alternative source of protein as well as other nutrients in goat production system.

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