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RESEARCH ARTICLE

Impact of Different Crude Protein Levels on Growth of Lambs under Intensive Management System

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Abstract

Study was conducted on twelve uncastrated Kooka lambs about 6-7 month of age kept under intensive management system at Livestock Experiment Station, Faculty of Animal Husbandry and Veterinary Sciences, SAU, Tandojam. Animals were divided into four group i.e., A, B, C and D, where group A was treated as control and fed ration supplemented with 12% crude protein. While, group B, C and D were supplied ration containing crude protein concentration 14, 16 and 18%. During study, initial body weight observed on fortnightly, final body weight, feed consumption, feed conversation ratio and economics. The average initial live body weight was noted as 22.7 in group A, 22.3-B, 22.7-C and 22.3 kg/lamb in group D. Further, the results showed that highest live body weight was recorded in group C (40.0±1.1kg/lamb) followed by group D (36.0±0.85), B (35.0±0.8) and A (32.0±0.59), respectively. Feed consumption of lambs in over all experimental period was recorded; the lambs in group C consumed feed 188.0 kg/lamb, group B: 213.7, group A: 250.3, while lambs in group D (fed 18% CP) consumed highest feed 278.0 kg/lamb. Feed conversation ratio of Kooka lambs of group C was found to be most efficient i.e., 4.7:1, followed by group B-6.1:1 group A-7.8:1 and group D-7.85:1. Economic evaluation of experiment showed that the total cost of lambs in groups A, B, C and D was Rs. 7150, 7039, 6808 and 7340 per lamb which generated a total income of Rs. 7800, 8000, 8500 and 7900 per lamb with a net profit of Rs. 650, 961, 1692 and 560 per lamb, respectively. It was concluded that Kooka lambs fed ration containing 16% CP and 70% TDN gained highest significantly body weight, with FCR and generated net profit Rs. 1692 per animal than other groups.

INTRODUCTION:

Pakistan is an agricultural country and livestock being sub sector of agriculture, plays a significant role in national economy of Pakistan (Pasha and Khan, 2010). It contributes about 55.4% to value addition in the agriculture sector, and 11.9% to GDP. Among the livestock, population of sheep is 28.3 million number, it contribute 759 thousand tone of milk, 220 thousand tone of meat and 42.5 thousand tone of wool (Farooq, 2013). Role of sheep in improving the rural economy is well established. In the event of failure of seasonal rain, the rearing of sheep gives a helping hand to the farmers at the time of crisis arising from crop failure. Their fore, sheep is affectionately labeled as "mortgage lifter" by the rural poor (Gopalakirshnan and Morley, 1985).

Sheep converting non valuable roughages/grasses into valuable product meat, milk, wool, and skin, most of rural people engaged in this farming to increase meat production due to increasing demand for sheep mutton and also

scope for export it. Small ruminants especially sheep are growing in importance to meet animal protein requirements. The Performance of ruminants is influenced by the proportion of nutrients in their daily feed intake, the proper growth and development of growing lambs depends heavily on the nutrition. Nutrition has a profound effect on immunity and health. Nutritional deficiencies impair immune responsiveness and thereby, increase morbidity and mortality (Boon, 1995). Several micro and macro-nutrients are needed for normal maintenance and growth of animals. These include amino acids, essential fatty acids, and several vitamins and minerals. More recent studies have looked beyond deficiency of nutrients and focused on the level of nutrients needed for optimal growth response (Meydani et al., 1992). Energy is the major dietary element that is responsible for the different utilization of nutrients (Sinclair et al., 2008). Protein and energy are the main determinants in the ruminant feed that can alter the animal's performance. However, in developing countries ruminants are mainly fed on crop residues generally receiving only 62% of their crude protein (CP) requirements (Khalid et al., 2012).

