

Growth Performance of Young Pateri Cross Breed Goat Supplemented with Selenium Yeast

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Abstract

Object of current study was to evaluate the effects of selenium supplementation growth performance and feed conversion ratio of goats. Forty females crossbred (Pateri x local) goats were divided into two isonitrogenous diet groups: one without any supplementation and the other was supplemented with Se, along with same basal diet for both the groups supplied on the dry matter basis per kg body weight (BW) per day. The control group had lower daily total dry matter intake (779.70 vs. 904.77 g/d) is lower than the Se treated group. Daily grass intake (3.69 vs. 4.29 kg), crude protein (11.41 vs. 13.28 g) were also significantly different. Body weight gain (1.20 vs. 1.66 kg) is also increased for Se supplemented group as compare to control, significant differences were observed between groups for average daily gain (17.14 vs. 32.8 g). The feed conversion ratio (45.63 vs. 38.24 kg) was lower in Se supplemented group as compare to the control. Se supplemented goats have higher total dry matter intake, feed conversion ratio, average body weight gain than those fed high concentrate only.

Keywords: Selenium Supplementation; Growth Performance; Goat Average Daily Gain; Feed Conversion Ratio; Body Weight Gain; Pateri Goat

Abbreviations

BW: Body Weight; ADG: Average Daily Gain; FCR: Feed Conversion Ratio; F:G: Feed Gain Ration; DM: Dry Matter; Se: Selenium; CP: Crude Protein; TDN: Total Digestible Nutrient

Introduction

Majority of small ruminant farming depends upon open grazing in Pakistan. Due to the land topography, lack of natural pastures is one of the major constraints in small ruminant farming; even medium scale farming is restricted to the selected desert or hilly areas of the country. On the other hand, use of concentrate in small animal feeding increases production cost which is main reason for this type of farming. Although the world is facing many challenges to mitigate rural poverty, the goat rearing has been promoted by various governmental and non-governmental organizations to resolve the issue [1]. Goats are drought-tolerant animals mainly depend upon wild grasses, tree buds and leaves to satisfy their hunger, hence they require less care and provide small farmers with employment opportunities in agricultural lean.

Trace elements are very much important to the metabolic and protective processes in human and animal nutrition; selenium (Se) is one of them. As an element Se shows properties of both metals and non-metals exist in four different states [2] i.e. Se^{-2} , Se^0 , Se^{+4} , Se^{+6} . Naturally the Se is present in inorganic form within soil called sodium selenite, intake by the plants and stored in organic form i.e. selenomethionine and selenocysteine. Almost 50 - 80 percent of total selenium concentration within plants constitutes of selenomethionine and selenocysteine.

There are two ways of using Se in diet, as food supplement (both organic and inorganic forms are available) and medicinal use of Se. As food supplement mainly, inorganic form is used in animal diets *i.e.* Sodium Selenite or selenate. Selenium yeast (SY) is the source of synthetic organic Se present in either form selenomethionine or selenocysteine [3,4] which make proteins called selenoproteins. Gammelgaard in his studies found that in ruminants the absorption of inorganic Se is much lower as compare to the organic thus the effect of organic Se predominate over the inorganic Se in ruminants [5].

In the past Se has been treated as toxic element, produces diseases in both animals and humans as reported by the Tinggi that the excess of this element may cause selenosis. Selenosis can be diagnosed by stiffness of muscles, furr loss and necrosis of horn tissue [6]. Meschy in his research found positive effects of Se over health of animal reflected in increased anti oxidative status by preventing process of peroxidation and increased immunological potential when supplemented with selenium yeast (SY) [7].

Se is the part of glutathione peroxidase (antioxidant enzyme) which catalyze reduction of hydrogen per oxide and lipid hydro peroxidase to destroy free radicals produced during normal metabolic activity [8]. It also plays various roles in biochemical transformation in animals and humans [2]. However, the plants have very low concentration of Se, due to that very little quantity of this microelement is incorporated into animal or human body [9]. This is in continuation with the results found by Wenbin, he in his studies suggested that the source and concentration of Se doesn't affect plasma glutathione peroxidase [10].

