

Original Research Article

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Energy Partitioning and Performance of Male Buffalo Calves Fed Ajwain Seed (*Trachyspermum ammi*) as Feed Additive

Kundan Kumar*, V. B. Chaturvedi, Vipin and Pramod Kumar Soni

Animal Nutrition, Division of Animal Nutrition, ICAR-Indian Veterinary Research Institute, Izatnagar, U.P., India-243122, India

*Corresponding author

ABSTRACT

The present experiment was aimed to study the effect of ajwain seeds (*Trachyspermum ammi*) as feed additive on energy partitioning and performance in male buffaloes. 15 animals were divided and assigned to three treatments viz., T1 (control) animals were fed basal diet without additive, T2 and T3 were fed basal diet with ajwain @ 1 and 2% DMI. The basal diet consisting of wheat straw and concentrate mixture in 50:50 ratio. The intake of gross energy (GE, MJ/d), digestible energy (DE, MJ/d), metabolizable energy (ME, MJ/d), as well as energy losses in the form of faeces, urine, methane, heat production (HP), and net energy (NE) were measured. Faecal output was measured in apparent digestibility trial. Heat and methane production were measured in an open circuit respiration chamber. The intake of GE, DE, and ME of the animals receiving ajwain @ 1 and 2% DMI showed no differences ($P>0.05$) from the control. The methane emission in terms of l/d and l/kg DMI were comparable in all the groups, whereas, in terms of l/kg DDMI it was reduced by 18% ($P=0.029$) in T₃ as compared to T₁. It can be concluded that dietary supplementation of ajwain did not have any significant impact on energy metabolism in buffaloes.

Keywords

Ajwain,
Additives,
Buffaloes,
Respiration, Rumen

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Introduction

The long drawn interest of researchers towards energy partitioning process consists of evaluating the amount of energy ingested by the animal and quantifying the loss of this energy during metabolism. Research has shown that for ruminants between 6 and 12% of gross energy (GE) intake is lost in the form of methane. Livestock forms a major anthropogenic source of CH₄ emission from

the agriculture sector. Globally, livestock accounts for ~37% of anthropogenic CH₄ which is largely produced by enteric fermentation in ruminants as part of their normal digestive processes (FAO, 2006).

Need for safe and sustainable strategies for efficient utilization of feed in ruminants has brought to front use of plant extracts rich in phytochemicals as natural feed additives to modify the rumen fermentation and to

decrease various losses. These inhibition properties of different PSM against a particular group of microbes can be exploited to reduce undesirable microbes in the rumen. The ajwain seed used in the present study contain 2-4% brown oil having active factor thymol (50%) with germicidal, carminative and laxative property. Several *in vitro* studies have suggested that the effect of thymol (active principle of ajwain) is diet and pH dependent (Castillejos *et al.*, 2006). Ajwain seeds are otherwise very popular in human kitchen as it is one of the major spices of Indian culinary. Thus, a study is proposed to assess the effect of adding *T. ammi* seeds as feed additive to describe the energy partitioning in male buffaloes.

Materials and Methods

The experiments were conducted in the sheds of Animal Nutrition Division, Indian Veterinary Research Institute, Izatnagar. The animal experimental protocol was approved by the Institutional Animal Ethics Committee (IAEC) and carried out as per the guidelines of Committee for the Purpose of Control and Supervision of Experiments in Animals (CPCSEA), Ministry of Environment, Forests and Climate Change, Government of India.

