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Impact of Ashwagandha (*Withania somnifera*) supplementation on the performance of Beetal kids under stall-fed conditions

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ABSTRACT

Eighteen kids of both sexes in equal number with age of 5-6 months and having average body weight of 15.29±0.33 kg were randomly distributed into three groups to evaluate the effect of Ashwagandha (*Withania somnifera*) supplementation on the performance of Beetal kids under stall-fed conditions. The kids of T_1 and T_2 group were orally supplemented with *W. somnifera* for 90 days at the dose rate of 100 and 200 mg/kg BW, respectively. The group without any supplementation was treated as control (T_0). All other management practices were similar in the three groups. The mean temperature humidity index (THI) during the study period was 77.85±0.57. The overall average daily gain (ADG) was significantly ($P<0.05$) higher in T_1 (53.70±4.75 g/day) and T_2 (59.63±7.93 g/day) over the control (35.74±4.08 g/day) group. Daily feed intake was not affected due to Ashwagandha supplementation among various treatment groups. Various blood biochemical profiles like haemoglobin, TLC, neutrophils, lymphocytes were within the normal physiological limits. The faecal OPG (oocyte per gram) showed non-significantly declining trend in T_1 and T_2 over T_0. It was concluded that Ashwagandha (*W. Somnifera*) supplementation had potential to improve the growth performance of Beetal kids under stall-fed conditions without any adverse effect on health.

Key words: ADG, Ashwagandha, Beetal-kids, Blood-profile, Oocysts, Stall-fed.

INTRODUCTION

The shrinkage of pasture land and increasing demand for goat products (Dalgado *et al.,* 1999) are shifting the goat production towards intensive or stall-fed system, characterized by zero grazing for commercial purpose (Shalander Kumar, 2007; Arguello, 2011). Under intensive farming system, maintenance of good health and optimum performance in relation to inputs are the key factors for sustainability and adaptability of goat husbandry by the farmers. Traditionally, goats were kept on extensive grazing system using ethno-veterinary knowledge for treatment of various health disorders (Harun-or-Rashid *et al.,* 2010). Improving antioxidant status and non-specific immunity are the strategies which may be tried to minimize stress to the livestock and to improve their health and performance. At present, scientists are working to improve the performance of livestock using various herbs (Bunyapraphatsara, 2007). Ashwagandha (*Withania somnifera*) is one of those plants which is being used by many researchers due to its antioxidant (Udayakumar *et al.,* 2010), antibacterial (Rizwana *et al.,* 2012), anti-inflammatory and immunomodulatory (Yamada *et al.,* 2011) and haemopoitic properties (Mishra *et al.,* 2005). There is little published data concerned with the effect of *W. somnifera* supplementation on the performance of Beetal goats under stall-fed rearing system. Therefore, the study was conducted to evaluate the efficacy of Ashwagandha (*Withania somnifera*) supplementation on the performance of Beetal kids under stall feeding rearing system.

MATERIALS AND METHODS

Locale of the study: The present experiment was conducted at Goat Research Farm of Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana located at the Latitude of 30°54' North, Longitude of 75°48' East and at the height of 246 meters above the mean sea level. Ludhiana experiences a semiarid climate with three major seasons. During the summer months, from April till June, the average high temperature ranges from 38-43 °C with low rainfall. Monsoon season that starts in July and lasts till September brings more than 700 mm of rainfall in the city. On the other hand, winter in Ludhiana remains chilly as the temperature fluctuates between 6-20 °C (Anonymus, n.d.). The study was conducted for a period of 90 days during the months of July to October, 2012.

Selection of animals and feeding regimes: A total of 18 Beetal kids (both sexes in equal number) of 5-6 months age and average body weight of 15.29 ± 0.33 kg at the beginning of study were randomly distributed into three groups on the

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basis of body weight. The animals in treatment groups T_1 and T_2 were given *W. somnifera* orally at the rate of 100, 200 mg/ kg body weight, respectively against the control group where no supplementation was offered along with feed. The required dose of *W. somnifera* powder was dissolved in small quantity of water and then was administered orally to the animal. The dried, grinded powder of ashwagandha roots was purchased from local market. The concentrate feed was offered in the morning at 9:00 am and residues of feed were recorded after one hour. Green fodder (Maize/Bajra) was offered *ad. Lib* in weighed quantity. The body weights of all the kids were recorded at monthly interval in the morning, before offering any feed and water. The rest of feeding and managerial practices were similar among all the groups throughout the study period. All procedures involving animals during the period of study were approved by the Institutional Animal Ethics Committee under the Indian Animal Welfare Act.

