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Research Article

DIGESTIBILITY AND ENERGY UTILIZATION OF DIET ENRICHED WITH WHOLE LINSEED IN OSMANABADI GOAT KIDS

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ABSTRACT
The changes in digestibility and energy in utilization of Diet Enriched with Whole Linseed in kids as affected by dietary supplementation of whole linseed (with replacement of concentrate ration by 50,100,150 g) were studied. To achieve these objectives 24 weaned Osmanabadi kids divided in four groups fed with diets supplemented with whole linseed were monitored for period of 3 months. Digestibility of various nutrient under different treatments supplemented with linseed were similar and comparable with control indicating no adverse effect on nutrient digestibility. It was found that energy availability was more in treatment groups, however, it did not reflect significantly in contexts with gain in body weight.

Key words: *Kids, Digestibility, utilization, Linseed*

INTRODUCTION
Linseed is one of the oil seed crop grown in winter season. It is having 33.45 per cent oil, 19.22 per cent protein and 72.00 per cent total digestible nutrients on weight basis. But most of linseed is used in the paint industry, for production of printing ink, lacquers varnish and lubricating oils.
Goat meat (chevon) is preferred as fresh hot meat in India and is accepted by the society because there is no religious barrier attached. Being lean, it is an excellent source for the preparation of the low fat meal. Traditional meat eaters are attracted towards poultry products but due to recent episode of 'Bird Flu' in poultry sector, consumers have to look for some other alternative meat products. Demand for goat meat products is growing due to recent trends in low fat content products. As there is more demand and price for goat meat, entrepreneurs have shifted their investment towards goat farming.

MATERIALS AND METHODS
Animals and dietary treatments*:* Twenty four weaned Osmanabadi kids up to four month of age and average body weight 8.7 kg were randomly divided into four groups of six in each. The kids were fed for period of 3 months with four dietary treatments, T0: 1/3 concentrates mixture + 2/3 roughages (control) i.e. conventional feeding, T1: 1/3 concentrate including 50 g linseed + 2/3 roughages, T_2: 1/3 concentrate including 100 g linseed + 2/3 roughages, T_3: 1/3 concentrate including 150 g linseed + 2/3 roughages. The feeding of experimental kids was done as per the Feeding standards given by Mandal et al., (2004). At the end of ninety days representative samples of feed, fodder, and faeces were collected and analyzed for dry matter, crude protein, crude fiber, ether extract and total ash by using AOAC (1995) methods. The data from individual kids were analyzed following Randomized Block Design (Snedecor and Cochran, 1989).

RESULTS AND DISCUSSION
The concentrate mixture prepared for experimental feeding was having 19.46, 8.60, 3.60, 7.60 and 60.20 per cent for CP, CF, EE, TA and NFE, respectively (Table 1). Whereas the linseed is concern, it was found that, CP, CF, EE, TA and NFE content were 19.00, 6.20, 31.50, 7.10 and 36.10 per cent, respectively. It showed that linseed is also nutritionally sound, so that it can be used as protein rich feed for the animals. Similar results were also reported by Astellini et al., (2004), Petit et al., (2003) and Gonthier *et. al.,* (2004).

Table: 1 Physical and Chemical Composition of Concentrate mixture, Linseed and other forages.

(% DM basis)

Ingredients	Parts	Linseed	Lucerne	Tur Bhusa
Maize grain (crushed)	47	--	--	--
Groundnut cake	30	--	--	--
Wheat bran	22	--	--	--
Mineral mixture	1.0	--	--	--
Total	100.0	--	--	--
CP (%)	19.46	19.00	21.69	6.90
CF(%)	8.60	6.20	24.33	32.75
EE(%)	3.60	31.50	2.92	2.04
NFE(%)	60.20	36.10	41.59	49.78
TA(%)	7.60	7.10	9.47	8.53

Table: 2 Apparent digestibility (%) of nutrients based on *IN VIVO* digestion trial

Digestibility	Treatments				S.E.
	T_0	T_1	T_2	T_3	
Dry matter	62.48	64.91	62.00	63.19	1.73
Crude protein	67.26	70.64	69.28	70.92	1.48
Crude fiber	42.55	44.24	41.86	43.12	1.15
Ether extract	70.80^{a}	74.85^{b}	76.08^{b}	72.61^{ab}	1.22
Nitrogen free extract	83.67	83.95	80.04	85.18	1.90

** Value with different superscripts in a row differ significantly (P < 0.01).*

Table: 3 Feed utilization in kids

Parameter	Treatments				S.E.
	T_0	T_1	T_2	T_3	
Gain in body weight (kg)	5.17	5.47	4.63	4.57	0.576
Feed intake (kg)	99.19	97.88	99.01	98.17	2.881
Net energy for maintenance (Mcal/kg)	1.514^{a}	1.719^{b}	1.711^{b}	1.819^{b}	0.062
Net energy for gain (Mcal/kg)	1.021^{a}	1.127^{b}	1.126^{b}	1.209^{c}	0.027