Protein is an essential nutrient for growth and development of animals and thus a sufficient protein supply is a crucial factor for normal growth. In order to increase protein intake in animals, feeding ration should be formulated according to the protein requirement of animals and divided into portions so that it can be offered to animals, the fraction of proteins in feeding ration which are digested in rumen while the remaining fraction of proteins, which is not digested in rumen should be identified in excreted feces. Similarly, proteins which are degradable in rumen are not capable of providing protein requirement for high levels of meat & wool production in animals. Therefore, undegradable dietary protein (UDP) is necessary to provide amino acid requirement for potential growth of these kinds of animal. Feeding of ruminants according to their CP needs also reduces the hazards associated with excess and deficiency of this nutrient (Shahrbabak et al., 2006). Choei et al., 2005 reported that the 14%, 16%, and 20.3% levels of protein were used for the fattening purpose of lamb. Fattening of these animals with Crude protein for 90-100 days could add 9-10 kg weight and also improve the quality of meat (Pasha and Afzal, 2006).

Different vegetable protein sources are used to formulate the rations for growing and fattening lambs. These protein sources differ in amino acid profiles which results in varied responses (Khalid et al., 2012). Different protein sources in lamb diets like canola meal (CM), cotton seed meal (CSM), corn gluten meal (CGM) and sunflower meal (SFM) provide the condensed nutrients that may be efficiently utilized at ruminal level (Solomon et al., 2008). Quality protein with high values and efficient amino acid profiles in diets may result in better growth of lambs. Canola meal has a better amino acid profile with high lysine contents which makes it valuable to attain better growth rates in ruminants and higher sulphur contents that helps the microbes to synthesize essential sulphur containing amino acids and vitamins (Agbossamey, 1995). Cotton seed meal contains gossypol but their higher tolerances by ruminants allow its use for feeding (Gamboa et al., 2001). It also has a good amino acid profile. Corn gluten meal is a valuable source of methionine that complements other protein sources. Supply of these nutrients should be ensured to maximize the growth rate in young ruminants (Arthington and Kalmbacher, 2003). The main purpose of lambs fattening with various levels of crude protein is to get the most muscle tissue growth, without additional fat storage in meat, to get large amount of animal's protein with the least feed cost.

Limited work regarding the impact of different levels of crude protein on lamb growth has been reported under intensive management system in Pakistan. Therefore, the present study was designed to observed effect of various levels of crude protein on growth of Kooka lambs. To determine the effect of different levels of Crude Protein (CP) on live body weight gain of lambs.

MATERIALS AND METHODS:

Weighing balance: Manual weighing balance (Yameto Company made in China) was used to take weight of experimental lambs.
Analytical balance: Analytical balance (Mekong Company made in Taiwan) was used for the weighing of concentrate and green fodder.
Mangers: Large size plastic mangers were used to each experimental lamb for feeding.
Water tanks: Medium size water trough was used to each experimental lamb to provide 24 hours add libitum water.
Neck ring and rope: Cotton ropes 1 meter in length with 12 inches neck rings was used for binding of experimental lambs during feeding time.
Experimental procedure: Uncastrated Kooka lambs were purchased from Hyderabad pari (Market) and brought at Livestock Experiment Station, Sindh Agriculture University Tandojam. Before the beginning of experiment, lambs were treated in fifteen days of adaptation period to remove external & internal parasites and vaccinated against

seasonal contagious diseases (ETV, PPR all of injected subcutaneous) and anti-parasites drug was given to the lambs, after ten days washout period of treated agent. The initial body weight was recorded in the morning before offering any feed or water. Further, the weight of experimental lamb was recorded fortnightly and this process continued up to seven fortnights.

The experimental animals were divided into four groups i.e, A, B, C and D, where group A was treated as control according to national research council NRC (2007) and fed ration supplemented with 12% crude protein. However group B, C and D were supplied ration containing crude protein concentration 14, 16 and 18 percent, respectively. Each group was fed separately for fattening period of 105 days. Feed was given to each two times in the day (morning and evening) in large plastic manger, when fresh feed was given, the refusal feed was collected, weighed and subtracted from the total feed given, to obtain feed consumption. Ad libitum fresh water was given to each lamb; the water tub were emptied and refilled after every eight hours. In the experiment of impact of various levels of crude protein on uncastrated clinically healthy Kooka lambs following observations were recorded and described in (Table- 1 and 2).