Experimental protocol

To study the effect of feed additive on animal performance, fifteen growing male buffaloes (*Bubalus bubalis*) of average body weight of 260 Kg were used. Prior to initiation of the experimental trial, animals were treated for ecto and endo-parasites as per the standard protocol. All the animals were fed as per ICAR (2013). Roughage and concentrate mixture were offered in 50:50 ratio. The composition of concentrate mixture was maize 28%, solvent extracted soybean meal 10%, wheat bran 59%, mineral mixture 2% and salt 1%. To meet the vitamin requirement,

5 kg chopped green maize per animal was provided twice in a week. The animals were divided into three groups of five animals each and were assigned to three treatments viz., T1 (control) animals were fed basal diet without additive, T2 and T3 were fed basal diet with ajwain @ 1 and 2% DMI. The animals had access to clean drinking water throughout the experiment

Metabolism trial

A metabolism trial of 8 days duration including, 2 days adaptation in metabolic cages followed by 6 days collection was conducted after 30 days of experimental feeding to evaluate the effect of feeding ajwain as feed additive on nutrient utilization. Feed offered, residue, feces and urine were collected individually daily. After measuring the total amount, representative samples of residual feed, feces and urine were preserved for analysis.

Chemical analyses

The samples of feed offered, residual feed and faeces were analyzed for dry matter, ash, organic matter (OM), crude protein (CP) (N \times 6.25), and ether extract (EE) as per AOAC (1995). Neutral detergent fibre (NDF; estimated without amylase and sodium sulphite and expressed inclusive of the ash content), acid detergent fibre (ADF; also inclusive of ash content) were analyzed as per Van Soest *et al.*, (1991). Nitrogen balance was calculated by estimating nitrogen in feed offered, residual feed, faeces and urine.

Methane estimation

Methane emissions were estimated by shifting the animals in open circuit respiration chamber. After two days of acclimatization, methane emissions were recorded for two consecutive days.

The chamber was maintained at 25°C and 65% relative humidity with air flow rate of about 250 L/min. Methane was measured in air going in and coming out of the chamber through an infrared gas analyzer (Model 300, Analytical Development Co. Ltd., Hoddesdon, England).

Calculations

Energy partitioning was determined by subtracting the energy losses in the faeces, urine, methane, and the daily heat production from the GE intake. The DE was determined by subtracting energy losses in form of feces from GE. The ME was determined by subtracting energy losses in form of methane and urine from DE. The daily heat production of the animals was determined using the equation proposed by Brouwer (1965)

$$\text{HP (kJ)} = 16.18 \text{ O}_2 + 5.02 \text{ CO}_2 - 2.17 \text{ CH}_4 - 5.99 \text{ N}$$

Where O_2 is the volume of consumed O_2 (L/d), CO_2 is the volume of produced CO_2 (L/d), CH_4 is the volume of produced CH_4 (L/d), and N the amount of nitrogen excreted in the urine (g/d). net energy (NE) was obtained by subtracting HP from MEI

Statistical analysis

The statistical analyses were performed as per standard methods by using SPSS computer package. The means were compared using Tukey's test if the main effect was significant ($P < 0.05$) as per SPSS 16.0

Results and Discussion

The chemical composition of the concentrate mixture, wheat straw and ajwain seeds used for the feeding of the buffalo calves is given in Table 1. The concentrate mixture, wheat straw and ajwain contained 15.80, 2.53 and

14.9% CP, respectively. The faecal energy, urinary energy and methane energy losses were not affected due to feeding of any additives Table 2. There was no difference in the GE intake, faecal and urinary loss and digestible, metabolizable and net energy among the groups. There was non-significant difference in methane loss as % of GE and net energy retention, T2 and T3 groups, respectively. The net energy retention in T1, T2 and T3 groups indicated no influence of ajwain on the energy balance. Similar results were reported by Samal *et al.*, (2016) that faecal energy, urinary energy and methane energy losses were not affected ($P > 0.05$) due to feeding of harad, ajwain, soapnut and garlic to buffaloes. Neeti (2017) also reported similar results with no effect of feeding a mixture of seven herbal additives on the energy balance of buffalo calves. In the present study, the losses in the form of methane were similar in all the groups. In contrast, Patra *et al.*, (2010) observed about 24% reduction in methane production (l/kg DDMI) in sheep fed on the diet supplemented with harad, whereas, this reduction was 23.6% in the sheep fed on diet supplemented with the mixture of harad and garlic resulting in decrease in methane energy loss as per cent of digestible energy intake by 20 % in harad fed group and 24.8% in mix fed sheep. Yuan *et al.*, (2007) reported that the addition of tea saponin @ 5 g/ kg DM and tea saponin plus disodium fumarate @ 20 g/kg DM resulted in decreased methane emissions by 8.5 and 9.6%, respectively in sheep. *Lotus pedunculatus* having condensed tannins, when fed to lamb, showed 16% reduction in methane production (Waghorn *et al.*, 2003). Samal (2016) also reported faecal energy, urinary energy and methane energy loss were not affected by feeding feed additives containing PSM in male buffalo calves. The performance indices like feed intake and digestibility of nutrients were similar in the animals of all the three groups Table 3.

