



Research Article

STUDY OF DIFFERENT PROTEIN LEVELS ON PRODUCTIVE PERFORMANCE OF LANDRACE PIGLETS

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Abstract: This experiment was conducted in Swine and Avian Research Program, Khumaltar, Lalitpur from 2017 to 2018 for the period of 180 days. The objective of this study was to evaluate the different dietary protein level on effects of grower and starter piglet performance. Locally available feed ingredients were used for the feed formulation. Chemical analysis of all required feed ingredients was done and feed was formulated on the basis of nutrient requirement of pig. There were four treatment group (T1-22%, T2-20%, T3-18%, T4-16% for starter level and (T1-20%, T2-18%, T3-16%, T4-14%) for grower level diet. Sixteen Landrace piglets (30 days old) were selected; four piglets were allocated in each treatment. Data was recorded for monthly average body weight, feed intake and feed conversion ratio. One finisher pig was slaughtered from each treatment for meat quality evaluation and sensory evaluation for different parameters was done by using formatted questionnaire. There was significant different in feed conversion ratio and body weight gain ($p < 0.05$). FCR was better in treatment 3 (2.78) compared to other treatment (2.90, 2.92, 2.95). During starter phase, the average body weight gain was higher in treatment 1 (48.25kg) but grower phase's showed contrast as body weight in treatment 3 (63.50) was recorded to be highest. No significant difference in feed intake was recorded. Cumulative feed intake was 177 kg in all treatments group. Similarly, proximate analysis of carcass indicated 20% protein content in starter diet and 16% protein in finisher diet should be ideal for better body weight gain and feed conversion ratio.

Keywords: Protein, Carcass, Landrace, Starter, Finisher

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Introduction

Nepal's livestock numbers are estimated to be 7.27 million cattle, 5.24 million buffaloes, 10.17 million goats, 0.8 million sheep, 48 million poultry, and 0.37 million ducks [1]. The percentage of improved livestock accounts for only 13% in cattle, 25.9% in buffalo, 4.6% in sheep, 6.1% in goats, 34.2% in pigs, and 54.2% in poultry [2]. The remaining livestock populations are local indigenous breeds which are low in productivity and performance. Demand of the pig meat in the country has been increasing in recent years with the marked shift in the preference of the consumers towards good quality-low priced meat. The number of pigs reared and the farmers keeping pigs increased accordingly, there are reports of increasing piglet mortality, low quality meat produced and a big economic loss to the pig farming communities. Commercial pig production in some of the districts in Nepal is developing very fast. The pig growers need regular supply of piglets of good genetic quality. They need training on low-cost production technology, modern husbandry practices together with knowledge on diseases management in order to produce good quality pork from healthy pigs, which can fetch better price. Important thing is good quality of nutrition which includes proper balance of nutrient in diet resulting better growth. Profitability of pig enterprise depends on efficient use of feed for lean tissue growth and the rate of growth. Growth rate and nutritional requirement of pigs are two essential factors necessary for maximum pork productivity. An ideal nutritional programme should provide adequate nutrients to maximize pig productivity while minimizing excreted nutrients and feed costs. Increasing feed grains and supplements cost effects the total cost of pig production which represent 70% of total variable cost. This cost play important role to determine profitability of swine enterprises. Young pig's use most of the ration they consume for the growth and maintenance. Edwards [3] studied 75 % of total feed used in a farrow-finish operation is consumed in the grower-finisher phase.

Mature pig use feed mainly for maintenance and reproduction. Commercial farmer needs the high-quality nutritional package for the pig farming. The amount of protein in ration and quality of (balanced) amino acids of protein are extremely important in swine ration. Balanced pig ration includes two main components energy and amino acids. Many ingredients in Nepal are appropriate for use in pig diet for example: maize, soybean meal, wheat bran and rice bran for pig ration. Corn is good source of energy and soybean meal is important for protein and amino acids. Both ingredients are important for better growth and development in swine. In Nepal, demand of the pig meat has been increasing in recent years with the marked shift in the preference of the consumers towards good quality-low priced meat. The number of pigs reared and the farmers keeping pigs increased accordingly, there are reports of increasing piglet mortality, low quality meat produced and a big economic loss to the pig farming communities. Pig producers will have to continue using a combined program of scavenging with little supplementation of wheat and rice bran particularly during finishing period. In addition, some good quality fodders can also be provided especially on farms, which produce legumes as part of the pasture program. The advantage of complementary forage feeding is that it can counteract certain deficiency symptoms that arise due to improper balance of certain minerals and vitamins. The productivity of high-yielding breeds has therefore been decreasing for this reason despite farmers' efforts to keep productive breeds in their farms. Therefore, there is an immediate need for the improvement of starter feed with high content of protein. Study of pig farming in the eastern part of Nepal in low input system of management suggests that the small scale indigenous black pig farming in village can contribute Rs 468 to their income by one weaned piglet, but when they were reared for one year of age, fetch Rs 3719 in the market with a very little input spent.