1. Initial body weight (kg)
2. Fortnightly body weight (kg)
3. Final body weight (kg)
4. Feed consumption (kg)
5. Feed Conversation ratio (FCR)
6. Economics (Rs)

Statistical analysis: The data so obtain was tabulated and analyzed according to statistical procedure of analysis of variance (ANOVA) and in case of significant difference ,the mean were further computed used least significant difference (LSD) at 5% level of probability through computerized statistical package i.e. student edition of Statistix (SXW), version 8.1 (copyright 2005, analytical software, USA).

RESULTS:

The body weights of experimental un-castrated Kooka lambs of different group were analyzed and results are depicted in Fig. 1. The experimental animals were divided into four groups' i.e., A, B, C and D, where group A was treated as control fed ration supplemented with 12% crude protein. However group B, C and D were supplied ration containing crude protein levels 14, 16 and 18 percent respectively. The initial body weight was recorded in groups A, B, C and D as: 22.7 kg/lamb, 22.3 kg/lamb, 22.7 kg/lamb and group D: 22.3 kg/lamb respectively. There was no significant difference ($P>0.05$) set between initial body weights of groups. The final body weight was recorded in group A, B, C and D as: 32.0, 35.0, 40.0 and 36.0 kg/lamb respectively. It was noted that the live body weight of lambs of group C was found to be remarkably ($P<0.05$) higher than the group A, B, and D. However, mean value of body weight of group A was recorded as: 26.39±0.59 kg/lamb, group B: 28.02±0.8 kg/lamb, group D: 28.52±0.85 kg/lamb. While, group C was recorded highest mean value of live body weight (30.2±1.1 kg/lamb) than other groups. However statistical analysis (ANOVA) were showed that the mean of live body weight in group C was significantly ($P<0.05$) higher than that of groups. The groups A, B and D were also observed statistically non significant ($P>0.05$).

Table. 1. Experimental details

Groups		**A**	**B**	**C**	**D**
Breed		Kooka	Kooka	Kooka	Kooka
Lambs		3	3	3	3
Initial age of lambs (months)		6-7	6-7	6-7	6-7
Experimental Ration	CP%	12	14	16	18
	TDN%	70	70	70	70

Table- 2. Twelve Uncastrated Kooka Lambs under Intensive Management System

Groups	**A**	**B**	**C**	**D**
Crude protein levels	**(12%)**	**(14%)**	**(16%)**	**(18%)**
Animal Number	Tag Number	Tag Number	Tag Number	Tag Number
01-	AN-05	AN-09	AN-10	AN-11
02-	AN-01	AN-06	AN-08	AN-03
03-	AN-04	AN-12	AN-07	AN-02

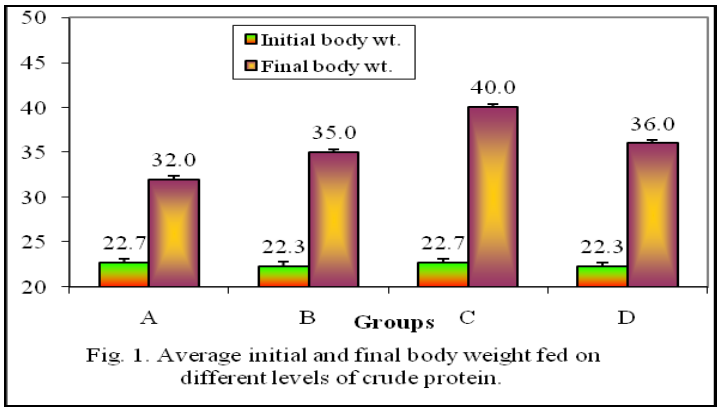

Fig. 1. Average initial and final body weight fed on different levels of crude protein.

