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Influence of Dietary Phytoadditive as Polyherbal Combination on Performance of Does and Respective Litters in Cross Bred Dairy Goats

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ABSTRACT : The aim of the present work was to study the effects of a polyherbal supplement on cross bred does, starting from the last month of pregnancy to weaning, on milk yield, kid birth weight and growth rate. Thirty does were divided into three treatments of ten each in individual pens: low level supplementation (LS), high level supplementation (HS) and non-supplemented treatment (NS) as control. Low supplemented goats were given 125 mg/kg BW/d of polyherbal combination; high supplemented goats were given 250 mg/kg BW/d. The study was carried out in 2008. Fifty-nine kids were born from all the experimental animals. There was no difference on milk yield between supplemented groups and control ($p>0.05$), although polyherbal supplementation had positive effect on litter birth weight and growth rate compared to control. Weaning weights were higher ($p<0.001$) in LS and HS compared to NS does. In both supplemented treatments compared to control, mortalities and morbidities were also lower in kids born. It is concluded that pre-partum to weaning supplementation increases kids growth rates and weaning weights, as well as reduces kid mortalities, but it doesn't have significant effect on milk production. (**Key Words :** Doe Performance, Goat Kid Growth, Polyherbal Supplement)

INTRODUCTION

The goat is among the earliest species to be domesticated, with records showing domestication occurred around 7000 years B.C. in Southeast Asia along the present Iraq-Iran borders (Mason, 1981). Goats are kept for various reasons, of which milk and meat are the most important. The use of goat milk for human consumption dates back to the earliest domestication of economically important animals (Dubeuf, 2005). The world wide importance of goats as providers of essential food in meat and dairy products has been discussed and documented in many recent proceedings of national and international conferences (Haenlein, 1992, 2001; Haenlein and Fahmy, 1999; Morand-Fehr and Boyazoglu, 1999; Rubino et al., 1999; Gruner and Chabert, 2000). Inaccessibility and cost of timely veterinary health care has been identified as major constraints to the viability and productivity of goat production in many regions of the world. As recognized by the World Health Organization, local ethno-veterinary medicines could play an important role in ensuring general well-being and welfare of livestock in the developing world (WHO, 2008). Since extracting the effective agent(s) from these herbs is uneconomic, it is better to use them in the form of mixtures as some herbs have a galactogouge property besides the capacity to improve the palatability and are carminative to aide the digestion process. These herbs are a good source of plant secondary metabolites and are usually abundant and inexpensive in developing countries. According to the FAO, the lack of drugs to treat diseases and infections causes losses of 30 to 35% in the animal breeding sector of many developing countries, where poor animal health remains the major constraint to breeding (Confessor et al. 2009). Farmers are also aware of the use of ethno-veterinary herbs and they can adopt this approach easily. Keeping these facts in view, the potential of a herbal mixture based on commonly available and cheap herbs was evaluated for its efficacy for increasing of dairy goat performance as measured by kid performance and doe productivity. It was hypothesized that polyherbal combination would result in higher kid growths and doe weight gain.