Growth performance is influenced by SY provided as food supplement during different trails by previous researchers. Gieven in his research conducted on dairy goats shows an increase fat percentage throughout the lactation period [11] while Wenbin reported that blood Se concentration is increased relatively with improved antioxidative status by the Se supplementation with no any adverse effect of Se is seemed [10]. Majority of studies suggested that amount of supplement fed influence milk yield, fat content, protein and lactose [9,12,13]. Environment also plays an important role in "livestock" farming in both growth [1], marketing of animals depends upon sessions since they can be sold during a severe drought [14]. ADI, TBG, ADG and FG ratio are economically important traits, which are controlled by polygenes and also effected by feeding practices which mainly depend upon sessions as these animals have common feeding practice of grazing.

The overall effect of Se supplementation is seemed to have positive effect over growth of goats at highest level of Se supplementation *i.e.* 1.0 mg Se/kg DM [10,15], the optimum dose of SY for better growth performance should be 300 mg/kg of ration DM. Hence it can be said that Se promotes growth, health, reproduction of animal and also in biosynthesis of selenoproteins [15] contrary some studies suggest that organic Se supplementation did not affect growth performance [10]. The objectives of current study were to analyze the effects of dietary Se supplementation on feed intake and growth rate of goats.

Materials and Methods

The experimental procedures, sampling and processing were performed according to the standards of Ruminant Research Unit, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University, Tando Jam, Pakistan. The study was conducted during Nov. 2016 on crossbred (Pateri × local) goats at the Ruminant Research Unit, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University, Tando Jam (25°N and 28°E), Pakistan. Twenty 4 months old crossbred young female goats, with initial body weight of 15.56 ± 0.46 kg, were selected for experiment divided into A and B groups. A group fed with high concentrate supplementation; and B

group fed with Se supplementation along with high concentrate. Before the start of the trail period the goats were injected with Ivomectin (Ivermectin 2%) manufactured by Vetz Pharmaceutical Ltd., S.I.T.E., Kotri, Pakistan and Oxfenox Plus (Oxfebndazole 22.65 mg/ml, oxcyclozanide 62.50 mg/ml, cobalt chloride 0.20 mg/ml) manufactured by Breeze Pharma Pvt. Ltd. Islamabad, Pakistan, against parasitic infection. Goats were left for thirty days before start of the trail period to adapt feeding management. Both groups were fed barseem as green grass ad. Lib., high concentrate ration at 1.0% of BW, same trend of feeding was followed throughout experimental period. The composition and chemical values of ingredients of high concentrate are given in table 1.

Ingredients	%	g/Kg	Nutrient content	g/Kg
Corn	54.56	545.4	Dry mater	855.92
Wheat bran	30.2	307.8	Crude protein	13.59
Soybean meal	12.62	120.6	Total digestible nutrient	70.6
Lime stone	0.60	6	Crude fiber	22.32
DCP	1.08	10.8	Total ash	6.67
Salt	0.32	3.2	Calcium	1.59
Vitamin/ Mineral Premix ^b	0.62	6.2	Phosphorus	1.12
			Selenium	0.06

Table 1 Ingredients and nutrient contents of the basal diet^a Composition of high concentrate diet (% ,g/kg as-fed bases).

^a: Experimental diet was supplemented with selenium at 0.3 mg/kg diet.

^b: The vitamin/ mineral supplementation provided per kg of diet: Vitamin A: 1200 IU; Vitamin D₃ 1500 IU; Vitamin E 44.1 IU; Vitamin K₃ 4.0 mg; Vitamin B1 1.4 mg; Vitamin B2 5.22; Vitamin B5 20.0 mg; Vitamin B12 0.01 mg; niacin 26.0 mg; pantothenic acid 14 mg; folic acid 0.8 mg; biotin 44 µg; Fe 100.0 mg; Cu 16.50 mg, Zn 90 mg; Mn 35 mg; I 0.30 mg.

The amounts of feed intake and Se were determined for individual goat on the basis of their BW, and adjusted biweekly to account for BW changes. The chemical composition of Barseem, high concentrate is shown in table 1. Se group organic Se using SY (Fubon Selenium Yeast, Angle Yeast Co. LTD. China) @ 0.3 mg Se/KG diet, the optimum dose was 150 mg SY per kg diet (150mg SY contains 0.3 mg Se). Fubon SY is produced by submerged fermenting *Saccharomyces cerevisiae* in a Se rich media. HI-PHOS DCP (Lyalpur Homeo Pharma, Faisalabad Pakistan) with concentration of Calcium 34% and Phosphorus 17% was used as DCP. Nutramin powder (Star Laboratories PVT. Ltd.); was used as mineral premix. The high concentrate and SY were offered twice in a day with equal intervals throughout 100 days of trail period.