Growth trend in body weight (%age) of all groups (A, B, C and D) showed the difference between (%ages) of body weights per fortnight. According to the trend the initial body weight (%age) of group A, B, C and D was 22.7 kg/lamb, 22.3 kg/lamb, 22.7 kg/lamb and group D was 22.3 kg/lamb, respectively. While, the final weight gain (%age) was reached at: 29.1%, 36.3%, 43.3%, and 38.1% in group A, B, C and D respectively. The growth trend showed that the weight gain (%age) per fortnight is remarkably increased in group C followed by group D, B, and A, which indicated that group C were gain highest body weight percentage Fig. 2.

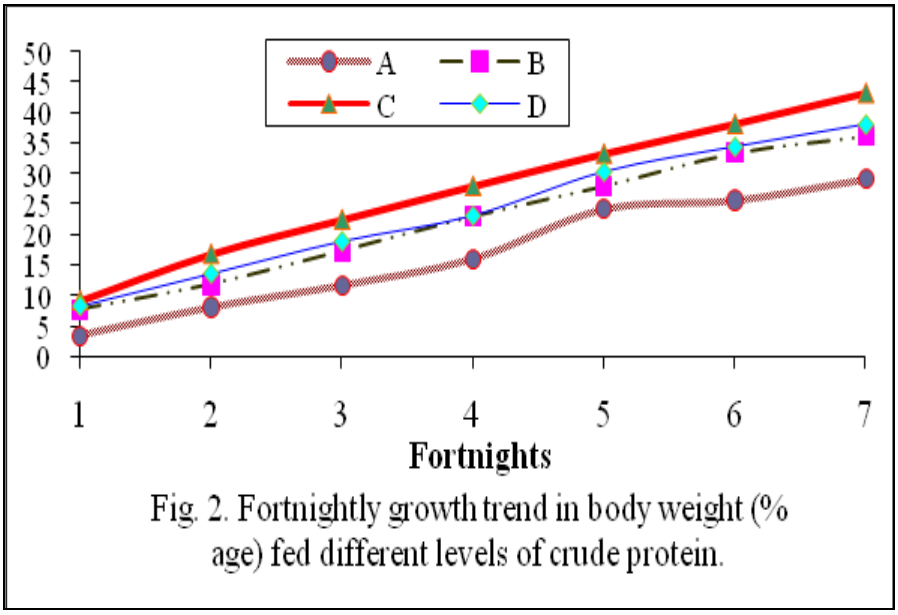

Fig. 2. Fortnightly growth trend in body weight (% age) fed different levels of crude protein.

The data on the feed consumption of Kooka lambs of different groups were analyzed and results are presented in Fig. 3. The average feed consumed per fortnight by group C was 26.9 kg/lamb, while the lambs kept in group A, B and D consumed average feed quantity of 35.7 kg/lamb, 30.5 kg/lamb and 39.8 kg/lamb respectively. While, maximum feed quantity consumed throughout experimental period by group A, B, C and D was 250.3 kg/lamb, 213.7 kg/lamb, 188.0 kg/lamb and 278.0 kg/lamb, respectively. Moreover mean value showed feed consumption of group A as: 35.7±1.24 kg/lamb, group B: 30.5±1.1 kg/lamb, group D: 39.8±2.13 kg/lamb and group C: 26.8±1.48 respectively, which indicated that group C was gain highest weight, consumed average minimum feed quantity. The statistical analysis (ANOVA) were showed mean of feed consumption of group-C was recorded as significantly high (P<0.05) then that of group A, B, and D. while, the group A and B were statistically non significant (P>0.05).