Yet another on-farm study at Kathmandu valley, farmers can make a profit of Rs 9360 from one Landrace or Yorkshire sow after 60 weeks with medium level of management and feed input. They need training on low-cost production technology, modern husbandry practices together with knowledge on zoonotic diseases in order to produce good quality pork from healthy pigs, which can fetch better price. Ball *et al.*, (2013) [5] studied that pig under 40 kg or less than 13 weeks of age require diets containing higher level of protein and for pig above 40 kg dietary protein level can be lowered with no adverse effects on performance. The young animal reported as not only growing at a more rapid rate as indicated by the percentage increase in the weight but that proportion of the protein in the entire body weight is higher that during the finishing period. National Research Council [6] suggested feeding standard for pig among the different classes. Due to high cost of and lack of feed and feed ingredients, pig farmers still occasionally and haphazardly mix one or two ingredients together without mentioning for age and nutrient requirement of the piglets [7,8].

Materials and Methods

The experiment was conducted for 180 days from 2015-2016 in Swine and Avian Research Program Khumaltar farm. Chemical analysis of all purchased feed ingredients (crude protein, crude fibre, ether extract, and ash) was done for feed formulation based on nutrient composition for the pigs.

Table-1 Composition of ingredients in pig diets for starter (kilogram)

Ingredients	Treatment 1	Treatment 2	Treatment 3	Treatment 4
Maize	40	40	40	40
Rice Bran	18	18	15	15
Wheat choker	10	10	10	10
Soybean meal	20	10	8	5
Mustard cake	8	8	8	8
Sunflower cake	0	10	15	18
Bone meal	1	1	1	1
Mineral mixture	1	1	1	1
Salt Multi vitamin	1	1	1	1
lysine	0.10	0.10	0.10	0.10
Methionine	0.12	0.12	0.12	0.12
Total	100	100	100	100

Table-2 Analyzed Nutritive composition of feed (Starter)

	Treatment 1	Treatment 2	Treatment 3	Treatment 4
Dry matter (%)	96	95	96	97.22
Crude Protein (%)	22	20	18	16
Ether extract (%)	12	11.21	11	10
Crude fibre (%)	3.89	4.1	4.12	5.22
Ash (%)	6.12	6.21	6.10	6.10

Table-3 Composition of ingredients in pig diets for finisher (Kilogram)

Ingredients	Treatment 1	Treatment 2	Treatment 3	Treatment 4
Maize	45	40	40	40
Rice Bran	20	18	15	12
Wheat Choker	12	10	10	12
Soybean meal	10	9	7	5
Mustard cake	10	10	10	10
Sunflower cake	0	10	15	18
Bone meal	1	1	1	1
Mineral mixture	1	1	1	1
salt	1	1	1	1
lysine	0.10	0.10	0.10	0.10
Methionine	0.12	0.12	0.12	0.12
Total	100	100	100	100

The experiment was conducted in 4*4 ANOVA design with four different treatments where protein level 16, 18, 20 and 22 were used for piglet weight until 40 kg and protein level was decreased in trends 20,18,16 and 14 respectively afterwards. A total of sixteen piglets of Landrace were used. Four piglets were used in each treatment and each piglet was used as replication. The required levels of protein were fulfilled using the locally available and cheap source of ingredients which is given in [Table-1] and [Table-3]. Starter diet was formulated and used from 15 kg till 40 kg body weight and finisher diet was used after this period. All the data were processed by SPSS ver 20.0 and the results were

expressed in terms of 5% level of significance to describe the difference in the different for statistical validation.