Offered feed and refusals were measured on daily basis to calculate feed intake. Goats were weighed every week early in the morning to calculate body weight gain. Total bodyweight gain was calculated by initial and final body weight differences. Average daily gain was calculated by dividing total body weight gain by total number of days of the trail period. Grass (Barseem) of two months maturity was chopped 5 - 7 cm above ground level and offered to animals twice daily. Dry matter was determined only weekly basis by analyzing oven dried subsamples of offered feed and residues at 70°C for 78 hours. Dried feed samples were passed through 1 mm sieve by means of willy mill, taken to plastic bottles for further analysis. According to the standard procedure of Helrich nitrogen and ash were determined [16]. Organic matter was calculated by subtracting ash from 100. Calcium concentration was determined by the standard procedures of University of Tokyo (1978) by flame atomic spectroscopy method. Data was analyzed under statistical program by one way ANOVA and if found significant than means were compared by Tukey’s HSD method using (Statstix10, USA, © statstix.com) statistical software package. Data is presented as Mean ± SEM and difference is considered significant at P < 0.05.

Results and Discussion

In the present study during 70 days of experiment the supplementation of the Se to basal diet increased the apparent digestibility of DM and crude protein. The total DM intake including green grass and concentrate feed had significantly increased in Se supplemented group as compare to the control group ($p < 0.05$; Table 2). Similarly, CP intake on DM basis for Se supplemented group had also been increased as compare to HC ($p < 0.05$; Table 2) respectively. Average daily intake has also been improved with Se supplementation ($p < 0.05$; Table 2) respectively.

Item ^{s1}	Treatment		P-Value	SEM ² (±)
	HC	SY		
TDM intake, g/day				
Barseem	646.46 ^b	766.08 ^a	0.04	29.18
Concentrate	133.06 ^b	138.72 ^a	0.006	1.29
Total	779.70 ^b	904.77 ^a	0.03	29.17
CPI	11.41 ^b	13.28 ^a	0.03	0.43
ADI (kg)	3.69 ^b	4.29 ^a	0.04	0.20

Table 2: Mean values DM intake, CP intake, feed intake for goats fed a basal diet of high concentrate (HC) and selenium yeast (SY) supplementation.

Means followed by different letters within same row are significantly different ($p < 0.05$).

¹TDM: Total Dry Matter, CPI: Crude Protein Intake, ADI: Average Daily Intake, LW: Live Weight.

²SEM: Standard error of mean, where $n = 20$ per treatment.

Basal diet supplemented with Se also improved daily live weight gain and feed conversion ratio. Total body weight gain and average daily gain for Se supplemented group was increased significantly as compare to the control group ($p < 0.05$; Table 3). F:G of control group is significantly higher as compare to Se supplemented group ($p < 0.05$; Table 3) respectively which indicates that Se supplementation has increased the feed gain ratio. Average daily gain and feed gain ratio for both groups is presented in figure 1.

Item ^{s1}	Treatment		P-Value	SEM ² (±)
	HC	SY		
Live weight kg				
IBW	15.6	15.53	0.95	0.72
FBW	16.8	17.2	0.7	0.47
TBG	1.20 ^b	1.66 ^a	0.03	0.10
ADG, g/day	17.14 ^b	32.8 ^a	0.03	1.46
TDMI, g/day	779.70 ^b	904.77 ^a	0.03	29.17
F:G (g DMI/ g ADG)	45.63 ^a	38.24 ^b	0.02	1.55

Table 3: Mean values for live weight, live weight change, feed DM intake, DM feed conversion and feed cost of goats fed a basal diet of high concentrate (HC) and selenium yeast (SY) supplementation.

Means followed by different letters within same row are significantly different ($p < 0.05$).

¹IBW: Initial Body Weight, FBW: Final Body Weight, ADG: Average Daily Gain, TDM: Total Matter, F: G: Feed Gain Ratio.

²SEM: Standard Error of Mean, where $n = 10$ per treatment.

