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Full Length Article

Growth Response of Growing Lambs Fed on Concentrate with or without Ionophores and Probiotics

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ABSTRACT

The present study was planed to appraise the effect of concentrate with or without ionophore and probiotics on nutrients intake, nutrients digestibilities, blood metabolites, nitrogen balance, weight gain and its economic in twenty four weaned male *Lohi* lambs of four months of age. All lambs were randomly and equally divided into each of three groups. In this trial, dry matter (DM), crude protein (CP), neutral detergent fiber (NDF) and acid detergent fiber (ADF) intake of % body weight were unaltered in concentrate (C), ionophores (CI) and probiotics (CP) diets. The DM, CP and ADF digestibilities were also non-significant ($p>0.05$) in all treatments, where as NDF digestibility was significantly ($p<0.05$) higher in CI and CP. Nitrogen balance was unaltered ($p>0.05$) in all lambs in all treatments. The blood urea nitrogen (BUN) and creatinine were also non-significant ($p>0.05$) in all treatments, whereas blood glucose was significantly higher ($p<0.05$) in CP than C and CI. The initial, final and daily weight gains were unaltered in all treatments (C, CI & CP). Similarly, economic of nutrition and feed to gain ration were also non-significant among all treatments in all lambs.

Key Word: Lamb; Concentrate; Ionophore; Probiotics; Blood metabolites

INTRODUCTION

Livestock sector has maximum growth rate (4.1%) among all other major Agriculture components like pure Agriculture, forestry and fishery (Economic survey of Pakistan, 2009-2010). Sheep production is an important segment of livestock in Pakistan for mutton production. The *Lohi* has about 15% share in total sheep population (FAO, 1997) and fulfilling the 40% demand of mutton of province of Punjab (Rafiq *et al*., 2007). Indoor feeding of lambs with nutrient rich diets is an important tool for better growth in lambs. This high input feeding ensures sufficient supply of nutrients, which not only increased weight gain but also improve mutton quality in growing lambs (Ryan *et al.,* 2007).

Efficient utilization of nutrients in high input feed system at ruminal level can further be improved by adding suitable levels of feed additives like ionophores and probiotic. Ionophores increases the feed conversion efficiency in growing ruminants by improving dry matter and protein digestibilities (Raun *et al.,* 1976) and probiotic have also been reported to increase weight gain in small ruminants by enhancing the utilization of nutrients at ruminal level (Abu El-Ghani, 2004). Effective feeding system and search for a very cost-effective feeding system to produce lean slaughter weights in lambs (Borton *et al*., 2005) is of prime importance in developing countries (Bellof, 2003). However significant evidences regarding the effect of high input feeding system on growth performance and blood metabolites of *Lohi* lambs are limited.

Present study was conducted to check the effect of concentrate with or without ionophore and probiotic on nutrients intake, nutrients digestibility, nitrogen balance, blood metabolites and growth performance and economic of nutrition in *Lohi* male lambs.

MATERIALS AND METHODS

Experimental animals, diets and management: This experiment was conducted at Institute of Animal Nutrition and Feed Technology, University of Agriculture, Faisalabad, Pakistan to evaluate the performance of postweaned *Lohi* male lamb raised on concentrate with or without ionophore and probiotics. In this Postweaning experiment, 24 *Lohi* male lambs of four months of age were randomly divided into three treatments. Eight lambs in first, second and third groups were fed with concentrate (C), concentrate supplemented with ionophore (CI; Monensin, RumensinR) and concentrate supplemented with probiotics (CP; Yea Sacc, Saccharomyces cerevisiea), respectively. All lambs were maintained into 10×10 feet metallic pens. They were offered ample quantity of clean water. The lambs were drench and vaccinated against all local viral diseases before the start of experiment.

Growth performance study: The growth parameters study lasted for 90 days, including a 20-days adaptation period.

