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Effect of dietary energy and protein levels on certain serum enzymes activities in ghungroo pigs

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Abstract
An experiment was conducted to evaluate the effect of dietary energy and protein levels on certain serum enzyme activities in growing indigenous (Ghungroo) pigs. Twenty-four piglets were selected and divided into four groups. Four different rations prepared by maintaining 2 levels of protein and 2 levels of energy and fed to respective groups *i.e*, high protein-high energy (Gr-I), high protein-low energy (Gr-II), low protein-high energy (Gr-III), and low protein-low energy (Gr-IV). Blood samples were analyzed at day 0, 30, 60 and 90 for estimation of serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT) and serum alkaline phosphatase (ALP). All the enzymes increase with advancement of age in all the groups. However, no significant differences were observed in enzyme level and were found within the normal range. These results indicated that the ration with low protein and high energy could be optimal to sustain the serum enzymes level within the range.

Keywords: Ghungroo pigs, Energy level, Protein level, Serum enzymes

1. Introduction
The pig is one of the most economically important species among domesticated livestock and is a major protein source for human consumption. A major objective of pig production is to increase skeletal muscle growth and reduce excess fat accretion. Livestock researchers and producers practice various nutritional strategies in an attempt to increase protein accretion in the muscle, while they often simultaneously reduce fat deposition (Dunshea *et al.,* 2005; Tan *et al.,* 2009) [1, 2]. The growth and development process of pigs include changes in body weight and shape as well as metabolic and physiological functions depends on factors such as the breed, nutritional status, and feeding condition of the animal. The protein and energy ratio is important for the production performance and utilization of available feed resources by animals. Increased protein consumption by mammals leads to elevated feed costs and increased nitrogen release into the environment (Liu *et al.,* 2015) [3]. Economic and viable rearing of pigs depends upon the efficiency of feed utilization as feed accounts about 70-75% of total cost of swine production. Swine can convert fed more efficiently than any other livestock. Thus, a carefully planned and efficient feeding programme is essential for successful swine production. The study of blood composition has received great significance from economic standpoint of nutrition because levels of various serum components often serve as a valuable strategy in evaluating nutritional status of the animal. So it has been realized that serum profile often reflects the nutritional adequacy of the diet as well as nutritional status of the animal (Baruah *et al.,* 1988) [4]. Against this background, the objective of the present study was to examine the effect of dietary energy and protein levels on concentration of certain serum enzyme in growing indigenous (Ghungroo) pigs.

2. Materials and methods
2.1 Experimental animals and design
A total of 24 indigenous (Ghungroo) pigs of about 10-12 weeks age with 12.47 ± 0.08 kg mean body weight irrespective of sex were used as experimental animal. Prior to the start of experiment the male animals were castrated by open method and all animals were conditioned for a period of 15 days during which they were fed standard diet, dewormed and vaccinated against the prevalent contagious diseases. They were reared under standard hygienic and uniform managerial conditions throughout the experimental period. During the experimental periods, the pens were washed and cleaned every day before feeding and watering. Feeding and watering troughs were cleaned regularly to avoid any digestive disturbances. After 15 days

of conditioning period, all the animals were randomly divided into four different groups of six animals each having both male and female animals. Four different rations were prepared by maintaining two levels of protein (high protein-100 % and low protein-75%) and two levels of energy (high energy-100% and low energy-75%) of NRC (1998) [5]. The percent compositions and metabolizable energy content of the ingredients in different rations were calculated. Experiment was conducted in a 2×2 factorial design for a period of 90 days. Four different rations *viz.* rations-I, II, III and IV were fed to four respective group of animals *i.e.* high protein –high energy (Gr-I), high protein –low energy (Gr-II), low protein-high energy (Gr-III) and low protein – low energy (Gr-IV) (Table 1).