Environmental variables: The data on daily variations in environmental temperature, humidity, sunshine and rainfall were taken from the observatory, department of Agro Metrology, Punjab Agricultural University, Ludhiana. The daily variations in shed temperature and humidity (microclimate) were recorded twice in a day (i.e. 07:30 am and 14:30 pm) during the experiment period with the help of Thermo-hygrometer which was hanged in the middle of the shed under the covered area. THI (Temperature Humidity Index) was calculated as measure of thermal comfort as per the formula given below (Tucker *et al.,* 2008):

THI = (1.8T + 32) – [(0.55-0.0055 RH) (1.8T – 26)]

Where T is the air temperature (°C) and RH is the relative humidity (%)

Hematological attributes: Blood samples (2 mL) from individual animal were collected aseptically via jugular vein puncture in K_3EDTA coated disposable vials (Accuvet®Quantum Biologicals Pvt. Ltd). The blood sampling at monthly interval was done in the morning at 9 am from day zero to the 90th day of trial period. The whole blood, immediately after collection, was used for Haemoglobin, TLC and DLC as described by Jain (1986).

Haemoglobin (Hb; g/dL) concentration was estimated by Sahli's Acid Haematin Method using Sahli-Adam's Haemoglobinometer. Total leukocyte count (TLC; $x10^3$/ml) was determined using Neubar's counting chamber method (Benjamin, 1985) and differential leukocyte count (DLC; %) was estimated manually under oil immersion of light microscope on blood smear stained by Wright-Giemsa or Leishman stain (Jain, 1986).

Fecal parasitic load: Faecal parasitic load was calculated by using the Modified McMaster Technique (Soulsby, 2005). Three gram faeces was weighed and soaked in some quantity of saturated salt solution until they were sufficiently soft. Then 42 ml of saturated salt solution is added and poured through a fine sieve. After thorough shaking sample was withdrawn by means of a wide pipette and run into the McMaster's counting chamber, filling all the spaces. The number of oocyst within each ruled area, multiplied by 100, represented the number of oocyst per gram of the faeces of the sample.

Statistical analysis: The statistical significance of the mean differences within control and treated groups was analyzed by ANOVA, with Duncan's multiple range test (Snedecor and Cochran 1994). The software used was Statistical Package for Social Sciences (SPSS) for windows version 12.0 (SPSS, 2003). A p-value of < 0.05 was used to establish statistical significance.

RESULTS AND DISCUSSION

Environmental conditions: The animals under study were kept under loose housing system, where they were exposed to external environment of the open area. The mean air temperature, relative humidity, sunshine, rainfall and THI as per outside weather during the study period were recorded as 27.42±0.33 °C, 71.68±1.59 %, 6.97±0.35 hours, 3.29±0.88 mm and 77.85±0.57, respectively. Provision of shed or covered area during this period resulted significant lowering of mean THI inside the shed (Table 1). Though, goats can tolerate high THI, but associated with poor growth performance as well as adverse effects on physiological characteristics of the goats. Therefore, management strategies needed to improve goat production by minimizing stress in order to attain optimal animal comfort (Popoola *et al*., 2014).

Growth performance and feed intake: The initial average body weights of kids were 15.35± 0.77, 15.33± 0.39and 15.18± 0.60 kg for T_0, T_1 and T_2, respectively (Table 2). The average body weight after 90 days was 18.57± 1.04, 20.17±0.77 and 20.55±1.16 kg for the T_0, T_1 and T_2 groups, respectively. Total gain in weight (Kg) was 3.22±0.37, 4.83±0.43 and 5.37±0.71 in T_0, T_1 and T_2 groups, respectively which was lower than as reported by Deka (2009) in Jamunapari kids supplemented with Tulsi and

Table 1: The fortnightly variations in THI during the study period.

	Fortnight						
Particulars	1st	2nd	3rd	4th	5th	6th	Overall
Covered area	81.18±0.28[a]	79.88±0.48[a]	79.95±0.28[a]	75.40±0.34[a]	73.81±0.38[a]	68.63±0.38[a]	76.31±0.49[a]
Open area	83.31±0.43[b]	81.30±0.92[b]	82.22±0.34[b]	76.80±0.73[b]	75.31±0.39[b]	69.31±0.62[b]	77.85±0.57[b]

Mean values bearing different superscripts within a column differ significantly (P<0.05)

Table 2: Growth performance of kids during the study period.

