



E-ISSN: 2320-7078

P-ISSN: 2349-6800

www.entomoljournal.com

JEZS 2021; 9(1): 1682-1686

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Received: 01-10-2020

Accepted: 03-12-2020

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Effect of feeding *Tinospora cordifolia* and *Mentha arvensis* on growth and nutrient utilization in crossbred calves

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Abstract

Twenty crossbred calves were divided into 4 groups to study the effect of feeding *Tinospora cordifolia* and *Mentha arvensis* on growth and nutrient utilization for 90 days. Group I was taken as control while Group II was provided with *Tinospora cordifolia* @ 4% of concentrate mixture, group III with *Mentha arvensis* @ 4% of concentrate mixture and group IV with both *Tinospora cordifolia* and *Mentha arvensis* @ 2% of concentrate mixture each. The dry matter intake, dry matter intake/W^{0.75}, TDN intake/W^{0.75} and DCP intake/W^{0.75} in group III was significantly ($P < 0.05$) higher than group I. The digestibility coefficient of nutrients like dry matter, organic matter, crude protein, ether extract, nitrogen free extract, crude fibre, neutral detergent fibre and acid detergent fibre were not significantly different among the groups. Body weight gain was significantly high in group IV. *Tinospora cordifolia* and *Mentha arvensis* can be fed to crossbred calves.

Keywords: crossbred calves, growth, *Mentha arvensis*, nutrient utilization, *Tinospora cordifolia*

1. Introduction

India is a country where livestock plays a vital role in Indian economy. Calf mortality and diseases of the new born are the two main causes of economic losses in livestock production. Calves are sensitive to stress and environment, so they need proper care and management. The antibiotic ban and increased awareness about bacterial resistance has triggered a need for natural and safe feed additives to achieve better production results of farm animals. In order to limit the spread and development of antibiotic resistant micro flora, several European countries have banned the use of antibiotics as feed additive and we also need to use safe and potent feed additives instead of antibiotics. Herbs are more compatible with body because of their normal nature and having medicine homologues components together and usually lack unwanted side effects; therefore they are most suitable, especially in cases of long consumption as well as in chronic disease. *Tinospora cordifolia* is a climbing shrub commonly known as Giloy or Guduchi belonging to family Menispermaceae. It is widely used as an ancient veterinary medicine/ayurvedic system of medicine for its general antiulcer, antidiabetic, anticancer, anti-inflammatory, anti-allergic, antioxidant, anti-infective, hepato-protective properties ^[1]. It stimulates immunity, reticuloendothelial system, bone marrow cellularity, proliferation of stem cells and enhances the haemopoietic growth factor and IL-3. Giloy enhances glutathione stimulating hormone ^[2]. *Mentha arvensis* is a species of plant in the mint family Lamiaceae. The plant is highly effective in treating headaches, rhinitis, cough, sore throat, colic, and vomiting. Medicinal uses of *Mentha arvensis* are anaesthetic, anti-inflammatory ^[3], antiseptic, antioxidant antispasmodic, antimicrobial activity, aromatic, cancer, carminative, diaphoretic, emmenagogue, febrifuge, galactofuge, salve and stomachic. It has been seen that *Mentha arvensis* oil is being extracted now a days and the leftover part is destroyed but even after extraction some amount of oil still remains in the plant. *Mentha arvensis* contains menthol (77.5-89.3%) as main constituent, followed by menthone (0.3-7.9%) and isomenthone (3.7-6.1%) ^[4]. Realizing the importance of *Tinospora cordifolia* and *Mentha arvensis* in providing medicinal uses to the animals, an attempt was made to find out the effect of supplementation of *Tinospora cordifolia* and *Mentha arvensis* on growth and nutrient utilization in crossbred calves.