Table-4 Analyzed Nutritive composition of feed (Finisher)

	Treatment 1	Treatment 2	Treatment 3	Treatment 4
Dry matter (%)	96	95	96	97.22
Crude Protein (%)	20	18	16	14
Ether extract (%)	12	11.21	11	10
Crude fibre (%)	3.89	4.1	4.12	5.22
Ash (%)	6.12	6.21	6.10	6.10

Chemical Analysis

All feed sample were analyzed for DM, CP, EE, CF and Ash by standard methods AOAC [2] in Animal Nutrition Division and meat sample was analyzed in Food technology Division, Khumaltar, Lalitpur.

Assessments of carcass

Pigs were slaughtered for the carcass quality inspection. The carcass was cut 13th and 14th rib in loin area to measure pH. value and proximate analysis.

Statistical Analysis

Experimental data were processed and analysis of Randomized Block Design using SPSS ver 20.0 package.

Results and Discussions

Monthly body weight

The monthly body weight of piglets was measured till six months for growth trend and is given in the [Table-5].

Table-5 Average monthly body weight (kg)

Treatments	Average Monthly Body weight (kg) (mean±SE)				
	2 months	3 months	4 months	5 months	6 months
1	21.2±0.01 ^a	27.5±0.050 ^a	48.25±0.06 ^a	54.00±0.06 ^a	60.50±0.05 ^b
2	18.5±0.02 ^b	27.72±0.06 ^a	46.50±0.07 ^b	51.00±0.07 ^b	61.00±0.07 ^b
3	19.0±0.04 ^b	27.41±0.05 ^a	46.87±0.05 ^b	53.25±0.06 ^a	63.50±0.06 ^a
4	17.6±0.01 ^b	25.71±0.07 ^b	48.00±0.07 ^a	52.00±0.07 ^b	61.00±0.07 ^b
P value	**	**	**	**	**

P value- Probability value, SE-standard error, NS- Non significance** level of significance at 5%

There was significant different in average monthly body weight among the treatments ($P<0.05$). This result revealed that average monthly body weight in 6 month were highest in treatment 3 (63.50kg) followed by treatment 2 (61.0kg), treatment 4 (61.0kg), and treatment 1 (60.50kg) respectively. The possible reason for such outcome might be due to the difference in level of protein used in starter and finisher ration. As the protein level in treatment 3 for starter was used @20% and finisher for 16% while the same for remaining were used in different amount. Thus, this suggests that the level of protein for starter and finisher should be 20 % and 16% respectively for proper growth and development. The finding of this result also agrees with Jorgensen *et al.*, (1996) [9] as the authors reported that higher fibre resulting higher organ weight cause higher body weight and the same is the outcome of this study.

Feed intake and feed conversion ratio

The feed intake and feed conversion ratio of piglets were measured till six months for and is given in the [Table-6]. These results showed that total cumulative feed intake was same in all treatments group. There was no significant difference for cumulative feed intake in different treatment group. However, Feed Conversion Ratio (FCR) was slightly better in treatments 3 (2.78) followed by treatment 2 (2.90), 4 (2.90), and treatment 1 (2.95). Additionally, there was significant different between treatment 1, 2, and 4 with treatment 3 ($P<0.05$). The possible factor for such outcome might be due to the difference in level of protein used in starter and finisher ration. As the protein level in treatment 3 for starter was used @20% and finisher for 16% while the same for remaining were used in different amount. Thus, this suggests that the level of protein for starter and finisher should be 20 % and 16% respectively for proper growth and development. The finding of this result also agrees Anugwa and Okwori (2008) [10] as they reported that ideal feed conversion ratio and economic feeding should be in 16% protein content diet.

Table-6 Feed intake and feed conversion ratio until 6 months age

Treatments	Cumulative Feed Intake (kg) (mean±SE)	FCR
1	177±0.80	2.95±0.01 ^a
2	177±0.90	2.90±0.02 ^a
3	177±0.70	2.78±0.01 ^b
4	177±0.89	2.90±0.02 ^a
P value	0.08	0.04
Level of significance	NS	**

FCR- Feed conversion ratio SE-standard error, NS- Non significance** level of significance at 5%

Proximate analysis of carcass

The different parameters of proximate analysis for carcass have been given in the [Table-7] as under.