Particulars	Control	T_1 group	T_2 group
Average Initial body weight (kg)	15.35± 0.77	15.33± 0.39	15.18± 0.60
Average Final body weight (kg)	18.57± 1.04	20.17±0.77	20.55±1.16
Total body weight gain (kg)	3.22±0.37	4.83±0.43	5.37±0.71
Average Daily Gain or ADG (g/day) during 1- 30 day	34.44±6.13	41.11±5.75	36.67±7.74
Average Daily Gain or ADG (g/day) during 31- 60 day	32.78±5.26	55.56±10.84	61.67±13.13
Average Daily Gain or ADG (g/day) during 61- 90 day	40.00±3.65[a]	64.44±7.63[b]	80.56±8.14[b]
Average Daily Gain or ADG (g/day) during 1-90 day	35.74±4.08[a]	53.70±4.75[b]	59.63±7.93[b]
Dry Matter Intake from concentrates (g/day/animal)	284.00± 5.67	284.00± 5.67	284.00± 5.67
Dry Matter Intake from fodder (g/day/animal)	430.60± 20.60	444.84± 19.84	421.35± 11.77
Total Dry Matter Intake (g/day/animal)	714.61± 25.42	728.84± 24.95	705.35±25.88

Mean values bearing different superscripts within a row differ significantly ($P<0.05$)

Ashwagandha dried powder (11.5 kg in treatment group against 7.37 kg in control). The difference in average total body weight gain during period of 90 days was non-significant among the groups. The ADG (g/day) during the study period of 90 days was highest in T_2 group (59.63±7.93), followed by T_1 (53.70±4.75) over the control (35.74±4.08). The overall ADG in treatment groups was significantly ($P<0.05$) higher than the control. In the first and second month of study, variations in ADG among the groups were statistically non significant. With the progress of experiment in the third month, the ADG was reported highest in T_2 (80.56±8.14) followed by T_1 (64.44±7.63), which was significantly higher over the control (40.00±3.65). That might be due to feeding of *W. somnifera* which enabled the animals to fight against stress and improved the growth performance. Our findings were in line with the findings of Joshi *et al*., (2015) in broiler birds. Similarly, Deka (2009) recorded ADG of 127 g/day in weaned Jamunapari kids supplemented with Tulsi and Ashwagandha dried powder against 81.9 g/day in control group. In contrast, dietary addition of *W. somnifera* (Thange *et al*., 2009) at various doses did not have any effect on body weights in broilers. The total DMI (g/day/animal) was highest in T_1 group followed by T_0 and T_2 group. The variations among groups for DMI was non-significant, which indicated that feeding *W. somnifera* caused no adverse effect on feed intake of the animals. Similar non-significant ($P>0.05$) differences in overall feed intake (g/broiler bird) with supplementation of *W. somnifera* was reported by researchers (Shisodiya *et al*., 2008; Thange *et al*., 2009 and Joshi *et al*., 2015). However, Biswas *et al*., (2012), Mushtaq *et al.,* (2012) and Srivastava *et al.,* (2013) reported significantly ($P<0.05$) improved feed intake and body weight gain in broilers fed *Withania somnifera* root powder.

Hematological Parameters: The blood biochemical profile of the kids were reported within the normal physiological limits, indicating that feeding of *Withania somnifera* at the dose rate of 100, 200 mg/ kg body weight, respectively against the control group produced no adverse effect on the health (Table 3). *Withania somnifera* supplementation resulted in improved mean blood hemoglobin (g/L) concentration in T_1 and T_2 over T_0 group. Similar results of rise in blood hemoglobin in broiler chicks due to supplementation of *W. somnifera* were reported by Mushtaq *et al.,* (2012). In another experiment, Ziauddin *et al.,* (1996) found a significant increase in haemoglobin concentration in mice given extract of *W. somnifera*. Mean blood hemoglobin (g/L) was significantly ($P<0.05$) higher in T_1 (93.67±3.16) and T_2 (93.67±2.39) over T_0 (81.67±2.27) at 90th day of study. The overall variations in blood hemoglobin, TLC ($X10^9$/L), neutrophils (%) and lymphocytes (%) were statistically non-significant. Similar non-significant variations were recorded in broiler chicks for counts of neutrophils and lymphocytes, but rise in TLC was noted when administered with *W. somnifera* extract (Mushtaq *et al.,* 2012).

