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Effect of Garlic *(Allium sativum)* Supplementation on Nutrient Utilization, Gastrointestinal Parasites and Haemato-biochemical Profile of Crossbred Calves

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ABSTRACT

Background: With the ban on the use of antibiotics as feed additives and growth promoters in animal nutrition, livestock scientists are now shifting their attention towards natural and safe products like organic acids, probiotics, prebiotics and herbal growth promoters. Plants containing essential compounds can be a cost-effective means of improving efficiency of nutrient utilization and growth performance of animals. Garlic (*Allium sativum* L.) belongs to the family *Liliaceae*, which is a genus of 500 species. The medicinal properties of garlic may have beneficial effects on nutrient utilization and health of animals. However, very few studies have been reported whereby garlic has been fed to ruminants. Therefore, the present study was design to investigate the effect of garlic supplementation on nutrient utilization, gastro intestinal parasites and haemato-biochemical profile in crossbred calves.

Methods: Twelve crossbred male calves of similar age (3-6 months) were randomly allotted to two equal groups ((n=6) on basis of body weight. All animals were maintained on common feeding regime consisting of required concentrate mixture and roughage as per requirement given by ICAR (2013). Calves in experimental group were supplemented with garlic (*Allium sativum)* @ 250 mg per kg body weight whereas; the control group was remaining unsupplemented. The study was conducted for 90 days. After 60 days of experimental feeding a digestion trial of seven days was conducted to access the nutrient utilization of animals. The faecal sample of each animal was collected fortnightly for parasitological examination of helminthes eggs. Blood samples were collected from each animal at 0 and 90 days of feeding trial to assess the haemato biochemical profile of crossbred calves.

Result: The results indicated that the intake and digestibility of DM, OM, CP, EE, ADF and NDF were statistically (P>0.05) similar in both the groups. The haemato-biochemical parameters like Hb, PCV, RBC, WBC, glucose, TP, albumin, globulin and A:G ratio were statistically (P>0.05) comparable among both the groups at 0 and 90 days of study. Similarly, the fortnightly faecal egg per gram (EPG) was also statically (P>0.05) similar in both the groups. From the results it can be deduced that the garlic (*Allium sativum)* supplementation has no any effect on feed intake and digestibility of DM, OM, CP, EE, ADF, NDF and CP but significantly increases in digestibility of CF. Garlic powder supplementation did not have any appreciable effect on haemato-biochemical profile and faecal egg per gram (EPG) in crossbred calves.

Key words: Crossbred calves, Egg per gram, Garlic, Nutrient digestibility.

INTRODUCTION

Feed additives are important materials that can improve the efficiency of feed utilization and animal performance. Modern animal production requires the use of safe and effective additives to stimulate feed consumption and destroy harmful microorganisms of the diet in addition to be used as rumen manipulators to increase animal productivity (Karnani *et al.,* 2021). In recent years, studies have been published on the use of natural food additives in animal diets. Many secondary products or plant extracts have been used, such as essential oils, in feeding animals to improve their growth, production and immune responses (Thakare, 2004; Westendarp, 2005; Chandra *et al*., 2017). It has been observed that there is an antibacterial or antifungal effect in the rumen when using such additives and this improves the utilization of the diet (Wallace, 2004). The use of such additives has increased after the prohibition of antibiotic usage as growth promoters in the feeding of animals (Saleem *et al.,* 2019). These additives may contribute a direct influence on some blood parameters including blood glucose levels as recorded by Bartimaeus and Rebeccae (2003) and Mohammed *et al.* (2004). Garlic has several beneficial effects on humans and animals having antimicrobial, antioxidant, anticancer, immunomodulatory, hypoglycemic, antiparasitic (Parsani

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et al., 2020), antiviral, anti-inflammatory as well as antihypertensive properties (Ankri and Mirelman, 1999; Reuter *et al.*, 1996). Garlic has been used to treat animals that suffer from gastrointestinal parasitism (Guarrera, 1999). It has benefits in lowering total plasma cholesterol, reducing blood pressure and decreasing platelet aggregation (Sterling and Eagling, 2001). These functions are mainly attributed to the bioactive components present in garlic (Amagese *et al.*, 2001), which is a sulphur containing organic compound known as diallyl polysulphide which possess antimicrobial activity (Tsao and Yin, 2001) that could be responsible for the growth promoting effects of garlic.