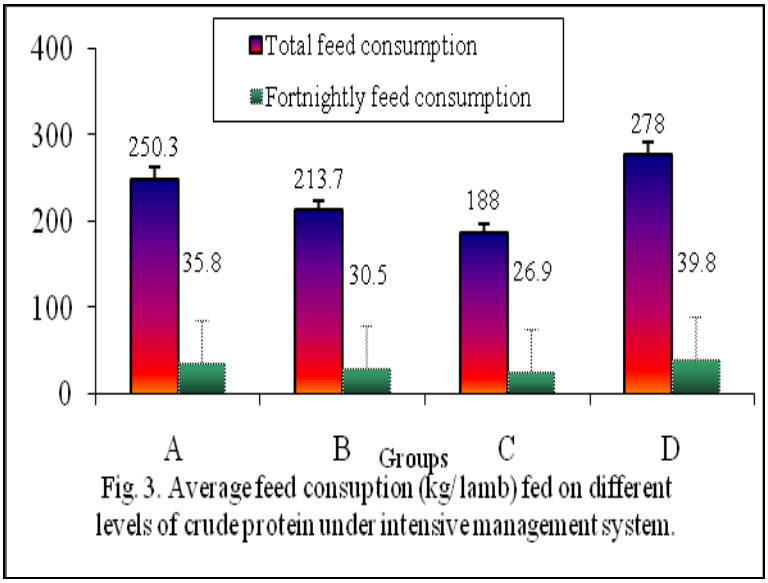

Fig. 3. Average feed consuption (kg/ lamb) fed on different levels of crude protein under intensive management system.

The feed conversation ratio (FCR) of Kooka lambs of different groups (A=12%, B=14%, C=16% and D=18% crude protein level, respectively were analyzed and results are presented in Fig. 4. The minimum feed conversation ratio in group A was recorded as 5.1: 1, in group B: 5.3: 1, in group D: 7.0: 1 and in group C: 4.0: 1, kg/lamb respectively. While the maximum feed conversation ratio of group A was noted as 9.5: 1, group B: 7.0: 1, group D: 9.0: 1, and group C: 5.3: 1, kg/lamb respectively. Furthermore mean value of (FCR) of each groups were recorded and presented in Figure 4. The value of group A was 7.8±1.4, in group B: 6.1±0.49, in group D: 7.8±0.61 and in group C: 4.7±0.39 kg/lamb respectively. The most efficient ratio of feed conversation were recorded in group C (fed 16% CP) which indicated that for gaining 1 kg weight, the lambs in this group consumed 4.7 kg of feed, followed by group-B, group-D and group-A, respectively, this indicating that the lambs in these three groups (A, B, D) consumed higher feed for gaining one kilogram of live body weight. The statistical analysis (ANOVA) showed that the feed conversation ratio of group-C was significantly (P<0.05) higher than that of group A, B, and D. while, the group A and D were recorded statistically non significant (P<0.05).

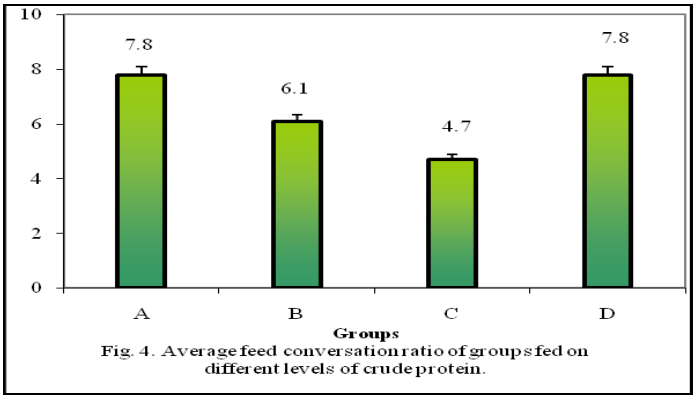

Fig. 4. Average feed conversation ratio of groups fed on different levels of crude protein.