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MATERIALS AND METHODS

Study area and experimental diets

The experiment was carried out at livestock farm of the National Dairy Research Institute, Deemed University (NDRI), Karnal, situated in eastern zone of Haryana and in the Trans Gangetic Plain Region of India at an altitude of 250 m above mean sea level on 29° 42'N latitude and 75° 94'E longitude. The minimum ambient temperature falls near to freezing point in winter and the maximum can reach 45°C in May/June. The annual rainfall is close to 700 mm, most of which is received from July to September. The climate of the farm is typically sub-tropical and the land area is very productive with sufficient irrigation facilities for growing green fodder for animals year round. The relative humidity of this farm varies from 41 to 85% and vapour pressure ranges from 7.0 to 25 mm of Hg. Thus this farm receives the extreme climates due to the wide range of variation in various meteorological factors. The polyherbal supplement contained; *Asparagous racemosous* (Shatavari), *Leptadenia reticulata* (Jivanti), *Nigella sative* (Kolonji), *Cuminum cyminum* (Jeera) and *Pueraria Tuberosa* (Vidarikand). Individual herbs were procured from local market after assessing their quality in consultation with ayurvedic practitioners and drug manufacturers. The part of each herb that was used was as follows: for Asparagous and Pueraria (root), Nigella and Cuminum (seed) and Leptadenia (leaf). Active compounds of treated medicinal plants were also as follows; for Asparagous (sapogenins and saponin), Pueraria (puerarin), Nigella (thymoquinone), Cuminum (cuminaldehyde) and Leptadenia (triterpenes and steroids). They were purchased as dried (sun-dried). Each sun-dried herb was pulverized separately. The polyherbal supplement was prepared after mixing powdered specific parts of five herbs in same proportion based on weight of dry matter. The dried samples of the feeds (concentrates and herbs) were ground through 1mm sieve and further dried at 105°C for one hour to determine the dry matter. The crude protein(CP) in and dried samples of the feeds and herbs was determined according to Kjeldahl procedure (AOAC, 1980), while the neutral detergent fibre (NDF) and acid detergent fibre (ADF) of feeds were determined according to the procedure of Goering and Van Soest et al. (1991). The AOAC (1980) procedures were followed to determine the ash content of the feeds and herbs, and also that of the crude fibre (CF) and ether extract (EE) for feeds. The samples were ashed by charring in a Muffle furnance at 500^0C for about three hours or until a whitish ash remained. Total phenolics and condensed tannins were analyzed colorimetrically (Milton Roy 401 Spectronic spectrophotometer) using modified Folin-Dennis procedures (AOAC, 1990) and vanillin-HCL procedures (Price et al., 1978), respectively.

Experimental design and animal management

Beetal is one of the heaviest dairy type goat breeds of Northern India. The animals are characterized by a large size, long drooping ears and Roman nose. The Beetal breed has been used for cross-breeding with Saanen and Alpine breeds in the All India Coordinated Research Project on goats, both for milk and meat components (Rana et al., 1981). Lactation responses to the supplements were tested with 30 cross bred of Alpine×Beetal (AB) goats (Mean body weights 44.6±4.20 kg). The does were mated in June/July 2008 and kidded in November/December 2008. In September, a month pre-partum they were vaccinated against pulpy kidney, dosed against internal parasites. Animals were allowed access to green fodder in open area and water during the day for seven hours and penned overnight under the same environment throughout the trial. Goats of an average age of 2.3 years were selected on the basis of milk production records from a herd at the station and assigned randomly (10 does each) to either a supplement of polyherbal combination at 125 mg/kg body weight (BW) as a low level polyherbal supplement (LS) or 250 mg/kg BW as a high level polyherbal supplement (HS). The goats received this supplement from 6 weeks before kidding till weaning time of their kids. One treatment with equal numbers of does served as control without supplement (NS). To avoid dominance behavior and to ensure equal access to the supplement, each goat from every treatment was randomly assigned to separate pens, eliminating of possible biases due to environmental variation within the animal house. Pregnant goats were kept on isocaloric and isonitrogenous diet according to NRC (1981) feeding standard. The animals were kept in the shade in individual feeding pens. The experimental diets offered to the goats consisted of concentrate mixture according to requirements in advanced pregnancy and green fodder (Berseem) as *ad libitum*. Clean and fresh water was always available for consumption. The feed was given to the animals twice a day; in the morning (9:00 am) and afternoon (2:00 pm). Goats were adapted for 10 days to the experimental diets before measurements. BW changes were determined by weighing each goat for three consecutive days at the beginning and subsequently at fortnightly intervals early in the morning before feeding. Thirty advanced pregnant cross bred goats of an average age of 2.3 years were randomly allocated to three dietary treatments using a complete randomized design (CRD). Goats in different treatments were tagged with different colours for easy identification. After kidding, the dams were weighed to know the parturition weights, which were taken as their initial weights. Kids' weights, sex, and type of birth (single