2. Materials and Methods

Twenty crossbred calves were selected from the herd of Instructional Dairy Farm, Nagla, Govind Ballabh Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, India and divided into 4 groups of 5 each based on similar body weight. The feeding trial continued for 90 days. The crossbred calves of group I were fed with concentrate mixture @ 1kg each and mixed green fodder (containing green oats, green berseem and green mustard approximately in 1:1:1 ratio) along with wheat straw. Mixed green fodder and wheat straw were mixed in 10:1 ratio on fresh basis. The calves in group II were fed concentrate mixture @ 1 kg plus *Tinospora cordifolia* @ 4% of supplemented concentrate, group III concentrate mixture @ 1 kg and *Mentha arvensis* @ 4% of supplemented concentrate and group IV concentrate mixture @ 1 kg plus *Tinospora cordifolia* @ 2% and *Mentha arvensis* @ 2%. *Tinospora cordifolia* was collected from the MRDC, Pantnagar. Its stem was cut into smaller pieces and dried in the shade until it became totally dried. Then it was powdered in the Willey machine of 2 mm sieve. Steamed oil extracted *Mentha arvensis* was collected from Central Institute of Medicinal and Aromatic Plants (CIMAP), Pantnagar. It was dried in shade until it became totally dried. Then it was powdered in the Willey machine of 2 mm sieve. All the animals were housed in a well ventilated shed having concrete floor with individual feeding arrangement. The animals were let loose in enclosure between 8.00 AM to 9 AM daily to have exercise and access to fresh drinking water. Water was offered again at 4.00 PM. The byre was washed and cleaned daily. All the animals were cleaned regularly by splashing with water and then groomed. Proper hygienic conditions and healthy surroundings were maintained in shed throughout experimental period. In the last of feeding trial, digestion trial was conducted during which samples of feeds, residue and faecal were collected and analysed for proximate principles^[5] and cell wall components^[6]. Body weight was measured fortnightly upto 90 days. Data was analysed by using one way ANOVA and two way ANOVA test to find out the significance of difference between the treatment group in accordance with^[7] using SPSS 16.0 version software.

3. Results and Discussion

The chemical composition of feeds has been given in Table 1. The total mixed ration with 39% dry matter which was offered to crossbred calves in all the groups had 90.8% organic matter, 15.24% crude protein, 3.01% ether extract, 19.75% crude fibre, 52.80% nitrogen free extract, 9.2% total ash, 72.55% total carbohydrates, 37.75% neutral detergent fibre and 27.5% acid detergent fibre on dry matter basis. There was considerable variation in dry matter of mixed green fodder ranging from 22 to 28% with an average of 25.018% during the experimental period. It contained, 92.4% organic matter, 13.51% crude protein, 2.61% ether extract, 25.5% crude fibre, 50.78% nitrogen free extract, 7.6% total ash, 76.28% total carbohydrates, 44.2% neutral detergent fibre and 30.75% acid detergent fibre on dry matter basis. Mixed green fodder contained green oats, green berseem and green mustard approximately in 1:1:1 ratio. The chemical composition of concentrate mixture with 89.5% dry matter offered to the animals during the experimental period had 90.75% organic matter, 20.86% crude protein, 3.65% ether extract, 10.5% crude fibre, 55.74% nitrogen free extract, 9.25% total ash, 66.24% total carbohydrates, 26.5% neutral detergent fibre and 17.75% percent acid detergent fibre on dry matter basis. *Tinospora cordifolia* with dry matter 66.4% had 92.15% organic matter, 7.5% crude protein, 6.89% ether extract, 57.1% crude fibre, 20.66% nitrogen free extract, 7.85%, 77.76% total carbohydrates, 59% neutral detergent fibre and 55% acid detergent fibre on dry matter basis while *Mentha arvensis* with dry matter 86.7% had 89.7% organic matter, 18.56% crude protein, 3.4% ether extract, 10.5% crude fibre, 57.24% nitrogen free extract, 10.3% total ash, 67.74% total carbohydrates, 40.6% neutral detergent fibre and 22.6% acid detergent fibre on dry matter basis respectively. The wheat straw with dry matter 90.48% fed to calves of all the groups had crude protein 2.7%, ether extract 1.2%, crude fibre 41.6%, nitrogen-free extract 47.8%, ash 6.7%, organic matter 93.3%, total carbohydrates 89.4%, neutral detergent fibre 78.5%, acid detergent fibre 50.2% respectively, on dry matter basis. Similar results regarding chemical composition of *Tinospora cordifolia* has been reported by Tiwari^[8].

Table 1: Chemical composition of feeding stuffs (on% Dry matter basis) fed to experimental crossbred calves during experimental feeding period.