Economic evaluation of feed containing different levels of crude protein were carried out on the basis of a series of variables which accumulate production costs, capital costs, weight gain and net profits etc. The data so calculated of the experiment are presented in (Table-3). Per animal total feed consumption in 105 days of group A was 250.3 kg/lamb, in group B: 213.67 kg/lamb, in group C: 188.0 kg/lamb and group D: 278.0, respectively.

The total cost of feed (concentrate + green fodder) per lambs in groups A, B, C and D, was Rs. 1505, 1389, 1258 and 1760/animal respectively and after accumulation of other costs, medication, vaccination, labor, miscellaneous and including the purchasing cost was Rs. 7150, 7039, 6808 and 7340/animal, respectively.

Total generated income per animal of groups A was Rs. 7800, in group B: 8000, in group C: 8500 and group D: 7900 rupees/ lamb, with a net profit per animal of group A, B, C and D was Rs. 650, 961, 1692 and 560 respectively. These figures indicated that lambs in group C fed on ration containing 16% CP had remarkably higher net profit (Rs 1692) as compared to lambs in other treatment groups.

Table. 3. Economics of lambs fed various level of crude protein during 105 days of experiment (per animal basis).

S. #.	Particulars	Groups			
		A	B	C	D
a	Consumption of feed (Kg) per lamb	250.3	213.67	188.0	278.0
b	Concentrate consumed (Kg) per lamb	28	29	25	30
c	Rate of concentrate (Rs/kg)	22	22.44	24.24	25.62
d	Cost of concentrate; Rs/lamb (BxC)	616	650.76	606	768.6
e	Green fodder consumed (Kg) per lamb	222.3	184.67	163.0	248.0
f	Rate of green fodder (Rs/kg)	04	04	04	04
g	Cost of green fodder Rs/ lamb (E x F)	889	738.68	652	992
h	Total feed cost (Rs) (D+G)	1505	1389	1258	1760
i	Cost of medication (Rs)	85	90	50	80
j	Labor cost (Rs)	800	800	800	800
k	Miscellaneous cost (Rs)	260	260	200	200
l	Purchasing cost of lamb (Rs)	4500	4500	4500	4500
m	Total cost (Rs) per lamb	7150	7039	6808	7340
n	Initial live body weight (kg) of lamb	22.7	22.3	22.7	22.3
o	Final live body weight (kg)of lamb	32.0	35.0	40.0	36.0
p	Weight gain kg/animal in (105 days	9.3	12.7	17.3	13.7
q	Sale cost (Rs) per lamb	7800	8000	8500	7900
r	Net profit P-M (Rs) per lamb	650	961	1692	560

DISCUSSION:

Sheep farming in Pakistan, particularly in Sindh is done on traditional patterns and no substantial development has been noted to this effect at mass level in the farming communities. Although, the sheep breeds found in Sindh province has great potential not only to fulfill the domestic needs of meat and wool, but a considerable foreign exchange can be earned by export of mutton and carpet wool. The present study was carried out to investigate the

impact of various levels of crude protein on the growth of lambs under intensive management system at Sindh Agriculture University Tandojam during the year, 2012-2013.