Table 1. Physical composition of concentrate mixture

Ingredient	Parts (%)
Maize	33
Groundnut cake	20
Mustard cake	13
Wheat bran	20
Deoiled rice bran	11
Mineral mixture	2
Common salt	1
Total	100

or twin) were recorded on day one postpartum. Thereafter, weekly weights for both does and kids were recorded in between 8 AM and 9 AM up to weaning. In addition, the kids' mortalities and morbidities were recorded. The does were left with their respective kids for seven days in the kidding paddock. Milking started on the eighth day post-partum to weaning at an average of 100 days of kids' age. Goats were hand milked twice daily (6.00 and 16.00 h) and daily milk yield of individual goats was recorded throughout the experiment. Milk yield measurement was commenced after the kids were allowed to suckle the dams for the first seven days postpartum to consume colostrum and to establish strong dam-kid relationship to forestall rejection of kids by their dams after overnight separation to measure milk yield. The kids were separated from their dams for 12 h over night (6 pm-6 am) and only re-introduced to their dams after milking.

Statistical analysis

Data were analyzed using the least squares means Harvey (1990). Analyses of variance (ANOVA) were performed to establish effects of supplementation on sex and type of birth, and effects of supplemented feed on kid growth rate and milk output. The kid parameters analyzed were birth weights, growth rates and weaning weights, and doe parameters analyzed were milk yield, post-partum weight and doe weight at weaning. Duncan's multiple range was used to determine significant differences between the means. The results were expressed as the mean±the standard error of the mean. For reproduction performance only the effect of treatment was analyzed using descriptive statistics.

Table 2. Plant secondary metabolites and nutritional properties of polyherbal supplement and feeds

Parameters (% DM basis)	Polyherbal supplement	Concentrate	Berseem
OM	90.8	91.3	89.9
CP	6.46	20.5	17.8
EE	0.35	4.23	3.34
Total ash	2.5	8.67	10.1
NDF	38.1	43.5	31.3
ADF	13.5	13.5	26.5
Total phenolics	4.57	-	-
Total tannin	3.69	-	-

RESULTS

Supplementation period

Pythochemical and proximate composition of the offered polyherbal combination and feeds is presented in Table 1 and 2. The efficacy of supplementation on milk production, kid birth weight, doe post-partum weight and doe weight at weaning, as well as the effect of milking on kid weight from birth to weaning and doe performance is shown in Table 3. There was no effect of treatment (p>0.05) on doe body weight post partum or at weaning and milk yield. The fortnightly pattern of milk yield is depicted in Figure 1. Total milk produced was 2.41±0.12 kg in LS, 1,932.37±0.12 kg in HS and NS (2.37±0.12 kg) in LS does (p>0.05). The litters' birth weight and daily BW gain, were similar between treatments, but weaning BW was higher (p<0.001) at both the lower dose as well as the high level of supplement compared to control. At birth, litters' live weight (LW) were similar between the low level supplement and high level supplement compared to non-supplement, but tended to be higher in LS rather than HS. Similarly, Average daily growth rate was higher for two supplemented treatments compared to control and ranged from 0.147±0.02 to 0.198±0.02 kg/d.

Table 3. Summary of litter and doe growth performance due to polyherbal supplementation

Variable	N	NS	LS	HS	SEM	p
Milk yield (kg/d)	30	2.37^{b}	2.41^{b}	1.93^{a}	0.12	0.01
Litter birth W (kg)	59	5.12	6.67	6.40	0.65	0.22
Doe postpartum W (kg)	30	39.60	40.10	39.00	1.84	NS
Litter weaning W (kg)	58	13.76^{a}	17.42^{b}	17.02^{b}	0.68	0.001
Doe W at weaning (kg)	30	42.85	42.30	43.50	2.06	NS
Kids daily gain (kg/d)	58	0.147	0.178	0.198	0.02	0.07

NS = Non polyherbal supplemented group. LS = Low polyherbal supplemented group.
HS = High polyherbal supplemented group. N = Number of animal.
Values in the rows with different superscripts are significantly different.

