

## Research Article



## Effect of Different Levels of Protein and Energy Feeds on Growth Performance of Beetal Goats (*Capra aegagrus hircus*) in Punjab

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**Abstract** | Present study was conducted to observe the growth performance of beetle goats reared under natural environmental conditions and supplemented with special diets. Forty male goats of same age (6 months) and weight ( $14.41 \pm 0.02$ kg) were divided into four groups (A, B, C and D). These groups were randomly allotted to four experimental diets. Group-A (control) was given the usual diet of 20.75% crude protein (CP), the group-B were fed on diet of 21.23% CP, while the groups C and D were fed on diets having CP levels of 21.72% and 22.20%. The trial consisted of 60 days including the 10 days of adaptation period. The results indicated that group-D gained higher live weight ( $p > 0.05$ ) as compared to group-A (40.18kg vs 21.25kg). Likewise, groups B and C also gained higher weight ( $p > 0.05$ ) as compared to control group (37.65kg and 36.15kg vs 21.25kg). The findings on feed efficiency indicated that the group-D showed better feed efficiency ( $p > 0.05$ ) as compared to the group-A (2.35kg vs 4.45kg). Likewise, the feed of group B and C also showed better results ( $p > 0.05$ ) as compared to the animals of control group-A (2.50kg, 2.61kg vs. 4.45kg). However, there was no significant difference ( $p < 0.05$ ) in weight gain and feed efficiency among groups B and C. Overall results indicated a linear increase in weight and energy levels of beetle goats resulted in increased live weight gains and better feed efficiency.

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### Introduction

Livestock is one of the vital sources of livelihood for the majority of Pakistan. About 35–40 million people in Pakistan are related directly or indirectly with livestock industry, which makes up 55.1%

of agriculture and 11.5% of the country's GDP and greatly affects their quality of life ([Rehman et al., 2017](#)). Goats are among the first domesticated animals and are an essential part of almost all

developing tropical countries including Pakistan. Goats play a crucially important role in the economy of the country due to the demand of their meat and value as sacrificial animals ([Ramzan et al., 2020](#)). There are 28.21 million sheep and 62 million goats in the country, respectively and both breeds are essential for lowering levels of pervasive poverty. An estimated 616 thousand tons of mutton and 759 thousand tons of milk that are produced by sheep and goats, respectively provide quantity of high-quality protein to a sizeable human population ([Saeed et al., 2021](#)). There are about 30 breeds of beetal goats available in Pakistan and it is considered to be third largest goat populated country in world ([Khan et al., 2008](#)). Beetal goats are famous among farmers for their beauty and fast growing characters and its meat is highly delicious.

In Pakistan, the goats are typically kept by nomads, fed on low quality forages and naturally grown grasses but now a day, the goats are being raised on commercial lines fed on balanced feeds to get maximum profit out of these animals. Among all commercial goat breeds, the Beetal goats are mostly referred by farmers because of their quick growth ([Khan and Okeyo, 2016](#)). Growth rate of sheep and goats at various ages has been extensively studied and encouraging results were observed. Most sheep breeds have carcass percentages of 45 to 55%, which indicated inefficient feeding of these animals. The mature body weight of ten Pakistani goat breeds that have a good potential for producing meat is comparable. Most Punjabi goat breeds such as Nachi, Beetal, and Dera Din Panah raised under the traditional farming practices have a dressing percentage of 50%, which is higher than Indian goat breeds like Jamnapari and Serohi ([Magsi et al., 2020](#)).