Values with different superscripts in a row differ significantly with each other. (P < 0.01)

The dry matter digestibility of different experimental ration (Table.2) showed that dry matter digestibility ranged from 62.00 and 64.91 per cent. It was highest in T_1 (64.91), followed by T_3 (63.15), T_0 (62.48) and T_2 (62.00). However, all treatment differences were non-significant. From the result it seems no specific trend for dry matter digestibility was found. These finding are in confirmation with the finding of the Ueda et al. (2003) who observed non-significant difference for dry matter digestibility when 3 percent linseed oil supplementation was done in dairy cows and also with Kempe and Saastamoinen (2007) in Dog. The mean values of crude protein digestibility under treatment T_0, T_1, T_2 and T_3 were 67.260, 70.640, 69.287 and 70.927, per cent respectively. Numerically higher digestibility of crude protein was observed in T_3 treatment (70.917) followed by T_1, T_2 and T_0, respectively. However, no significant difference was observed among the linseed fed groups and control. The higher digestibility of CP linseed containing ration and in experimental groups was observed than control group. These results were similar to that of findings of Mustafa et al., (2002), Gonthier et al., (2004) and Alemu et al.,(2010) reported higher CP digestibility in linseed cake supplemented ration than control ration of Sidama Goat. It may be due to higher solubility of heat treated of linseed protein which might favoured to higher digestibility. The perusal of data indicated that linseed protein can be efficiently used by ruminants without affecting overall digestibility of experimental ration.

The mean crude fiber digestibility found under treatments T_0, T_1, T_2 and T_3 were 42.55, 44.24, 41.86 and 43.12 per cent respectively. Highest crude fiber digestibility was found in T_1 (44.24) and lowest in T_2 (41.86). The treatment differences were non significant which indicated that all treatment groups were at par and inclusion of linseed in kids' diet did not cause adverse effect on crude fiber digestibility. The digestibility of ether extract for various treatments was 70.80, 74.85, 76.08 and 72.61 per cent in treatment T_0, T_1, T_2 and T_3 respectively. The analysis of variance showed that the ether extract digestibility was significantly higher ($P < 0.01$) in treatment T2 (76.08) followed by T_1 (74.85) over control but both of them were at par with each other. The treatment T_0 and T_3 were at par. These results are on similar line as those of the Drouillard et al., (2002), Farren et al., (2002).

The mean digestibility of nitrogen free extract was 83.67, 83.85, 80.04, and 85.18 per cent, in treatment groups T_0, T_1, T_2 and T_3, respectively. The differences were statistically non-significant but numerically higher digestibility was found in T_3 (85.18) followed by T_1, T_0 and T_2 (83.95, 83.67 and 80.04 %) respectively, it may be because of higher oil content. The perusal of data indicates that there was no specific trend in NFE digestibility. The findings of present study envisage that digestibility of various nutrient under different treatments supplemented with linseed were similar and comparable with control indicating no adverse effect on nutrient digestibility.

Feed utilization*:* The mean total body weight gain (Table-3)during experimental period of 90 days were 5.17, 5.47, 4.63, 4.57 kg for treatment T0, T1, T2 and T3 ,respectively in differences were non-significant. The feed intake during the experimental period 99.19, 97.88, 99.01 and 98.17 kg/kid/for 90 days period treatment i.e. T0, T1, T2 and T3, respectively the difference was non-significant with each other. It is quite clear from perusal of data that the net

energy utilization for maintenance was marginally higher intreatment T3 (1.819 M Cal/day) which was followed by T1, T2 andT0 (1.719, 1.711 and 1.514), respectively. But the difference was statistically non-significant. The energy utilization for maintenance and gain were estimated on the basis of digestibility results by using formulae given by Lofgreen and Garret (1968). Net energy for gain was 1.127, 1.126 and 1.021 M Cal/day in T1, T2 and T0, respectively (NE.g). It was observed that the experimental treatments were at par with each other but differs significantly with control (T0). It was indicated that maximum energy was diverted from gain purpose in T3 (1.209 M Cal/day) followed by T1 (1.127 M Cal/day), T2 (1.126 M Cal/day) and control T0 (1.021 M Cal/day). All treatments were differed significantly, even though treatment T1 and T2 were found at par with each other. It was therefore concluded that kids fed linseed was utilized to the fullest extent in order to extract the maximum energy from linseed. It indicated that energy availability was more in treatment groups, however, it did not reflect significantly in contexts

with gain in body weight. It may be because of part of energy might have been utilized to catabolise glycoside content of linseed, which noticed in increased level of linseed.

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