Table 1: Ingredient composition of experimental rations fed to different groups

Ingredients	% Level			
	Ration-I	Ration -II	Ration -III	Ration -IV
Maize grain	72	45	72	42
Wheat bran	-	25	2	25
Rice polish	-	7	8	20
Soy bean meal	16	12	7	5
Groundnut cake	4	-	3	-
Fish meal	5	8	5	5
Mineral mixture	2	2	2	2
Salt	1	1	1	1
Total	100	100	100	100
Composition of mineral mixture				
Calcium= 28%, Phosphorus= 5%, Sodium chloride=23.5, Iron=0.35%, iodine=10ppm Copper= 100 ppm, Manganese=200ppm, Cobalt= 50 ppm				

2.2 Data recording and sampling

The nutrient density (CP %; ME, M cal/Kg) in different experimental rations was calculated from the values of ingredients used for formulating the experimental rations. The body weight of all the animals was recorded individually on day 0 and at monthly interval for a period of 90 days. The individual body weight of the pig was recorded to compute average daily gain (ADG) in body weight. Blood samples were collected during morning before feeding and watering from each animal of different treatment groups at monthly intervals for a period of 90 days *viz*. on day 0, 30, 60 and 90.

2.3 Serum enzymes

Serum was separated for estimation of enzymes *viz.* serum glutamate pyruvate transaminase (SGPT), serum glutamate oxaloacetate transaminase (SGOT) and serum alkaline phosphatase. The estimation of SGOT, SGPT and serum alkaline phosphatase activity was performed by using *in vitro* diagnostic kits manufactured by Merck Limited India, was expressed in U/L.

2.4 Statistical analysis

Statistical analysis of the experimental data was carried out by using 2x2 factorial design as described by Snedecor and Cochran (1994) [6].

3. Results and Discussion

3.1 Nutrient Density

Four different experimental rations were prepared with two levels of protein and two levels of energy (Table 1). The estimated percentage of crude protein and calculated metabolizable energy content of different experimental rations *i.e.* high protein high energy (100% CP; 100% ME Kcal/kg), high protein low energy (100% CP; 75% ME Kcal/kg), low protein high energy (75% CP; 100% ME Kcal/kg) and low protein low energy (75% CP; 75% ME Kcal/kg) based on NRC (1998) [5] feeding standards are given in Table 2. As desired, the percentage of protein in high protein groups was higher by 3% than the low protein groups. Similarly, the energy content in high-energy rations was higher than the low energy rations. The calorie protein (CP) ratio ranged from 1:177 to 1:228 in different experimental groups.

Table 2: Nutrient density of the experimental rations based on ingredient table value

Parameter	Ration			
	I	II	III	IV
CP%	18.21	18.43	15.23	14.98
M.E. (Kcal/kg)	3458	3258	3468	3268
C P ratio	1:190	1:177	1:228	1:218

3.2 Average Daily Gain

The average daily gain (g) in body weight was found to be highest in Gr-I which was almost similar to Gr-III and lowest in Gr-IV which was similar to Gr-II. Gain in bodyweight in Gr- I and Gr-III were significantly higher than Gr-II and Gr-IV.

3.3 Serum Enzymes

The effect of different treatments on serum enzyme is summarized in Table 3. The normal levels of the enzymes were observed within the normal range that correlates with the findings of Kaneko *et al.* (2008) [7].

Table 3: Effect of different levels of protein and energy in the rations on various serum enzymes of Ghungroo pigs