Pakistan is deficient in the feed resources that are needed for ruminant livestock in

terms of protein, energy and dry matter. This deficiency results in low animal productivity. Proteins are required for production of cell products for example enzymes, hormones, milk and hair. In ruminants, amino acids come from dietary protein, and non-protein nitrogen and ruminal ammonia, which are synthesized into protein by rumen microbes ([Habib et al., 2016](#)). Molasses is an all-inclusive additive that has been used for a very long time to improve maturity and silage quality. The possibility of silage deteriorating is reduced since molasses increases the treated grain's carbohydrate content while decreasing oxygen entry and increasing the amount of unprocessed protein content. Pakistan has been supplying several million tonnes of easily available sugarcane molasses to many offshore companies for the past ten years ([Hartinger et al., 2019](#)). A better nutritional plan is required if the animals are weaned earlier in order to compensate the reduction in Average Daily Gain (ADG) caused by post-weaning stress. Intake of early-stage dietary protein is essential for promoting the growth in small ruminants. Studies demonstrated that high-protein diets are beneficial for the growth of small ruminants ([Olafadehan and Okunade, 2018](#)).

Little work has been done to see the effects of different protein and energy levels of feed on growth rates of native beetal goats, the present study was therefore designed to ascertain how different protein and energy levels of feed effected the growth of young beetal goats for fattening before slaughter.

## 2. Materials and Methods

### 2.1. Experimental site and design

The study was conducted at a private goat farm in district, Jhang, Punjab, Pakistan. This district is rich in goat population and is the major source of income for small

livestock farmers. Forty (40) male beetal goats were purchased from local market of about same age (6 months) and weight (about 15kg) which were included in the study. The animals were divided into four groups (A, B, C and D) having ten goats in each group. Four rations were prepared by mixing different feed ingredients which were also purchased from local market (Table 1).

**Table 1: Ingredients and their percentage used in different feeds for beetal goats**

Ingredients	Control Group-A	Group-B	Group-C	Group-D
Soybean meal	14	15	16	17
Canola meal	14	15	16	17
Corn Gluten	10	11.2	12.4	13.6
Corn Gram	19	20	21	22
Wheat Bran	40	35	30	25
Molasses	2	2.5	3.0	3.5
Sodium bicarbonate	0.4	0.5	0.6	0.7
Limestone	0.2	0.3	0.4	0.5
Sodium chloride	0.3	0.4	0.5	0.6
Mineral Mixture	0.1	0.1	0.1	0.1
Total	100	100	100	100

### 2.2. Studied animals and diet

Four rations/ diets were randomly allotted to four groups of animals which were kept/ placed in their separate feeding stalls/pens. Before putting the animals into the stalls, they were weighed and grouped according to their initial body weights and sizes so as the average weight of animals in each group becomes almost the same (14.41±0.02kg).

All the experimental animals were dewormed with locally available dewormer (Nilverm) and vaccinated before the start of the experiment. Free access to clean water and weighed quantity of formulated feed was ensured throughout the entire duration of the experiment. Ten (10) days preliminary feeding was done with standard diet to acclimatize the goats with environment and the feeding stalls. The animals were fed on group basis and feed was offered twice a day, 8:00am in the morning and 6:00pm in the evening along with three kg of green fodder per animal per day. Each animal was weighed before the trial and there after weekly weight was taken to measure the weight gain progress. Similarly the feed offered

and refusal was regularly monitored on daily basis to calculate the feed efficiency. The experiment lasted for 60 days. The feed samples were analyzed from district feed analysis laboratory for ash, crude fat, crude proteins, moisture, dry matter and Total Digestible Nutrient (TDN) and the results are shown at Table 2.

**Table 2: Chemical composition of feed samples for all four diets used in the trial**

Contents	Control Group-A	Group-B	Group-C	Group-D
Ash	4.86	5.06	5.26	5.46
Crude Fat (C.F)	2.55	2.41	2.31	2.14
Crude Protein (CP)	20.75	21.23	21.72	22.20
Moisture	9.50	9.4	9.30	9.21
Dry Matter (DM)	90.50	90.6	90.70	90.79
Total Digestible Nutrients (TDN)	63.46	62.57	61.69	60.80

### 2.3. Growth performance and feed intake

The data on weight gain and feed efficiency was obtained for each group on weekly basis. The animals were properly weighed on electronic weigh machine and the average daily gain of each group of animals was calculated as per Equation 1. While the feed efficiency/dry matter intake was calculated as per elaboration in Equation 2.