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During whole experimental period, the mixed rations were offered *ad libitum* for all allotted groups. Daily feed intake was recorded. The mixed rations were weighed daily and offered three times in a day (6 am, 12 Noon & 10 pm). The residue was collected and weighed and disposed off. The lambs was weighed weekly before morning feeding. Initial and final weight of trial was used to calculate the average daily gain (ADG), total gain and Feed: gain. Different nutrients intake was also calculated.

Digestibility trials: For digestibility trial all lambs were shifted to metabolic crates to determine the digestibilities of dry matter (DM), crude protein (CP), neutral detergent fiber (NDF) and acid detergent fiber (ADF). Digestibility trials were conducted for 7 days after every 14 days. Total four digestibility periods were conducted during whole the experiment. Trial period comprised seven days (three day preliminary period & 4 days for quantitative period) for complete collection of faeces and urine. During total collection method urine was collected in urine collection bowls and faces collected in faeces collection polyethylene bags fixed to the rear of lambs. Faeces and urine were collected twice in a day, weighed and represented sample stored at -20°C for further analysis. At the end of 7 days collection period, urine and faeces samples for individual pens were thawed and composite for individual pen lambs homogenized for four minutes. Composite samples dried at 55°C for 96 h and ground through 1 mm mesh. Urine samples were acidified with 50% H_2SO_4 during collection to avoid sample from N lose (Nisa *et al.*, 2004). Feed and faecal samples were analyzed for ADF, NDF by the methods of Van Soest *et al.* (1991), crude protein using Kjeldahal method described by AOAC (1990). Nitrogen balance was calculated using equation as described by NRC (2001).

Blood sampling and biochemical analysis: Blood samples (10 mL/lamb) were collected in vacationer tubes by jugular vein puncture containing 81 µL of 15% EDTA solution from which, the serum was harvest for further analysis. Blood glucose was analyzed by method as described by Davies *et al.* (2007), whereas creatinine was analyzed as described by Meyer (1996). Blood urea nitrogen was analyzed according to Bull *et al.* (1991).

Statistical analysis: The experiment was laid out in completely randomized design. At the time of maturity of lambs the data was collected and analyzed using Analysis of Variance using GLM with SAS (2000). The results found significantly different were treated by Duncan multiple range test for exploring of the treatment differences.

RESULTS

Nutrients digestibility and body weight: The DMI as % of body weight was nonsignificant ($p<0.05$) in lambs fed on concentrate (C), concentrate supplemented with ionophore (CI) and concentrate supplemented with probiotics (CP). The dry matter intake (DMI), as percent of body weight, had increasing tendency in CI and CP as compare to C (Table II). Matching trends were also observed in the CPI as % of body weight in all lambs fed C, CI and CP. The NDFI and ADFI as percent of body weight in lambs fed C, CI and CP were unaltered. The DM digestibility was unaltered ($p>0.05$) among all treatments but DM digestibility was 5% higher in lambs fed CP as compare to lambs fed C (Table II). Similar pattern was also observed in CP and ADF digestibilities. The NDF digestibility was significantly higher ($p<0.05$) in lambs fed CI and CP as compare to lambs fed C.

Nitrogen balance: The nitrogen balance was non-significant ($p>0.05$) among all treatments (C, CI & CP) in all lambs but the nitrogen balance was 2% higher in lambs fed CI as compare to lambs fed only C. (Fig. 1).

BUN, glucose and creatinine: The blood urea nitrogen (BUN) was unaltered ($p>0.05$) in all lambs fed C, CI and CP, which ranged from 20.13 to 21.38 mg/dL. Blood glucose value was significantly higher ($p<0.05$) in lambs fed CP as compare to lambs fed C and CI (Fig. 2). Serum creatinine has increasing ($p>0.05$) tendency followed by C, CI and CP in all lambs (Fig. 2). The all values for BUN, glucose and creatinine fell within recommended range value according to Merck Veterinary Manual.