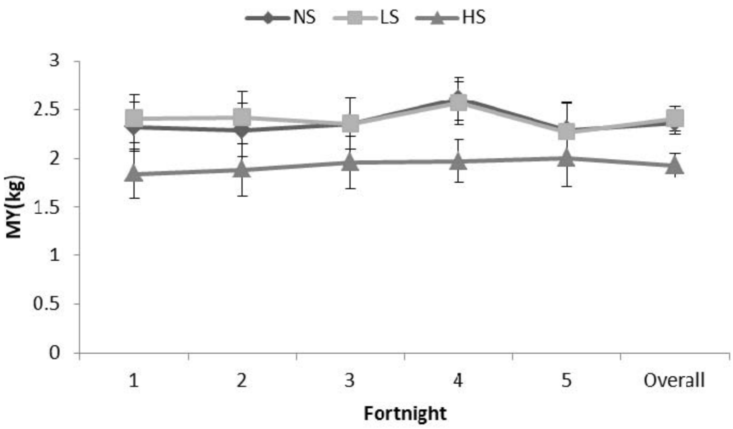

Figure 1. Fortnightly changes in milk yield (LSM±SEM) in different treatments groups. NS = Non polyherbal supplemented group. LS = Low polyherbal supplemented group. HS = High polyherbal supplemented group.

The results of the reproductive performance of lactating goats observed during the experiment are shown in Table 4. These results show the total number of kids born, weaned, and those that died in different treatments and indicate there was a slight improvement of reproduction performance in supplemented groups compared with the control group.

Supplementation withdrawal period

The performance of does after of the polyherbal supplement was withdrawn was studied until the next parturition by December, 2009. The results of the reproductive performance of lactating goats observed during the experiment are shown in Table 5. The average gestation length (d) was 151.33±7.54, 146.33±1.89 and 145.40±2.11 for goats in NS, LS and HS respectively. The goats in HS and LS had a better length of gestation compared to goats in NS. The pregnancy rates (%) were 70, 80 and 90 for goats in NS, LS and HS, respectively. Goats in HS had higher pregnancy rate followed by the goats in LS. Two goats in NS aborted; whereas in LS and HS all goats had successful births. There were variations in the average litter size (2 kids/head) of lactating goats of 1.80±0.29, 2.20±0.20 and 2.00±0.21 for goats in NS, LS and HS, respectively. The results were in agreement with Beyan (2009) findings. The average litter BW (kg) per goat was 5.58±1.00, 6.64±0.56 and 5.88±0.49 for goats in NS, LS and HS respectively, while the corresponding average birth weight (kg) of kids was 2.99±0.10, 3.20±0.15 and 3.21±0.16, respectively. The goats in LS recorded higher

Table 4. Total number of kids born, weaned, and those that died in different treatments

Variable	NS	LS	HS
Total kids born	17	24	18
Single	2	1	2
Twin	6	7	5
Triple	1	2	2
Overall kid mortality (%)	6	0	0
Mortality of single (%)	50	0	0
Mortality of twin (%)	0	0	0
Mortality of triple (%)	0	0	0
Total number weaned	16	24	18
Single weaned	1	1	2
Twin weaned	6	7	5
Triple weaned	1	2	2
Male (%)	47	46	55
Female (%)	53	54	45

NS = Not polyherbal supplemented group.
LS = Low polyherbal supplemented group.
HS = High polyherbal supplemented group.