The all above said properties of garlic are very important and necessary to enhance the health of animals by stimulating the immune system and nutrients utilization. Earlier studies on the effect of garlic supplementation on growth performance in animals have revealed inconsistence results. Bampidis *et al.* (2005) have reported no appreciable effect on growth of lambs fed with garlic bulbs, whereas, significantly (P<0.01) improvement in the overall feed intake, body weight gain and feed conversion efficiency in garlic supplemented Murrah buffalo calves was observed (Duvvu *et al.* (2018). Keeping in view the various reports, this study was designed to assess the effect of garlic (*Allium sativum*) supplementation on nutrient utilization, gastro intestinal parasites and haemato-biochemical profile in crossbred calves.

MATERIALS AND METHODS

Location

The present study was conducted in Animal Nutrition Department and in animal's sheds of College of Veterinary Science and A.H., Mhow (Madhya Pradesh) in the year 2019. Permission for using the animals for the experiment was duly taken from Institutional Animal Ethics committee (IAEC) constituted as per CPCSEA rules laid down by Government of India.

Preparation of garlic powder

Fresh garlic was purchased from the local market and garlic powder was prepared by dying garlic under sun for 3 days and then ground to pass through a 4 mm sieve.

Animals and experimental design

Twelve male crossbred calves of approximately similar age (3-6 months) and body weight (69.77±3.59) were selected and randomly allotted into two equal groups (6 in each group) on the basis of body weight. All calves were maintained on common feeding regime consisting of required concentrate mixture, wheat straw and green as per requirement given by ICAR (2013). The calves were housed in live stock farm complex, having facilities for individual feeding and watering. The calves in group T_0 was not given any supplement (control). In addition to normal routine feeds and fodders, calves in groups T_1 was given garlic powder @ 250 mg/kg BW for 90 days. To determine the actual intake of nutrients by each calf, representative samples of concentrate and roughage were taken. Percent average composition is given in (Table 1) of feed and fodder (on DM basis) fed to experimental calves. Animals was weighed fortnightly in the morning before offering feed and water. After 60 days of preliminary period 6 days of digestion trial was adopted to access the nutrient utilization of animals. The quantity of feed offered, residue and faeces voided was recorded. Representative samples of feed, residue and faecal samples were collected, preserved and analyzed for their proximate principles (AOAC, 2005) and fibre fractions (Van Soest *et al.,* 1991). During experimental period, daily feed offered and residue leftover was recorded to determine voluntary feed intake at fortnightly intervals.

Blood was collected at 0 and 90 days of experimental trial by jugular vein puncture and serum was collected and then stored at -20°C until further analysis. Serum was analysed after thawing for various biochemical and enzymatic profile by standard protocol using commercial diagnostic kit. (Transasia Bio-medicals Ltd.)

Determination of helminthes eggs

The faecal sample of each animal was collected fortnightly for parasitological examination of helminthes eggs by McMaster method (Soulsby, 1982). The number of eggs per gram of faeces (EPG) was calculated by using the following formula:

No. of eggs per gram of faeces =

$$\frac{\text{No. of eggs in two chamber}}{0.3} \times \text{Dilution factor*}$$

$$\text{*Dilution factor} = \frac{\text{Total volume of suspension}}{\text{Total volume of faeces}}$$

Statistical analysis

Data were subjected to statistical analysis using 't' test (Snedecor and Cochran, 1994). Independent 't' test was used to compare differences between groups and period means for different parameters by using SPSS 20.0 software.

RESULTS AND DISCUSSION

Effect of garlic supplementation on intake and digestibility of nutrients in crossbred calves

Feeding garlic did not make any significant change in voluntary dry matter intake, but numerically the treatment group consumed more than the control (Table 2). In the present study, the apparent digestibility of DM, OM, CP, EE, NDF and ADF were similar (P>0.05) in both the groups but digestibility of CF was found significantly (P<0.05) higher in the treatment group in comparison to control group. Similar intake of DM and digestibility of nutrients is suggestive of no positive effects of garlic supplementation on palatability and nutrient utilization.