#### Equation 1:

$$ADG (gm/day) = \frac{\text{Change in weight during the study period (gm)}}{\text{No. of Days of study period}}$$

#### Equation 2:

$$DMI (gm/day) = \frac{\text{Total feed consumed during the study period (DM) in gm}}{\text{No. of Days of study period}}$$

## 3. Results

### 3.1. Growth performance

Overall weight gain (kg) in beetal goats during 9 weeks of study is shown in Table 3 and 4.

The results depicted a marked increase in the live weight gain of beetal goats. The animals of group-D were fed comparatively higher amounts of protein and energy (molasses) thus the gained weight was higher (40.18kg) as compared

to the animals of group-A (control) that were fed lesser amount of protein and energy (21.25kg).

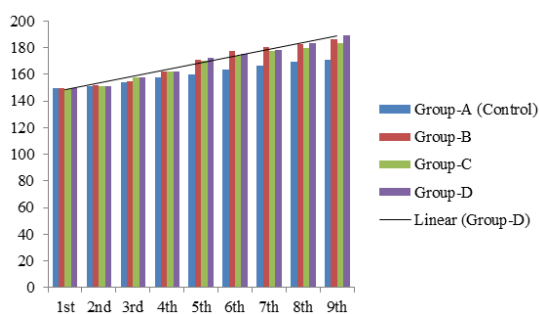
**Table 3: The combined weight gain in 9 weeks**

Week	Control Group-A	Group-B	Group-C	Group-D
1	149.65	149.6	149	149.75
2	151.25	151.45	151.1	151.3
3	154.1	154.8	157.50	157.80
4	157.5	162.4	162.4	162.3
5	160.1	170.8	170.3	172.0
6	163.5	177.4	173.9	175.0
7	166.2	180.4	177.7	178.0
8	169.3	182.5	179.8	183.0
9	170.6	186	183.3	189.0

**Table 4: Overall weight gain (kg) in 9 weeks in beetal goats**

Weight	Control Group-A	Group-B	Group-C	Group-D
Initial weight	149.35	148.35	147.15	148.82
Final weight	170.6	186.00	183.3	189.00
Total weight gain	21.25	37.65	36.15	40.18

It was also observed that the animals of group B and C gained also gained more weight (37.65kg and 36.15kg, respectively) as compared to the animals of control group-A. It was further noticed that the weight gain in animals increased with an increase in protein and energy levels. Statistically, it was observed and there was a significant difference ( $p>0.05$ ) on higher side in the animals of group B, C and D as compared to control group. However this difference was comparatively less among treatments as illustrated in [Figure 1](#).



**Figure 1: Weight gain (kg) in beetal goats during 9 weeks of study**

### 3.2. Feed efficiency

The results of feed utilization efficiency showed that the animals of group-D that were fed higher levels of protein and

energy had better feed utilization efficiency (2.35kg for 1kg gain in weight) compared to the animals of control group where the animal were fed lower levels of protein and energy (4.45kg for 1 kg gain in weight). Similarly among treatment groups, the feed utilization efficiency was comparatively better, 2.50kg and 2.61kg in animals of groups-B and C as compared to the animals of group-A (control). From the data it was observed that feed utilization efficiency improved with increased levels of protein and energy levels in the feed of animals ([Table 5](#)).

**Table 5: Overall feed utilization efficiency by beetle goats during trial**

Weight	Control Group-A	Group-B	Group-C	Group-D
Total weight gain (kg)	21.25	37.65	36.15	40.18
Total feed consumed (kg)	94.5	94.5	94.5	94.5
Feed efficiency	4.45	2.50	2.61	2.35

### 3.2. Statistical analysis

Two-way analysis of variance ANOVA was used to analyze data, where  $p$  value ( $p>0.05$ ) was considered significant difference between groups.