Faecal parasitic load: The monthly variations in number of oocyst per gram (OPG) of faeces of kids under stall-fed are depicted in Table 4. The mean number of OPG was found significantly highest in T_2 group over T_0 and T_1 group at the beginning of the trial period. In T_0 group, the mean OPG increased from 2208.33±1095.93 to 3150.00±801.98 during first 30 days and then, it declined to 2808.33±589.41 at 60th day and after that remained almost stable at 2816.67±662.53 at 90th day of trial period. In T_1 group, similar trend of escalating mean number of oocyst eggs per gram of faeces from 1441.67±328.74 to 1566.67±346.09 was noted during the first 30 days and thereafter, reduced to 1075.00±375.00 and 816.67±361.86 at 60th and 90th day, respectively. In T_2 group, the mean number of oocyst eggs per gram of faeces registered a continuous decreasing trend from 5208.33±1173.34 to 2133.33±998.22 during the study period of 90 days. However, the variations between and within groups were found to be statistically non-significant. The efficacy of most of the traditional treatments mentioned in various reports were tested for their antihelmintic properties. The controlled antihelmintic trials along with contemporary knowledge of parasite control strategies may offer new opportunities for effective and economical control of parasitic diseases (Jabbar *et al.,* 2006). These natural

Table 3: Blood biochemical parameters of goat kids during experiment.

Parameter	Day	Control	T_1	T_2
TLC ($X10^9$ /L)	0	18.23 ± 2.15	17.82 ± 1.53	19.17 ± 1.90
	30	16.73 ± 1.46	17.03± 1.98	14.83± 1.13
	60	17.50± 3.38	19.18 ± 2.17	18.37 ± 1.83
	90	17.20± 1.56	17.77 ± 2.37	18.28± 2.62
	Mean	17.42±1.07	17.95±0.96	17.66±0.97
Neutrophil (%)	0	36.17±2.89	39.00±2.96	36.33±1.91
	30	40.00 ± 4.00	49.33 ± 2.86	42.50 ± 6.29
	60	42.83 ± 5.89	43.67 ± 5.35	50.00 ± 6.46
	90	41.33 ± 6.77	42.67 ± 1.61	47.33 ± 6.04
	Mean	40.08±2.44	43.67±1.79	44.04±2.79
Lymphocytes (%)	0	63.83 ±2.89	61.00 ±2.96	63.67 ±1.91
	30	60.00±4.00	50.67±2.86	55.50±5.93
	60	55.50±5.50	56.00±5.42	50.00±6.46
	90	54.00±7.32	52.33±2.03	44.00±4.03
	Mean	58.33±2.56	55.00±1.85	53.29±2.74
Haemoglobin(g/L)	0	93.33±3.49	93.00±1.77	88.67±2.62
	30	87.67±3.98	83.67±2.33	84.33±3.77
	60	85.33±3.29	90.33±3.27	89.67±2.75
	90	$81.67±2.27^a$	$93.67±3.16^b$	$93.67±2.39^b$
	Mean	87.00±1.78	90.17±1.51	89.08±1.53

Mean values bearing different superscripts within a row differ significantly (P<0.05)

Table 4: Efficacy of *Withania somnifera* in naturally infected goats (Fig.1) with Coccidial infections.

Day	Control	T_1	T_2	Row Mean
0	$2208.33±1095.93^a$	$1441.67±328.74^a$	$5208.33±1173.34^b$	2952.78±647.08
30	3150.00±801.98	1566.67±346.09	3116.67±1378.51	2611.11±541.76
60	2808.33±589.41	1075.00±375.00	2416.67±1165.74	2100.00±462.04
90	2816.67±662.53	816.67±361.86	2133.33±998.22	1922.22±440.55
Column Mean	$2745.83±384.68^a$	$1225.00±176.01^b$	$3218.75±607.49^a$	2396.53±263.37

Mean values bearing different superscripts within a row differ significantly (P<0.05)

products are environment friendly with relatively few side effects and can offer an alternative solution to the problems of pollution and residues in food like milk, meat etc. (Hammond *et al.,* 1997).

It was illustrated from the study that Ashwagandha (*W. somnifera*) supplementation had potential to improve the growth performance of Beetal kids under stall-fed conditions without any adverse effect on health. Therefore, these results may offer new future opportunities for further studies to improve the performance of goats under stall-fed using naturally available herbs without having any adverse effect on health and environment.

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