Table 5. Means and ±SE of reproduction parameters of lactating goats in different treatment groups

Parameter	NS (Control)	LS	HS
Gestation length (d)	151.33±7.54	146.33±1.89	145.40±2.11
Litter size and survivability/animal	1.80±0.29	2.20±0.20	2.00±0.21
Kid birth weight (kg)	2.99±0.10	3.20±0.15	3.21±0.16
Litter birth weight (kg)	5.58±0.49	6.64±0.56	5.88±0.49
Twining rate (%)	90	110	100
Pregnancy rate (%)	70	80	90
Kidding disorders (case)	2	0	1

NS = Non polyherbal supplemented group. LS = Low polyherbal supplemented group. HS = High polyherbal supplemented group.

litter body weight and HS showed higher kid birth weight compared to NS. Kid birth weights were similar ($p>0.05$). Litter body weight growth rates and weaning weights were different between treatments ($p<0.05$), the heaviest being from LS does, followed by HS does, then the NS does (Figure 2). Kid disorders were highest in NS (12%) and lowest in LS group (0%) which it has been depicted in Table 5.

DISCUSSION

The study showed that phytochemical additives nutrition had an effect on milk production, with low polyherbal supplemented does producing more milk than the non-supplemented and high supplemented does. This trend shows that supplementation is mostly of benefit in the first months of lactation period. There was no difference in supplementation and non-supplementation in doe weight post-partum and at weaning, suggesting that supplementation had no effect on doe weight changes. Polyherbal combination nutritional treatment effects were also evident on kid performance; with kids from low supplemented does having the highest average daily weight gains and weaning weights, as well as lowest disorders. Goat productivity, as measured by increased conception rates, kid survival and kid growth rate, was enhanced by polyherbal supplementation of does which is agreement with findings of Sikosana et al. (1990). The constraint of high kid disorders and mortalities (30-50%) up to weaning has been reported by Matika and Maphosa (1992), consequently the reduction in kid disorders in this study shows that supplementation of does can improve kid survival. Kids from polyherbal supplemented does had higher gains than those from non-supplemented. The similarity in mean birth weights of kids in all supplemented treatments in the year following the withdrawal of supplementation with polyherbal combination suggests that the survival of supplemented goats was higher than that of non-supplemented ones. It has also been shown in sheep that efficiency of foetal uptake of maternal glucose is only about 69% as a result of a substantial backflow of glucose from foetus to mother (Greyling, 2000). Type of birth had an effect on kid growth. There were also more twins from LS and HS does than NS does. This might explain the higher daily weight gains and weaning weights in kids from supplemented compared to non-supplemented does. Sex also had an effect on kid growth, with males being heavier than females at birth. Consistently heavier males has been widely reported, with similar trends being reported by Tawonezvi and Ward (1987). This has been attributed to hormonal differences between sexes and their resultant effects on growth (Meyer, 2001). Overall doe productivity was measured using kids weaning weights and total milk production. Does that were supplemented gave higher milk yields and their average kids' weaning weights at studied weeks were higher than that of non-supplemented group, suggesting that supplementation improves overall doe productivity. The results of the present study indicates that application of polyherbal supplementation both in higher as well as lower levels produced a better reproductive performance compared to control treatment. The improvements in reproductive performance achieved by supplementing polyherbal combination at the rate of 0.125 and 0.250 g/kg BW could be due to stimulation of the reproductive process by the steroidal saponins contained in supplementation.

Berhane et al. (2000) reported that highest reproductive performances (onset of estrus, pregnancy rate) were recorded in dairy cows supplemented with fenugreek as compared to the control group without supplementation. Rajkuwa et al. (2001) studied the effect of *Saraca asoca* stem bark and *Trigonella foenum- graecum* seeds on