Feeding stuff	DM	CP	EE	CF	NFE	ASH	OM	NDF	ADF	Total CHO
Mixed green fodder	25.01	13.51	2.61	25.5	50.78	7.6	92.4	44.2	30.75	76.28
Wheat straw	90.48	2.7	1.2	41.6	47.8	6.7	93.3	78.5	50.2	89.4
Concentrate	89.5	20.86	3.65	10.5	55.74	9.25	90.75	26.5	17.75	66.24
<i>Tinospora cordifolia</i>	66.4	7.5	6.89	57.1	20.66	7.85	92.15	59	55	77.76
<i>Mentha arvensis</i>	86.7	18.56	3.4	10.5	57.24	10.3	89.7	40.6	22.6	67.74
Total mixed ration	39	15.24	3.01	19.75	52.8	9.2	90.8	37.75	27.5	72.55

The plane of nutrition of animals has been given in Table 2. The supplementation of *Mentha arvensis* in group III resulted in significantly ($P < 0.05$) higher dry matter intake, dry matter intake/ $W^{0.75}$, TDN intake/ $W^{0.75}$ and DCP intake/ $W^{0.75}$. Sunetha^[9] and Rathore^[10] also reported significantly higher dry matter intake per kg metabolic body size in goats supplemented with *Mentha arvensis* compared to control group. Wawrzyńczyk^[11] also reported a tendency of higher

intake of concentrates containing herbs as well as forages in calves. Menthol in the leaves of mint is appetite and digestion stimulant^[12]. The possible reason for higher dry matter intake in herb supplemented feed may be due to the impact of feed supplement in physiological activity i.e. increased appetite, enzyme secretion etc. As a result digestion is accelerated and there is shortening of time of feed passage through the digestive tract further stimulating the intake^[13].

Table 2: Plane of nutrition of crossbred calves during digestion trial.

Particulars	Groups				SEm±
	I	II	III	IV	
Average Body wt (Kg)	111.4±14	113.8±10.9	112.4±11.59	115±10.13	11.74
Average metabolic body size (Kg)	34.09±3.19	34.72±2.49	34.37±2.71	35.01±2.32	2.70
DMI(Kg)*	3.87 ^Y ±0.67	4.01 ^{XY} ±0.46	4.39 ^X ±0.49	4.1 ^{XY} ±0.52	0.54
DMI/W ^{0.75} Kg(g)*	110.27 ^Y ±9.06	114.19 ^{XY} ±5.44	126.36 ^X ±4.83	117.87 ^{XY} ±7.35	6.87
TDNI/ W ^{0.75} Kg(g)*	68.85 ^Y ±6.37	72.68 ^{XY} ±3.51	79.47 ^X ±2.62	75.98 ^{XY} ±5.19	4.85
DCPI/ W ^{0.75} Kg(g)*	11.73 ^Y ±1.05	12.43 ^{XY} ±0.60	13.96 ^X ±0.44	13.03 ^{XY} ±0.85	0.51

The values bearing the different superscripts(^{X,Y,XY}) in a row differ significantly from each other, $P < 0.05$.

The digestibility of nutrients was found to be similar in all the groups as indicated in Table 3. The digestibilities of dry matter, organic matter, crude protein, ether extract, nitrogen-free extract, crude fibre, neutral detergent fibre and acid detergent fibre among all the groups were not significantly different but the digestibility coefficient in group III was slightly lower than other supplemented groups. These results may be due to decreased ruminal microbial activity involved in nutrient digestibilities, which may be explained by potent antimicrobial activity of *Mentha piperita* [14, 15, 16]. *Mentha piperita* has menthol, an essential oil mainly responsible for antimicrobial function and reduced digestibility [17]. Hosoda

[18] reported that feeding of *Mentha piperita* @ 5% per diet in cows results in significantly lower ($P < 0.05$) digestibilities of all nutrients, i.e., DM, OM, CP, NDF and ADF except for that of EE in the treatment group fed with *Mentha piperita* than those in the control group. Ando [19] reported that when peppermint (*Mentha piperita*) was fed to the steers, the digestibility of nutrients tended to be higher than that of the control. Rathore [10] reported that the digestibility of DM and OM were highly significant ($P < 0.01$), CP and EE were significantly ($P < 0.05$) different but no influence on digestibility of CF, NFE, NDF, ADF and hemicellulose on feeding of *Mentha arvensis*.

Table 3: Digestibility coefficients (%) of nutrients in crossbred calves during digestion trial.