Growth performance and economics of nutrition: The initial weight was unaltered among all treatments in all lambs. Matching trends were also observed in final weight and daily weight gain (Table III). The daily weight gain was 7% higher in lambs fed CP and 6% higher in lambs fed CI as compare to lambs fed only C. Economic of nutrition and feed to gain ration were also unaltered ($p>0.05$) among all treatments in all lambs (Table III).

DISCUSSION

The DMI as percent body weight is a measuring index of ruminant body satisfaction, as it increases with increasing body weight with age (Brown & Pate, 1997). Unaltered nutrients intake as percent body weight in CP and CI supplemented diets than only concentrate might be attributed to high crude protein and high energy diets, which are already providing adequate nutrients, while probiotics work efficiently in diets with low crude protein and high energy (Jouany *et al*., 1998a, b). The unaltered effect of yeast in present study is in agreement with Garcia (2000) who reported that DMI remained unaltered by yeast addition in the diets of Awassi lambs and Shami goats. Hernandez *et al*. (2009) reported that yeast culture supplementation in lambs had no effect on feed intake. Likewise unaltered effect of ionophore supplementation were supported by many researchers (Ding *et al*., 2008; Aguilera-Soto *et al*., 2008) who reported that monensin supplementation had no effect on DMI in lambs.

Unaltered response of lambs to probiotics and ionophore supplementation might be attributed to facts indicating that efficiency of probiotics differ depending upon the probiotic dose rate, stage of animals growth,

Table I: Ingredient and chemical composition

Ingredients	Concentrate	Concentrate + ionophore	Concentrate + probiotic
Corn grains	31.05	31.05	31.05
Soybean Meal	5.82	5.82	5.82
Wheat Bran	7.67	7.67	7.67
Cotton Seed Meal	6.13	6.13	6.13
Canola Meal	6.37	6.37	6.37
Rice Polishing	7.05	7.05	7.05
Wheat straw	10.00	10.00	10.00
Sunflower Meal	6.04	6.04	6.04
Corn gluten 30%	5.97	5.97	5.97
Molasses	8.32	8.32	8.32
Urea	0.49	0.49	0.49
Vegetable Oil	1.08	1.08	1.08
DCP	2.00	2.00	2.00
NaCl	1.00	1.00	1.00
$NaHCO_3$	1.00	1.00	1.00
Probiotic (%)	-	0.10	-
Ionophores, (mg/L)	-	-	20
Chemical composition			
Dry Matter	89.54	89.54	89.54
Crude Protein	18.00	18.00	18.00
TDN	70.00	70.00	70.00
ADF	12.48	12.48	12.48
NDF	21.90	21.90	21.90

Table II: Effect of concentrate with or without ionophore and probiotics on nutrients intake (% of body weight) and Nutrients digestibilities in growing *Lohi* male lambs

Parameters	Diets		
	Concentrate	Concentrate + ionophore	Concentrate + probiotic
Nutrient Intake (% of body weight)			
Dry Matter	3.65±0.54	3.86±0.77	3.87±0.25
Crude Protein	0.66±0.10	0.69±0.14	0.70±0.05
Neutral Detergent Fiber	0.78±0.11	0.82±0.16	0.82±0.05
Acid Detergent Fiber	0.46±0.07	0.48±0.10	0.48±0.03
Digestibility (%)			
Dry matter digestibility	66±4.68	68±3.20	69±3.72
Crude protein digestibility	74±1.28	72±3.02	75±1.20
Neutral detergent fiber digestibility	52^{b}±3.51	56^{a}±3.48	56^{a}±2.93
Acid detergent fiber digestibility	45±2.82	48±4.66	49±3.16

a,b =values in the same rows with different superscript differ significantly ($p<0.05$), C=Concentrate, I=Ionophores, P= Probiotic

Table III: Effect of concentrate with or without Ionophore and Probiotic on growth performance and economic of nutrition in growing *Lohi* male lambs