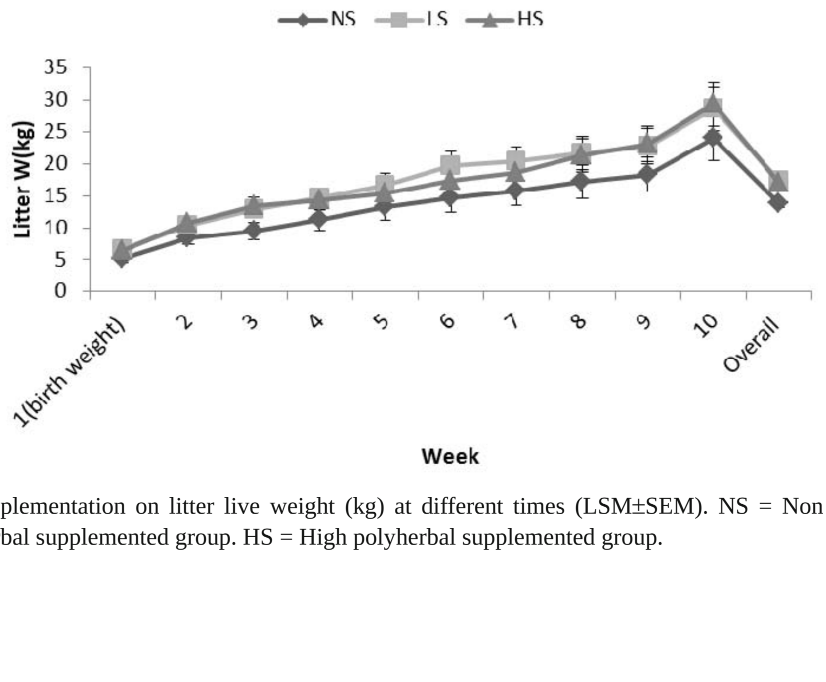

Figure 2. Effects of supplementation on litter live weight (kg) at different times (LSM±SEM). NS = Non polyherbal supplemented group. LS = Low polyherbal supplemented group. HS = High polyherbal supplemented group.

reproductive performance, serum progesterone and micro minerals profile in anoestrus cows and reported that the percentage of animals induced in oestrus and overall pregnancy rate using fenugreek seeds were higher (83.33 and 80.00%) as compared to *Saraca asoca* (66.66 and 50.00%) at doses of 50 and 100 g level.

Asparagus racemocus (Shatavari) has an immunomodulation and immunopotentiation effect in late gestation and has been shown to shortening the uterine involution period (Qureshi et al., 1997; Sattar et al., 2003b; Sattar et al., 2003c; Sattar et al., 2007; Hussein and Badr, 2008). The estrogenic (Mitra et al., 1999; Pandey et al., 2005) property of shatavari, one of the polyherbal ingredients, stimulates the ovarian function, improves uterine tonicity thus helps in early uterine involution which consequently results into early initiation of the estrus cycle. Additionally, resumption ovarian cyclicity after parturition depends on the nutritional status, body energy reserves and blood glucose levels of the animal. However, Mitra et al. (1999) reported that a shatavari based herbal formulation did not possess oxytocin like activity which might be useful in uterine hypermotility associated early abortion

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CONCLUSION

In conclusion, feed additive sources like polyherbal combinations are cheaper than commercial feed additives and can be stored and used during time of need when doe nutritional requirements are high, but feed resources are scarce. Feeding of does pre and post-partum with 125 mg/kg BW of polyherbal combination gave satisfactory results on overall doe productivity and kid performance. Supplementary feeding would not only improve milk production but also overall doe productivity as measured by prolificacy, kid survival, weaning rate and kid weaning weight. Smallholder farmers would benefit from more milk for their home consumption and at the same time get more kids per kidding season, thereby increasing flock sizes and consequently achieve a higher income. Supplementation was important in early lactation due to the effect of negative energy balance at that time. There is, however, need for further studies on kid growth rates post weaning to 18 months, as well as doe complete lactation period and conception rates, to determine if supplementation has any effect after weaning.

The beneficial effects of supplementary feeding with polyherbal combination on goat production in India were demonstrated in this study. It helps substantially reducing the incidence of abortion and increases the overall yield of kids per animal. Pregnancy rate was higher in LS group than HS and NS groups.

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