**EFFECT OF TURMERIC POWDER (*Curcuma longa*) AS GROWTH PROMOTER IN CROSS BRED HAMPSHIRE PIGS**

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**Abstract**

**Background and Aim:** The issue of drug resistance and search of alternative growth promoters has diverted many researchers to the use of herbal feed additives in feeding of livestock. The research is conducted to investigate the effect of different levels of turmeric as growth promoter on growth performance, feed conversion ratio and economics in cross bred Hampshire pigs.

**Materials and Methods:** A total of twenty - four Hampshire (cross bred) male pigs about 3 months of age, were randomly divided into four groups; control and treatment groups E1, E2 and E3 with 0.5, 1.0 and 1.5% respectively per 100 kg of feed. The study was conducted in AICRP ( All India Co – ordinated Research Project) farm, Khanapara, College of Veterinary Science, Khanapara, Guwahati – 22.

**Results: B**ody weight was measured every fortnightly. Digestibility was significantly lower in control groups and high in E2 group (1 %). The average daily gain in body weight and feed conversion efficiency of pigs were 369.44± 7.94, 441.67±9.38, 511.11±11.11 and 444.44±7.03 g; 4.01±0.26, 3.23±0.15, 3.03±0.04 and 3.4±0.16 in control, E1, E2 and E3 groups respectively. Significant (P<0.05) difference was observed between control and treatment groups in respect of average daily gain and feed conversion efficiency**.**

**Conclusion:** The inclusion of the turmeric powder (*Curcuma longa*) into the diet of growing pigs as feed additive have a positive effect in growth of pigs. but best result was observed in E2 group which was given 1% turmeric powder

**Key words**: Pig, Turmeric, Digestibility, Feed conversion ratio

**INTRODUCTION**

South Asian Countries like Bangladesh, India, Nepal, Bhutan, and other countries, is the home of pig farming (Gatenby and Chemjong 1992; Dukpa *et al*. 2011; Prasad *et al*. 2011; Nahar *et al*. 2012). Low caste Hindus in India keep pigs and eat pork because they are low on the social order (Stevenson 1954). During the customary celebration, they slaughter pigs and serve pork as a feast (Dhagamwar, 2003). Agriculture and non-vegetarian eating habits are the primary occupations of the North Eastern people. The sociocultural practices and means of subsistence of the tribal farmers are greatly influenced by backyard pig keeping, which is an essential component of their heritage. According to the 19th livestock census, pig population in India is 10.29 million as compared to world population of 977.02 million (FAOSTAT, 2014). North Eastern region consist of 38.42% of the total pig population of India and Assam possess highest 2,249,690 numbers of pigs among the NE states. Pork is naturally rich in protein. Pork is a source of zinc, selenium and vitamins B12 and B6 that help the immune system to work normally. Pork is a source of vitamins B12, B6, Niacin and Riboflavin – B vitamins that help reduce tiredness and fatigue as part of a healthy balanced diet and lifestyle. Pork is among the second highest consumed meat in the World according to 21st livestock census pork meat. Consumption in India was 2.95 lakh tonnes in 2021. Out of the total production, the north-eastern States consume the meat more than other States. While there are differences in the pig production systems of different ethnic groups, regions, and cropping systems, the main characteristics of these systems are small units, reliance on traditional management, fattening over breeding, reliance on locally available feed and food waste, low productivity, and the use of various Indigenous Traditional Knowledge (ITKs) by each tribe in general management, healthcare, and breeding systems. Over time, the production system has been dominated by traditional management, which is based on traditional knowledge from their respective area. The key difference is that native pigs have been primarily replaced by crossbreds, while scavenging practices have given way to penning (Singh and Mollier, 2016). For the management of the pig during its many growth stages, farmers are forced to adopt and rely on time-tested traditional wisdom due to their socioeconomic origins, isolated locations, and lack of access to veterinary care and medicine.

Pig farming helps to improve the economic conditions of tribal people and upgrade the socio-economic conditions. Pig rearing, among other species has a high potential to contribute to high economic gain due to two reasons: First the pigs have high fecundity, high feed conversion efficiency, early maturing, short generation interval and relatively small space requirement. Secondly, they are multipurpose animals providing about 40% of meat consumed in the world market, and by-products like pig dung as manure and bristle for brush industry. People of certain ethnic groups prefer to keep pigs, especially black ones, for festivals and ceremonial purposes. Interestingly, these ethnic groups are mainly concentrated in the North-Eastern Region where almost 28% of the country’s total pig population exists. Many strategies are used to improve pig production e.g. Implementation of Breeding Policies, Use of alternative nonconventional feed resources, Establishing **Pig Cooperatives Involving Women Entrepreneur,** Organize awareness programme among farmers, **Establishment of Livestock Extension Services for Pigs,** Establishment of **Modern Disease Diagnostic Laboratory, to improve marketing infrastructure, provide pig insurance to the pig farmers (Talukdar *et al.* 2018)**