## 4. Discussion

There was a weight gain observed in the treated groups with the increase of protein levels (21.23%, 21.72% and 22.20%) as compared to the control group (20.75%), which indicated that the increased level of protein enhanced the weight gain in animals. The weight gain in the group-A was 21.25kg, in 60 days, whereas 37.65kg in group-B, 36.15kg in group-C and 40.18kg in group-D as shown. The findings of this study matched with the previous research studies that showed higher weight gain in all groups of animals when protein level was increased. Increased CP levels increased weight gain in all groups of Thai goats ([Chobtang et al., 2009](#)).

Studies were conducted to see the effects of feeding different dietary protein levels on the growth performance of beetal goats

that indicated, higher doses of CP significantly increased the growth, feed intake, and feed efficiency. Feeding the beetal goats with greater concentrations of protein levels (18%, 25.5% and 31.6%) showed an increase in feed efficiency and weight gain (41.8 kg, 42.5kg and 43.7kg respectively) ([Mohsan et al., 2019](#)). The results matched with current study findings that an increase in CP level also showed an increase in the weight gain in beetal goats of this trial.

[Hwangbo et al., \(2009\)](#) demonstrated that different level of CP content of TMR affected the growth capacity and meat quality of Korean black goats. TMR had CP levels of 14, 16, 18, and 20% of dry matter (DM). The findings of this study indicated that the ultimate body weights gain of 32.09, 32.70, 33.25 and 32.6kg for maturing Korean black goats was an appropriate level of CP in TMR for attaining the best productive efficiency and meat quality. These results were in agreement with the findings of current study that indicated that the different protein levels had positive effect on the growth performance of beetal goats.

Further investigations were done to determine the impact of feeding dietary CP levels in the weight gain in lambs; as a result, feeding lambs in growth larger CP doses dramatically improved growth performance. Greater protein concentrations (12, 14, 16 and 18%) were fed to the lambs, which resulted in increased weight gain 32.0, 35.0, 40.0 and 36.0kg respectively ([Abbasi et al., 2014](#)). The results were consistent with recent research findings showed that the weight gain in experimental animals increased when CP levels were raised.

Dietary protein is an essential ingredient that has a direct impact on the wellbeing and productivity of cattle. Protein supplements improved Tibetan sheep's

ability to grow according to recent studies. Low protein (LP, 10.1%), medium protein (MP, 12.1%) and high protein (HP, 14.1%) diets were the three treatment groups. According to the findings, Tibetan sheep given the MP and HP diets had higher final weight gain. With LP, the overall weight gain was 47.8 kg, with HP it was 55.7 kg, and with MP it was 52.8 kg ([Wang, et al., 2020](#)). The results were consistent with recent research showing that weight growth in experimentation animals increases when CP levels rise.

Three levels of crude protein in the male goats were examined. Goats were distributed randomly among three diets supplemented with protein levels of 11.5% (A), 14.5% (B), and 16.5% (C). For 60-days study, feed efficiency, overall weight gain, carcass characteristics, and digestibility were examined. The highest daily dry matter consumption was 707.9g with CP level of 11.5% which showed no significant relationship ( $p>0.05$ ) between protein levels and dry matter intake. The relationship between feed efficiency and overall weight growth was significant ( $p>0.05$ ), with a larger weight gain of 22.04kg and a superior feed efficiency of 6.17 with CP level of 16.5% as reported by [Pirzado et al., 2016](#). These outcomes supported the current study's findings that the growth performance of Beetal goats had positive impact of various protein levels.

## 5. Conclusion

Overall the results of present study indicated that the linear increase in protein and energy levels in the feed given to beetal goats showed higher weight gain and better feed efficiency and the outcomes of the study were in agreement with the results of much previous research findings on the subject.

## 6. Author's Contribution



Authors contributed equally.

## 7. Conflict of Interest

No conflicts.

## 9. Novelty Statement

A little work has been done to see the effect of different protein and energy levels of feed on growth rates of native beetal goats, the present study was therefore designed to ascertain how different protein and energy levels of feed effects the growth of young beetal goats for fattening before slaughter.

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