Serum enzymes	Group	Days			
		0	30	60	90
SGPT(U/L)	Gr-I	18.00 ± 0.90	19.15 ± 0.48	19.80 ± 0.57	20.20 ± 0.73
	Gr-II	18.02 ± 0.91	19.00 ± 0.52	19.65 ± 0.79	19.92 ± 0.90
	Gr-III	18.00 ± 0.82	18.50 ± 0.68	18.80 ± 0.50	19.00 ± 0.40
	Gr-IV	18.03 ± 1.09	18.40 ± 0.85	18.85 ± 0.41	18.99 ± 0.46
SGOT(U/L)	Gr-I	22.00^{a} ± 0.98	23.22^{ab} ± 0.59	23.40^{bc} ± 1.03	25.42^{bc} ± 0.53
	Gr-II	22.02^{a} ± 0.76	22.90^{ab} ± 0.93	24.01^{bc} ± 0.78	25.30^{bc} ± 0.85
	Gr-III	22.01^{a} ± 0.63	22.30^{ab} ± 0.90	23.45^{bc} ± 0.77	24.50^{bc} ± 0.88
	Gr-IV	22.00^{a} ± 0.91	23.00^{ab} ± 0.67	23.80^{bc} ± 0.93	25.00^{bc} ± 0.82
ALP (U/L)	Gr-I	150.00^{a} ± 1.61	152.28^{b} ± 2.31	152.50^{bc} ± 1.72	154.30^{b} ± 1.97
	Gr-II	150.28^{a} ± 1.06	152.99^{b} ± 1.43	154.07^{bc} ± 2.93	154.98^{c} ± 2.40
	Gr-III	150.83^{a} ± 2.33	154.00^{b} ± 2.18	154.98^{bc} ± 2.08	156.00^{c} ± 1.85
	Gr-IV	150.30^{a} ± 2.21	155.28^{b} ± 1.45	156.20^{bc} ± 1.89	158.02 ± 1.18

Values with different subscript in a row differ significantly in days (P<0.05)

The mean SGPT activities in different experimental groups ranged from 18.56 ± 0.36 to 19.24 ± 0.36 U/L during the experimental period of 90 days. There was no significant effect of different levels of protein and energy on SGPT level in Ghungroo pigs amongst the different experimental groups as well as between the days (Table 3). The findings of the present experiment on serum SGPT are in contrast with Sahoo (2001) [8] who reported serum SGPT level as 20.00 to 26.25 U/L when fed on diets containing different levels of de-oiled rice polished with or without enzyme supplementation. High SGPT values are observed by Neog *et al.* (2003) [9] in group fed high protein diet due to high body protein catabolism.

The mean SGOT activities in different experimental groups ranged from 23.07 ± 0.57 to 23.51 ± 0.71 U/L during the experimental period (90 days). The SGOT activities were highest in Gr-I and lowest in Gr-IV. There was no significant (P > 0.05) effect of protein and energy observed on SGOT amongst the groups, however, the activity of SGOT was significantly ($P<0.05$) increased at day 30, 60 and 90 days of experiment. In the present experiment the higher SGOT activity observed was inconsonance with the result observed by Saikia *et al.* (2003) [10]. However, increased SGOT values were observed with increased level of energy due to increased metabolic activity (Lehninger, 2004) [11]. The blood glucose and protein level had direct influence on transaminase activity. Low glucose level triggered the gluconeogenesis to maintain the blood sugar level as a result the SGOT value increased due to high body protein catabolisation (Lehninger, 2004) [11].

The mean serum ALP activity in different experimental groups ranged from 152.27 ± 0.95 to 154.96 ± 1.00 U/L from 0 to 90 days of experiment. The highest value of serum alkaline phosphatase (U/L) was observed in Gr-IV and lowest in Gr-I. ALP activity was found to be significantly ($P<0.05$) increased in different groups with advancement of age. But no significant difference ($P>0.05$) was observed in ALP activity amongst the experimental groups. The serum alkaline phosphatase value was highest in Gr-IV and lowest in Gr-I. Higher serum alkaline phosphatase value observed in group fed on low protein diet (Ashida 1963; Deka and Gaur 1994) [12, 13]. The serum alkaline phosphatase value has increased from day 0 to 90 *i.e.* during their growth as reported by Guyton (2006) [14]. The energy and protein level had direct influence on serum alkaline phosphatase activity. The dietary deficiencies especially protein causes high level of alkaline phosphatase activity.

4. Conclusions

From the findings of the present experiment it can be concluded that the ration with low protein and high energy could be optimum to sustain the serum enzymes level within range in growing indigenous piglets.

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