This is consistent with Zhong *et al.* (2019) fed garlic powder @ 50 g/kg/BW to lambs and found no any significant

changes on the dry matter intake, feed conversion ratio, as well as the apparent digestibility of lipid, however, garlic powder supplementation significantly increased the lambs' average daily gain, digestibility of dry matter and crude protein. Similar results were also reported by Ahmad *et al.* (2011), Ikyume *et al.* (2017) and Hossian *et al.* (2020) in lambs, goats and rabbits, respectively. Contrary to our results, El-Naggar and Ibrahim (2018) showed that digestibility of DM, OM, CP, EE, CF and NFE were higher (P<0.05) for lambs fed garlic powder @ 2% supplemented diets than those fed control. Contrary results were also observed that supplementation of garlic powder (1% of DMI)

Table 1: Chemical composition of feeds offered to crossbred calves (% DM basis).

Particulars	Concentrate mixture (%)	Green fodder (%)	Wheat straw (%)
Organic matter	93.15	91.3	92.2
Crude protein	20.08	5.03	3.53
Ether extract	2.52	1.45	1.33
Neutral detergent fibre	37.5	49.12	79.24
Acid detergent fibre	10.2	47.21	58.2
Crude fibre	8.12	24.04	39.02
Total ash (TA)	6.85	8.70	7.80
Calcium	0.78	0.42	0.28
Phosphorus	0.52	0.23	0.08

Table 2: Intake (kg/d), digested (g/d) and digestibility (%) of various nutrients of crossbred calves.

Attributes	T_0 (Control)	T_1 (Treatment)	p value
Body weight (kg)	81.61±3.52	82.98±1.74	0.132
MBW (kg $W^{0.75}$)	27.13±1.23	27.49±1.98	0.123
DMI (kg/d)	2.510±0.13	2.641±0.09	0.161
DOMI (kg/d)	2.321±0.12	2.442±0.08	0.164
CPI (g/d)	322.4±22.44	331.72±12.89	0.131
CPI (g/kg $W^{0.75}$)	11.82±0.46	12.06±0.28	0.082
DCPI (g/d)	197.23±14.22	219.35±6.87	0.074
DCPI (g/kg $W^{0.75}$)	7.25±0.37	7.98±0.19	0.243
TDN (g/d)	1553±79.86	1664±49.92	0.164
TDN (g/kg $W^{0.75}$)	57.27±2.39	60.48±1.09	0.341
DCP (%)	7.83±0.26	8.32±0.21	0.830
TDN (%)	61.99±2.05	63.07±1.06	0.331
Nutrient digestibility (%)			
DM	61.88±2.50	63.29±1.10	0.250
OM	65.03±2.19	66.17±1.10	0.291
CP	61.31±2.07	66.26±1.61	0.953
EE	75.07±2.50	76.03±2.83	0.624
NDF	55.10±3.07	57.92±1.23	0.092
ADF	47.73±3.89	50.82±2.12	0.090
CF	41.24±3.54	46.48±1.22	0.021*

MBW- Metabolic body weight; DMI- Dry matter intake; DOMI-Digestible organic matter intake; CPI- Crude protein intake; DCPI-digestible crude protein intake; TDN- Total digestible nutrients;EE-Ether extract; NDF- Neutral detergent fibre; CF- Crude fibre

had improved digestibility of various nutrient (Patra- Kamra *et al.,* (2011); Mirzaei *et al.* (2012).

Effect of garlic supplementation on fortnightly egg per gram (EPG) of crossbred calves

The average EPG of all the fortnights was 273±39 and 256±28 and the values were statically similar (P>0.05) and comparable between both the groups (Table 3). The faecal egg count remained the same in crossbred calves of both the groups suggesting that garlic supplementation had no influence on gastro intestinal parasites. Burke *et al.* (2009) also observed that garlic lacked control over gastro intestinal nematodes in goat and lambs. Similarly, Santos and Carvalho (2014) also reported that the supplementation of garlic extract had no any significant effect on gastrointestinal endoparasites of sheep. Conversely to our study, Hasan *et al.* (2015) reported that EPG count of gastrointestinal parasites was significantly lower in the garlic supplemented groups as compared to control. Lapinski *et al.* (2018) also reported that the supplementation of garlic reduced the number of coccidia oocysts per gram of faeces in rabbits.