Parameters	Concentrate	Concentrate + ionophore	Concentrate + probiotic
Initial weight (g/d)	12.57±1.25	12.86±1.60	12.84±1.46
Final weight (g/d)	25.22±1.52	26.75±2.10	26.45±1.88
Daily gain (g/day)	139±6.45	148±10.52	149±7.56
Economic (Rs)	97±12.88	96±16.44	100±10.81
Feed: gain	5.04±0.67	4.99±0.85	5.13±0.55

animal age, viable yeast cell number, diets composition and strains of yeast (Chaucheyras-Durand *et al*., 2008). Unaltered nutrients digestibility in ionophore supplementation might be due to supply of nutrients more than their requirements. The ADF digestibility was unaltered in ionophore supplemented diets than without ionophore in lambs (Paterson *et al.,* 1983; Ricke *et al.,* 1984) with lasalocid supplementation regarding apparent total tract digestibilities of DM, NDF and ADF (Yang *et al*., 1993; Aguilera-Soto *et al*., 2008). Hernandez *et al.* (2009) reported that yeast culture supplementation in lambs had no affect on total tract digestion. Improved NDF digestibility in ionophore might be attributed to improved cellulytic and proteolysis activities in rumen. Improve fibre digestion was due to improve cellulose digestion by inhabitation the growth of lactate producing bacteria (Russell & Strobel, 1989). The NDF digestibility was higher in probiotic supplemented diets than without probiotic at different levels, which is consistent with earlier reports (El-Waziry & Ibrahim, 2007; Paryad & Rashidi, 2009).

No difference in N balance with or without probiotics or probiotic might be attributed to its reduced influence on rumen ecology, because of its lower dose rate as sufficient number of cells is necessary for alteration in rumen fermentation and digestibility (Kawas *et al*., 2007; Hernández *et al*., 2009). Unaltered effect of CI supplementation on N balance was supported by many researchers those reported that monensin supplementation had no effect on N balance as compared with the control (Ruiz *et al*., 2001; Benchaar *et al*., 2006).

Higher glucose concentration in probiotic supplemented diets might be due to better gluconeogenesis, which is responsible for maintaining the glucose concentration in blood (Crawford Jr. *et al*., 1969). Higher glucose may be due to propionic acid, which is the precursor of gluconeogenic and increased RUP ratio, which supplied glucogenic amino acids resulting into more gluconeogenesis and glucose (Sano *et al*., 2006). Abou El-Nor and Kholif (1998) reported that serum glucose is quite high in yeast based diets in ruminants, because probiotic induced the changes in rumen fermentation process (Arcos-Garcia *et al*., 2000) and this change increase the propionate concentration in rumen of lamb. A non-significant effect of ionophores on glucose concentration might be due to nature and composition of diets (Johnson *et al*., 1986; Van Maanen *et al*., 1978; Duff *et al*., 1994). Likewise Ding *et al*. (2008) reported non-significant difference in monensin based rations in lambs without monensin. Serum glucose concentration in lasalocid supplemented diets was unaltered in goat (Yang *et al*., 1993).

Unaltered effect of probiotic and ionophore supplemented diets on BUN might be due to similar ammonia absorption from rumen due to similar dietary composition and less effect of these feed additive on rumen ecology (Adams *et al*., 1981). Unaltered BUN concentration in yeast based diets than without yeast was consistent with the finding of Masek *et al*. (2008) in yeast *(Saccharomyces cerevisiae*) supplemented diet as compared to control diet in sheep. Likewise Ionophores had no effect on plasma urea N in lambs (Paterson *et al*., 1983; Yang *et al*., 1993). Similarly Spears and Harvey (1984) explained that BUN was unaltered in lasalocid supplementation. Non-significant creatinine concentration in ionophore and probiotic based diets agree with the findings of Galip (2006) who reported

Fig. 1: Effect of concentrate (C) with or without ionophore (CI) and probiotics (CP) on Nitrogen Balance (%) in male *Lohi* lambs