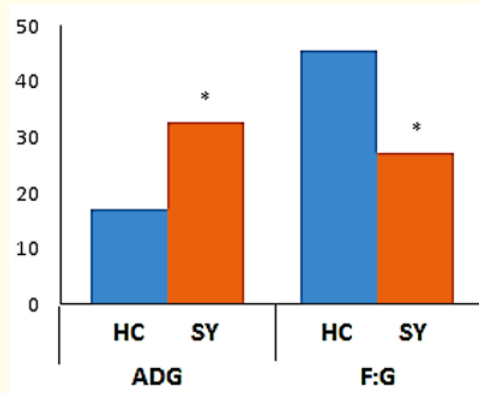


Figure 1: Effect of Se supplementation on average daily gain (ADG) and feed gain ratio (F:G).

Previous studies reveal some controversial results regarding dietary supplementation of Se and its effects upon growth performance on animals. The current study on young goats fed Se at an optimal dose of 0.3 mg/kg diet had significantly higher F:G during 70 days, Se could significantly improve growth performance of young goats compared with control diet (Table 3). The significant correlation values among DMI, CPI, ADI (Table 2) and ADG, F:G (Table 3) agrees with findings of Jiang, he concluded that selenomethionine could improve growth performance at the dose rate of 0.225 mg/kg in broilers [17]. Zhan compared maternal selenomethionine and sodium selenite at 0.3 mg/kg diet, same dose rate in piglets. He found more increase in maternal selenomethionine fed piglets from birth to weaning weight as compare to sodium selenite [18].

While the Miller did not report any effect of Se supplementation over growth performance fed different sources of selenium i.e. sodium selenite or selenomethionine at different levels 0 - 0.5 mg/kg [19]. Even some other researchers have some controversial conclusions that either Se source or Se level would not have any effect over growing finishing pigs and broilers [20-22]. These inconsistencies in different conclusions might be due the difference in type and dose of Se, species and breeds. Besides all the current study the basal diet was common for both the groups and goats in both groups were fed with high concentrate diet throughout the experimental period. Only SY group (i.e. treatment group) was supplemented with SY supplementation (selenomethionine) so the tissue Se concentration may be raised for this group, which leads to increase in overall feed intake and growth performance among both groups. Environmental conditions due to seasonal variations also have remarkable effect on growth of animals. Sandip and Jana reported that the birth weight during hot and humid climate was significant on birth [23]. This difference in body weight might be attributed to physiological adaptations to changes in environmental conditions. Fodder also depends upon seasonal crops, Yaqoob reported that the fodder availability and prolificacy highly effects birth weight, weaning weight, weight at 6 and 9 months age, and pre- and postweaning growth rates of Dera Din Panah goat [24]. These findings supported by several other researchers, they concluded that variation in supply and composition of feeds and fodder affects weight of kids, season, year of birth [25] and type of birth [26], influenced body weight and growth rate in goats. This study was conducted in intensive type farming during winter season; on the other hand, further studies can be conducted to evaluate differences in growth patterns in different environmental conditions.

Conclusion

The present study demonstrates that SY can improve DMI, CPI leading to increased growth performance. The optimum level of Se level is suggested 0.3 mg/kg diet. Since the Se supplementation improves the feed intake and growth performance, it is suggested that further studies on other aspects like meat quality and carcass characteristics is necessary to estimate the pattern of growth in under prevailing natural and ecological conditions in Sindh so for the introduction of the breed in the region.

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Conflict of Interest

The all authors read and approved final manuscript.