Table-7 Proximate analysis of carcass

Treatment sample	Moisture (%)	Crude Protein (%)	Crude fat (%)	Total Ash (%)	pH at 26 °C
Treatment 1	62.05	17.21	16.62	1.15	5.81
Treatment 2	61.01	17.00	16.50	1.12	5.75
Treatment 3	60.10	18.25	17.00	1.45	5.32
Treatment 4	60.17	18.10	18.79	1.35	5.58

Proximate analysis of pork sample from different groups in [Table-4] showed that moisture percent was little high in treatment 1 (62.05%) followed by treatment 2 (61.01), treatment 4 (60.17) and treatment 3 (60.10) respectively. Crude protein was high in treatment 3 (18.25%) followed by treatment 4 (18.10%), treatment 1 (17.21%) and treatment 2 (17.00%) respectively. Crude fat was in higher percentage in treatment 4 (18.79%) followed by treatment 3 (17.00%), Treatment1 (16.62%) and treatment 2 (16.50%) respectively. The finding obtained by Kerr *et al.*, (1995) [11] correspond to our findings as the authors reported that low protein diet has higher energy value resulting the deposition of the excess energy to form of fat. Total ash percentage was found high in treatment 3 (1.45%) followed by treatment 4, (1.35%) followed by treatment 4 (1.35%), treatment 1 (1.15%) and treatment 2 (1.12%) respectively. pH value at the 26.0oc there was high pH in treatment 1 (5.81) followed by treatment 2 (5.75), treatment 4 (5.58) respectively. Consumer test results also showed better meat quality treatment 3 due to good texture.

Conclusion

These results indicated that 20% protein content in starter diet and 16% protein content in finisher diet should be ideal for better body weight gain and feed conversion ratio. Likewise, finisher ration with 16% percent of crude protein is ideal for best quality meat.

Application of research: This study was designed to investigate the effects of different protein level on performance with finding the suitable feeding standard for the commercial pig farmers

Research Category: Livestock Production and Management

Abbreviations: ANOVA: Analysis of Variance, CP: Crude Protein, CF: Crude Fiber, DM: Dry Matter, EE: Ether Extract, FCR: Feed Conversion ratio, SPSS: Statistical Product and Service Solutions

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Research project name or number: Study of different protein levels on productive performance of Landrace piglets.

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Study area / Sample Collection: Swine and Avian Research Program, Khumaltar, Lalitpur, NARC

Breed name: Landrace Pig

Conflict of Interest: None declared

Ethical approval: Ethical approval taken from Nepal Agricultural Research Council, Kathmandu, Nepal.

Ethical Committee Approval Number: Nil

References

- [1] MoAD (2012) Ministry of Agricultural Development, Agribusiness Promotion and Statistics Division, Agri Statistics Section, Singhdurbar, Kathmandu Nepal. Statistical Information on Nepalese Agriculture. Accessed 2 May 2017.
- [2] MoLD (2016) Ministry of Livestock Development. Commitment paper (Nepali). Accessed 2 May 2017.
- [3] Edward S. (2010) Proceedings of the 1st Nigerian International pig Submit, Institute of Agriculture Research and Training, Moor Plantation Ibadan, 22-25, November, 2010, 69-77.
- [4] Dhaubhadel T.S. and Ghimire R.P. (2003) Proceedings of the Fifth National Workshop on Livestock and Fisheries Research, 2003, Khumaltar, Kathmandu, Nepal
- [5] Ball M.E.E., Magowan E., Mccracken K.J., Beattie V.E., Bradford R., Gordon F.J., Robinson M.J., Smyth S. and Henry W. (2013) *Asian-Aust. J. Anim. Sci.*, 26(4), 564-572.
- [6] National Research Council (NRC) (1988) *Nutrient Requirement of Swine*, 9th rev.ed. National Acad. Press, Washington D.C.
- [7] AOAC (1990) *Official Methods of Analysis*. 15th edition Association of official Analytical Chemist, Arlington, Virginia
- [8] Fanimio A.O. (1991) *PhD Thesis, University of Ibadan, Ibadan*
- [9] Jorgensen H., Zhao X., Eggum B.O. and Zhao X.Q. (1996) *British Journal of Nutrition*, 75,365-378.
- [10] Anugwa F.O.I and Okwori A.I. (2008) *African Journal of Biotechnology*, 7(15), 2665-2670.
- [11] Kerr B.J., Mckeith F.K., Easter R.A. (1995) *J. Anim.Sci.*, 73, 433-440.