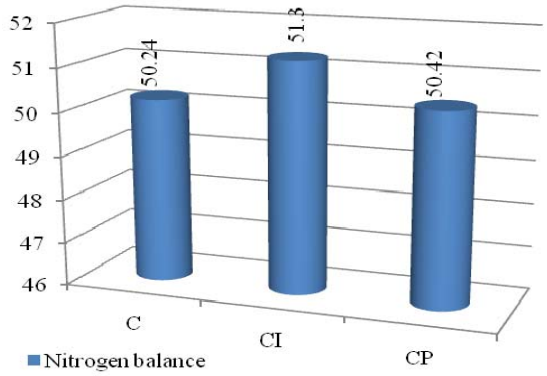
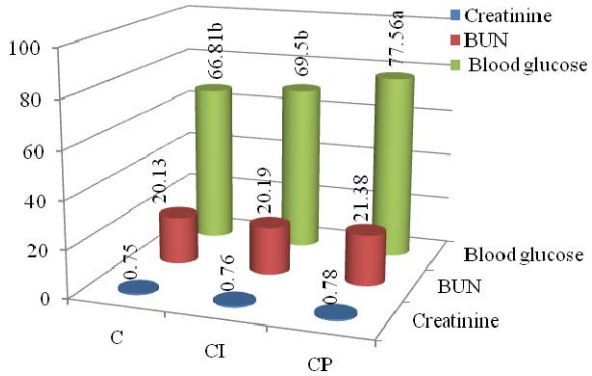


Fig. 2: Effect of concentrate (C) with or without ionophore (CI) and probiotics (CP) on blood metabolites (mg/dL) in male *Lohi* lambs



the non-significant distinction between yeast and without yeast diets in Kivircik ram. Belewu *et al*. (2008) also reported the unchanged creatinine level between control and probiotic supplemented shea-butter cake (7.5%) diets. Likewise ionophore has insignificant effect on serum creatinine at 7th, 35th, 73rd, 91st and 119th day of treatments in beef steers (Duff *et al*., 1994).

No change in weight gain with probiotic supplemented diets than without probiotic was consistent with the finding of Dominguez-Vara *et al*. (2009). Similarly chromium-yeast had no significant outcomes on weight gain. Brashears *et al*. (2003) also reported that the combination of two strains of probiotic had no significant effect on weight gain in ruminants. Similarly probiotic had significant effect on performance of dairy sheep and goats (Hadjipanayiotou *et al*., 1997). Unchanged effect of ionophore supplemented diets than without ionophore in lambs (Ding *et al*., 2008) who reported that ionophore supplemented diet had non-significant effect on average daily gain in lamb. Similarly Olatunji *et al*. (2006) and Morris *et al*. (1990) reported that daily gain and gain efficiency was unaltered in ionophore supplemented diets. Unchanged feed conversion ratio (FCR) in probiotic supplemented diets was consistent with the finding of Raeth-Knight *et al*. (2007), while that with ionophore based diets was consistent with the finding of Duff *et al*. (1994). Unaltered economic to produce one kg live weight in ionophore and probiotic was due to unaltered effect of these feed additives on ruminal ecosystem. Jabbar and Anjum (2006) reported lower cost of production of live weight gain in *Lohi* lambs at 75:25 concentrate to fodder ratio compared to 50:50 without ionophore and probiotic. Hutjens (1991) studies the impact of ionophore on production efficiency in term of economic and reported that there is 12:1 benefit to cost ratio in ruminants.

It is concluded that nutrients intake as % of body weight and DM, CP and ADF digestibilities and nitrogen balance were not different in C, CI and CP diets. NDF digestibility was significant higher in CI and CP. The BUN and creatinine were insignificant but blood glucose was higher in CP. The initial, final and daily weight gain, economic of nutrition and feed to gain ration were non-significant among all treatments in all lambs.

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