Bibliography

1. Solangi NB. “Effect of dietary selenium supplementation on growth performance, physiological indices and hematological indices in goat”. Thesis, Department of Veterinary Physiology and Biochemistry at Sindh Agriculture University, Tandojam (2017).
2. Mahima A., *et al.* “Inorganic versus organic selenium supplementation: A review”. *Pakistan Journal of Biological Sciences* 15.9 (2012): 418-425.
3. Finley and JW. “Selenium accumulation in plant foods”. *Nutrition Review* 63.6 (2005): 196-202.
4. Schrauzer GN. “Selenomethionine: a review of its nutritional significance, metabolism and toxicity”. *Journal of Nutrition* 130.7 (2000): 1653-1656.
5. Gammelgaard B., *et al.* “Estimating intestinal absorption of inorganic and organic selenium compounds by in vitro flux and biotransformation studies in Caco-2 cells and ICP-MS detection”. *Biological Trace Element Research* 145.2 (2012): 248-256.
6. Tinggi U. “Selenium toxicity and its adverse health effects”. *Review in food and Nutrition Toxicity* (2005): 29.
7. Mechy F. “Recent progress in the mineral requirement of goats”. *Livestock Production Science* 64.1 (2000): 9-14.
8. Ahmed Z., *et al.* “Dietary Selenium yeast supplementation improved some villi morphological characteristics in duodenum and jejunum of young goats”. *Journal of Animal and Plant Science* 26.2 (2016): 382-387.
9. Calamari I., *et al.* “Metabolic and hematologic profiles in heat stress lactating cows fed diet supplemented with different selenium sources and doses”. *Livestock Science* 142.1-3 (2001): 128-137.
10. Wenbin Y., *et al.* “Effect of supplemental selenomethionine on growth performance and antioxidant status in taihang black goats”. *Journal of Animal Science* 22.3 (2009): 365-370.
11. Givens DI., *et al.* “Enhancing selenium content of bovine milk through alteration of the form and concentration of the selenium in the diet of dairy cows”. *Journal of the Science of food and Agriculture* 84.8 (2004): 811-817.
12. Stockdale CR and HS Gill. “Effect of duration and level of supplementation of diets of lactating dairy cows with selenized yeast on selenium concentration on milk and blood after the withdrawal of supplementation”. *Journal of Dairy Science* 94.5 (2011): 2351-2359.
13. Stockdale CR., *et al.* “Selenium levels in cow fed pasture and concentrate or a total mixed ration and supplemented with selenized yeast to produce milk with supra nutritional selenium concentrations”. *Journal of Dairy Science* 94.1 (2011): 262-272.

14. Shankarnarayan KA., *et al.* "The Goat: An Appropriate Animal for Arid and Semi- Arid Regions". *Economical and Political Weekly* 20.45 (1985): 1965-1972.
15. Juniper DT., *et al.* "Tolerance of ruminant animal to high dose in feed administration selenium enriched yeast". *Journal of Animal Science* 86.1 (2008): 197-204.
16. Helrich K. "Official methods of analysis of the Association of Official Analytical Chemists". In: (Arlington) AOAC International 5.1 (1990).
17. Jiang Z., *et al.* "Effects of dietary selenomethionine supplementation on growth performance, meat quality and antioxidant property in yellow broilers". *Journal of Agriculture Food Chemistry* 57.20 (2009): 9769-9772.
18. Zhan XA., *et al.* "Effects of different selenium source on selenium distribution, loin quality and antioxidant status in finishing pigs". *Animal Feed Science Technology* 132.3-4 (2007): 202-211.
19. Miller WT and HW Schoening. "Toxicity of selenium fed to swine in the form of sodium selenite". *Journal of Agriculture Research* 56.11 (1938): 831-842.
20. Mahan DC and NA Parret. "Evaluating the efficiency of the selenium-enriched yeast and sodium selenite on tissue selenium retention and serum glutathione peroxidase activity in grower and finisher swine". *Journal of Animal Science* 74.12 (1996): 2967-2974.
21. Ortman K and B Pehrson. "Selenite and selenium yeast as feed supplements to growing fattening pigs". *Journal of Veterinary Medicine* 45.9 (1998): 551-557.
22. Payne RL and LL Southern. "Compression of inorganic and organic selenium sources for broilers". *Poultry Science* 84.6 (2005): 898-902.
23. Sandip B and D Jana. "Factors Affecting Birth Weight of Sirohi Goat Kids Reared in Hot and Humid Climate of West Bengal". *World Applied Science Journal* 9.12 (2010): 1379-1382.
24. Yaqoob M., *et al.* "Production performance of Dera Din Panah goat under desert range conditions in Pakistan". *Tropical Animal Health Production* 41.7 (2009): 1413-1419.
25. Baiden RY. "Birth weight, birth type and preweaning survivability of West African Dwarf goats rose in the Dangme West District of the Greater Accra Region of Ghana". *Tropical Animal Health Production* 39.2 (2007): 141-147.
26. Zahraddeen D., *et al.* "Factors affecting birth weight, litter size and survival rates of goats in Bauch, Nigeria". *Animal Production Research Advocacy* 3.1 (2007): 46-51.

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