Table.1 Chemical Composition (% DM) of wheat straw and concentrate mixture and ajwain fed to male buffaloes

Attributes	Concentrate	Wheat straw	Ajwain
Organic matter	91.3	92.4	87.25
Crude protein	15.8	2.53	14.9
Ether extract	3.43	1.24	2.65
Neutral detergent fibre	40.37	84.45	32.2
Acid detergent fibre	9.54	44.15	28.5
Ash	8.7	7.56	12.75

Table.2 Effect of feeding Ajwain on energy utilization of buffalo calves

Attributes	T1	T2	T3	SEM	P value
GE Intake (Mcal/d)	20.32±0.24	19.66±0.46	20.6±0.21	0.2	0.149
FE loss (Mcal/d)	6.47±0.22	5.93±0.81	6.56±0.55	0.32	0.717
DE (Mcal/d)	13.85±0.26	13.73±0.72	14.04±0.4	0.27	0.904
UE loss (Mcal/d)	1.81±0.11	1.82±0.12	1.64±0.11	0.06	0.454
Methane loss (Mcal/d)	1.34±0.04	1.27±0.05	1.2±0.05	0.03	0.166
Methane loss as % of GEI	6.6±0.2	6.44±0.26	5.85±0.23	0.15	0.086
ME (Mcal/d)	10.69±0.36	10.64±0.82	11.2±0.49	0.32	0.768
ME as % of GE	52.62±1.59	54.21±4.05	54.45±2.83	1.62	0.896
HP (Mcal/d)	8.63±0.27	8.56±0.5	8.25±0.33	0.20	0.762
NE (Mcal/d)	2.01±0.46	2.35±0.51	2.48±0.33	0.24	0.745

Table.3 Effect of ajwain feeding on growth performance in male buffaloes

Attributes	T ₁	T ₂	T ₃	SEM	P value
<i>Intake, body weight change and FCR</i>					
Initial BW (kg)	257.9	259.2	265.0	8.53	0.945
Final BW (kg)	270.9	272.3	279.4	8.30	0.917
Body weight gain (g/day)	433.3	436.6	479.9	17.44	0.510
Concentrate (kg/d)	3.09	3.05	3.11	0.01	0.273
WS (kg/d)	2.55	2.68	2.53	0.03	0.106
TDMI (kg)	5.64	5.73	5.64	0.03	0.372
FCR	13.17	12.76	11.39	0.55	0.410

Statistically the body weight was also similar in all the three groups, however, there was 10.75% more weight gain in the animals of T3 where ajwain was fed @ of 2 of DMI resulting 13.51% improvement in FCR of T3 group. Non significant improvement in the performance of the animals of T3 group might be due to less number of animals in each group so the differences among the groups could not reach up to the significance level. Similar findings were also reported by Kumar *et al.*, (2011), Pawar (2012), Vakili *et al.*, (2013) with no effect on DMI, ADG and FCR after dietary supplementation of plant parts or their byproduct as additive in buffaloes. Santosa *et al.*, (2015) reported no change in daily weight gain in dairy calves by feeding essential oils supplemented diet.

The above discussion indicating myriad of response by the animals to the feeding of EOs. which may find their explanation in factors like type, dose, combinations of EOs and also the breed and physiological stage of the animal. However, with the results of the present study it can be concluded that the feeding ajwain seeds, @ 1 and 2% DMI respectively, did not have a significant effect on the net energy for weight gain in buffaloes.

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