Nutrients	Groups				SEm±
	I	II	III	IV	
Dry matter	65.20±0.61	66.49±0.39	65.76±0.40	67.27±0.48	0.81
Organic matter	65.20±0.66	66.67±0.43	66.02±0.51	67.33±0.41	0.84
Crude protein	68.87±0.82	70.56±0.62	69.37±0.44	71.37±0.42	0.49
Ether extract	72.10±1.41	75.83±0.62	75.41±0.47	74.61±1.49	1.04
Nitrogen-free extract	70.98±0.80	71.88±0.54	71.35±0.67	72.90±0.45	0.90
Crude fibre	45.91±0.93	48.33±0.53	47.39±0.81	48.49±1.05	1.46
Neutral detergent fibre	52.27±0.93	53.98±0.60	53.07±0.51	55.06±0.61	0.98
Acid detergent fibre	43.93±1.12	45.94±0.53	44.71±0.65	46.94±0.81	1.38

The present results of no significant change of nutrient digestibility were consistent with the previous findings of Castillejos [20], Hosoda [21] and Wanapat [22, 23] which reported that nutrient digestibility did not change when animals were supplemented with plant herbs. According to Busquet [24], true digestibility of DM, OM, aNDF and ADF were not affected by garlic oil supplementation. In addition, the work of Yang [25] showed that feeding garlic oil to dairy cattle could increase ruminal DM and OM digestibility and Kongmun [26] showed that garlic powder supplementation at 16 mg/d did affect *in vitro* true digestibility.

The body weight gain was also noted during feeding trial and has been depicted in Table 4. Average total body weight gain and average body weight gain per day in group IV was significantly higher than group I and III but not significantly different from group II. Patel [27] reported similar findings in murrah buffalo calves which were supplemented with combination of *Emblica officinalis* and *Tinospora cordifolia*; there was a significant difference in the overall body weight gain of treatment group over control group. Gautam [28] also reported that the herbs used in the self-made rumenotonic drugs (*Tinospora cordifolia* is one of the constituent) not only improve the appetite and digestion process but also stimulate

growth parameters. Rathore [10] reported significantly higher weight gain as well as weight gain per day in *Mentha arvensis* supplemented group of goats in comparison to the control group. This indicated positive effect of the *Mentha arvensis* as feed additive on body weight. Increase in body weight in *Tinospora cordifolia* supplemented group may be due to its ability to reduce the loss of lipids secondary to its hypoglycaemic effect [29]. As the results reveal there was a significant increase in final body weight and body weight gain per day in group IV. This may be due to the cumulative effect of both the herbs i.e. *Tinospora cordifolia* and *Mentha arvensis* which had probably increased the body weight in this group followed by group II which was supplement by *Tinospora cordifolia* and then group III fed with *Mentha arvensis*. All the herbal treated groups gained more body weight than control group due to positive nitrogen balance and anabolic effect due to intake of herbal plants [26]. Higher average body weight gain in herb supplemented group could be possible due to higher DCP and TDN intake and nutrient digestibility particularly of DM, OM and CP with improvement in efficiency of utilization of absorbed nitrogen on account of supplementation of herb.

Table 4: Average body weight gain in growing crossbred calves during experimental feeding period of 90 days

Particulars	Groups				SEm±
	I	II	III	IV	
Average initial body wt(Kg)	70.2±9.78	71.0±8.30	70.8±8.69	70.0±7.27	8.56
Average final body wt(Kg)	113.2 ^Y ±14.14	116 ^{XY} ±11.00	114.4 ^Y ±11.71	117.2 ^X ±10.29	11.88
Average total body wt gain(Kg)	43 ^Y ±4.40	45 ^{XY} ±4.46	43.6 ^Y ±3.32	47.2 ^X ±3.21	3.89
Average body wt gain(g/day)	477.7 ^Y ±4.89	500 ^{XY} ±4.95	484.4 ^Y ±3.69	524.4 ^X ±3.57	4.32

The values bearing the different superscripts(^{X,Y,XY}) in a row differ significantly from each other, $P < 0.05$.

4. Conclusion

Tinospora cordifolia and *Mentha arvensis* can be fed to crossbred calves for improving growth performance.

5. Acknowledgement

We gratefully acknowledge Govind Ballabh Pant University of Agriculture and Technology, Pantnagar for providing all the required facilities.

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