Effect of garlic supplementation on haemato-biochemical profile of crossbred calves

In the present study, concentrations of Hb, PCV, Total Protein, Glucose, Albumin, Globulin, A:G, RBC and TLC were statically similar and comparable at 0 and 90 days of experimental feeding in both the groups (Table 4). It shows that the supplementation of garlic has no any adverse effect on health status of crossbred calves. The results were in agreement with the findings of Ikyume *et al.* (2017) who observed that supplementation with varying levels of garlic powder had not have any significantly (P>0.05) impact on hematological parameters like packed cell volume (PCV), hemoglobin (Hb), red blood cell (RBC) and white blood cell (WBC). However, Total protein (TP), glucose and albumin decreased significantly (P<0.05) with higher levels of garlic powder supplementation. Results are well consistent with findings of Prasad *et al.* (2009), El-Katcha *et al.* (2016) and Usur *et al.* (2019) in chickens, growing lambs and Iraqi black goats, respectively. However, contrast results were obtained by Kholif *et al.* (2012) and Dong *et al.* (2019) in goat and laying hens, respectively.

Table 3: Fortnightly egg per gram (epg) of crossbred calves.

Attributes	T_0 (Control)	T_1 (Treatment)	p value
0 day	283±97	392±79	0.441
1st fortnight	325±50	325±72	0.560
2nd fortnight	292±45	242±33	0.242
3rd fortnight	275±38	225±17	0.221
4th fortnight	250±43	225±40	0.792
5th fortnight	250±32	208±37	0.753
6th fortnight	200±52	183±31	0.192
Average	273±39	256±28	0.092
% Reduction		6.23%	

Table 4: Haemato-biochemical parameters of crossbred calves.

Attributes	T_0	T_1	p value
0 day			
Haemoglobin (g/dl)	11.62±0.37	12.04±0.28	0.972
PCV (%)	29.72±0.65	30.21±0.43	0.071
Total Protein (g/dl)	7.33±0.14	7.81±0.11	0.580
Glucose (mg/dl)	64.39±9.86	68.92±2.03	0.113
Albumin (g/dl)	4.72±0.15	4.86±0.34	0.312
Globulin (g/dl)	2.38±0.10	2.61±0.09	0.830
A:G (g/dl)	2.00±0.12	1.88±0.15	0.612
RBC (10^{12} /L)	7.68±0.45	8.40±0.74	0.114
TLC (10^9 /L)	8.16±0.38	8.86±0.47	0.304
90 day			
Haemoglobin (g/dl)	8.58±0.35	9.67±0.36	0.861
PCV (%)	34.33±0.84	34.67±0.80	1.000
Total Protein (g/dl)	7.27±0.17	7.62±0.34	0.200
Glucose (mg/dl)	64.22±1.95	70.79±2.86	0.622
Albumin (g/dl)	4.95±0.24	5.57±0.40	0.233
Globulin (g/dl)	2.42±0.07	2.57±0.08	0.993
A:G	2.05±0.10	2.16±0.12	0.761
RBC (10^{12} /L)	7.90±0.53	8.42±0.54	0.994
TLC (10^9 /L)	8.12±0.37	9.45±0.35	0.72

PCY-Packed cell volume; A:G- Albumin globulin ratio; RBC- Red blood cell; TLC- Total leucocyte count.

From the results it can be deduced that the garlic (*Allium sativum)* supplementation has no any effect on feed intake and digestibility of DM, OM, CP, EE, ADF, NDF and CP but significantly increases in digestibility of crude fibre. Garlic powder supplementation did not have any appreciable effect on haemato - biochemical profile and faecal egg per gram (EPG) in calves.

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Conflict of Interests

There is no conflict of interest.

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