In the present study, it was noted that the body weight of lambs of group A (fed 12%CP) was increased from 22.7 to 32.0 kg and averaged as 26.39±0.61 kg. The body weight of group B (fed 14% CP) was increased from 22.3 to 35.0 kg and averaged as 28.02±0.81kg, group C (fed 16% CP) was increased from 22.7 to 40.0 kg and averaged as 30.2± 1.11 kg and body weight of group D (fed 18% CP) was increased from 22.3 to 36.0 kg and averaged as 28.52±0.85 kg. The results of present findings, showed that the body weight of lambs of group C was found to be remarkably ($P<0.05$) more than the group A, B, and D. The result of Titi et al., (2009) supports the current study, they reported that the lambs at 16%CP gain final weight higher ($P<0.05$) than those lambs which fed rations containing 12, 14, and 18% CP. Similarly, Ismail et al., (2009) reported that the daily live weight gain was more ($P<0.05$) of lambs fed with 16% CP than the lambs fed with 10% and 13%. Other researchers also evaluated that the lambs fed concentrate of crude protein 16% gain higher live weight than 14 and 20% crude protein levels (Bras and Zootec, 2005; Haddad et al., 2006). While, NRC (1985) listed sheep crude protein requirements based on a formula that divided the sum of protein deposited, metabolic fecal protein, endogenous urinary protein, and dermal loss by net protein value. This resulted in CP requirements of 16.2, 15.1, and 14.5% for moderate to rapid growth of early-weaned lambs weighing 20, 30, and 40 kg, respectively. Okumura and Tasaki, (1969) give reason of falling of response of animal to higher crude protein levels; they reported that growth performance will be increase when given ration contain required protein levels. But it will be decreased when ration contain too high levels exceeded from need of animal, because digestibility of crude protein first increased in rumen and then decreased due to break down of balance between energy and degradation of protein. Ding, (2003) found that 15.5 - 16% protein level showed the highest nitrogen absorption, but more than 16% protein level decrease nitrogen absorption in rumen of animal and require more energy to run nitrogen ammonia cycle. (Ozek and Bahtiyarca, 2004) reported that some protein not degraded in rumen it passes out to small intestine from the absorbed in nitrogen form to liver where they converted into urea. Zinn and Owens, (1993) also describe that microbial population in the rumen require more energy to degrade higher levels of crude protein into simpler nitrogenous molecules, because exceeded protein in ration was not only caused the wastage of protein, but also increased the burden on the metabolism of animals, diverting nutrients away from growth because animals could not effectively use crude protein more than required amount but also higher levels reduced animal performance.

Fed consumption of lambs raised under group A, B, C and D was recorded as: 250.3, 213.7, 188.0 and 278.0 Kg/lamb respectively. While, the feed conversation ratio (FCR) was noted higher ($P<0.05$) in group C (4.7:1) followed by group B (6.1:1) group A (7.8:1) and group D (7.85:1). In current study, the feed consumption was found higher in animals that fed 18% CP. It is accordance with the finding of (Hwangob et al., 2009) who reported that feed consumption increase with increase of protein levels, it might be attribute to several different factors such as physical characteristics of feed ingredients like grinding size, tenderness, smells, palatability of feed ingredients, dryness and moisture of feed ingredients, but their higher consumption give inverse results decrease metabolic efficiency of animal resulted in decrease in performance and feed conversation.

Economic of lambs was also calculated in the present study. The total cost of group A, B, C and D was Rs. 7150, 7039, 6808, and 7340 rupees/ lamb respectively. The net profit generated by group C (Rs.1692 per lamb) was more ($P<0.05$) than the group A: 650 Rs/lamb, group B: 961 Rs/lamb and group D: 560 Rs/ lamb. These results are in lined with the results of Shahbabak et al., (2006) who reported that cost on experiment for group A, B, C and D was Rs.7335, 6695, 6300 and 7930, with net profit of group A, B, C and D as Rs 730, 890, 1400 and 780 rupees per lamb respectively. It was noted from this research and other parts of the world on similar aspects, that the live body weight of lambs fed ration containing 16% CP (Group C) was found higher than the 12, 14 and 18% CP levels and also sold price became more of such group. The main purpose of animal fattening is to get the most muscle tissue growth with least feed cost and avoiding additional fat storage in carcass.

On the basis of present study, it was concluded that Kooka lambs feed on ration containing 16% CP and 70% TDN gained more body weight than the lambs fed ration having 12, 14 and 18% crude protein, respectively. Further, it is concluded that the feed conversation ratio (FCR) of Kooka lambs fed on ration containing 16% CP was remarkably higher than that of lambs fed ration containing 12, 14 and 18% CP. It is also concluded that the male Kooka lambs those fed on ration containing 16% CP were more economical and gaining more net profit as compared to other groups. Further, studies should be conducted on the influence of different levels of crude protein on blood chemistry, carcass yield and composition.

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