In livestock industry natural feed additive is gaining an important place against antibiotic growth promoter. Turmeric is produced, consumed, and exported most frequently from India. India cultivated 3.24 lakh hectares of turmeric in 2022–2023; the country produced 11.61 lakh tons of turmeric, or more than 75% of the world's total. India cultivates more than 30 types of turmeric, which are cultivated in more than 20 states. The states that produce the most turmeric are Tamil Nadu, Telangana, Karnataka, and Maharashtra (Reported my Mistry of Commerce and Industry Posted On: 04 OCT 2023 3:30PM by PIB Delhi). Assam produces 20.88 thousand tonnes of turmeric. INDIA has a rich history of using plants for medicinal purposes Turmeric (*Curcuma longa* L.) is a medicinal plant extensively used in Ayurveda, Unani and Siddha medicine has home remedy for various diseases. *C*. *longa* L., botanically related to ginger (Zingiberaceae family). In recent times, traditional Indian medicine uses turmeric powder for the treatment of biliary disorders, anorexia, coryza, cough, diabetic wounds, hepatic disorders, rheumatism and sinusitis. The coloring principle of turmeric is the main component of this plant and is responsible for the anti-inflammatory property. India accounts for about 80 per cent of world turmeric production and 60 per cent of world exports. As per the latest market rates, the average Turmeric price is ₹7492.7/Quintal. The lowest market price is ₹4352/Quintal. The costliest market price is ₹12000/Quintal. Hence, this research was conducted to study the ability of turmeric powder as growth promoter in grower pigs. n various age groups of monogastric animals, including pigs, poultry, and fish, the use of curcumin has significantly improved a wide range of nutritional features, including growth, reproductive ability, digestibility, stress response, immunological systems, and histopathology (Maniruzamman *et al*. 2021)

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1. **Materials and Methods**
	1. **Ethical Approval**

As slaughtering was not conducted thus ethical approval was not required.

* 1. **Location of the study**

The study was conducted in All India Co-ordinated Research Project (A.I.R.C.P.) on Pigs, Assam Agricultural University, Khanapara, Guwahati – 22. The feeding trial was performed for a period of 60 days (from 16.25±1.48 kg mean body weight to 42.75±0.53 kg mean body weight) during which a digestibility trial was conducted on 6 animals of each group for a period of 7 days

* 1. **Preparation of Turmeric powder ( *Curcuma longa* )**

The turmeric was purchased locally from the market, fine powder was prepared and kept in air tight packets. The turmeric powder was given in powdered form to treatment groups as per treatment details.

* 1. **Experimental Design**

A total of twenty - four Hampshire (cross bred) pigs about 3 months of age, irrespective of sexes were randomly divided into four groups - control (Standard grower ration with no turmeric supplementation) and treatment groups E1 (Standard grower ration with 0.5 % turmeric powder) , E2 ( Standard grower ration with 1 % turmeric powder ) and E3 ( Standard grower ration with 1.5 % turmeric powder) having 6 animals in each group. Each animal represents replicate from individual groups. The experiment was carried out following the recommendation of BIS (1994). The ingredients taken for computation of ration were maize, wheat bran, de-oiled ground nut cake, soyabean meal, fish meal and turmeric powder. All the animals were given access to ad libitum feeding. The chemical composition of the four experimental rations was analyzed as per AOAC, 1990 for dry matter (DM), total ash, crude fiber, nitrogen and crude protein, ether extract.

**Measurements**

*Animal Performance*

 Fortnightly change in body weight (kg), Daily feed intake (kg) in group feeding, nutrient utilization and Economics of pig production were recorded during the research work.

*Digestibility Trial*

During the digestibility trial feed, feed residue, feacal sample were collected from all animals.

**Chemical Analysis**

 Feed, residue, feacal sample were dried at 100°C for 8 hours and then grinded and sieve before analysis. All samples were analyzed for crude protein, Crude fibre, ether extract, total ash, acid insoluble ash, calcium and phosphorous. In case of faeces calcium, phosphorous estimation is not done.

**Statistical Analysis**

Statistical analysis was done as per Snedecor and Cochran (1989)

**Result & Discussion**

**1. Chemical composition of Pig Grower Ration**

The chemical composition of turmeric powder used in research is given in Table 1. The percent chemical composition in terms of crude protein, ether extract and nitrogen free extract were in good agreement with the results of Bhowmik *et al.* (2008) and Chattopadhyay *et al.* (2004). The ingredients used in grower ration is given in Table 3. The Chemical composition of grower pig ration (on DM basis) is given in Table 4. The crude protein content and ME content of the experimental rations were 18% and 3107 Kcal/kg of the ration (BIS, 1992).

**2. Change in body weight**

The average initial body weight of pigs ranges from 16.17±1.38 kg to 16.33±1.43 kg and average final body weight of pigs varied from 38.33±1.45 to 46.83±1.56 kg. The body weight was taken fortnightly and significant difference was found between the treatment groups in respect of final body weight. In respect of average gain in body weight (Table 4) all the experimental group E1, E2, E3 differ significantly (P<0.05) from the control. Highest mean daily gain was found highest in E2 group (511.11±11.11) with 1 % turmeric followed by E3 group (444.44±7.03) with 1.5 % turmeric and E1 group (441.67±9.38) with 0.5 % turmeric powder. The findings of the present experiment in respect of growth was in good agreement with Park *et al.* (2000), Durrani *et al.* (2006), Wang *et al.* (2008), Onu *et al.* (2011) and Galib *et al.* (2012).

**3. Average Feed Intake (g) in Pigs**

The average fortnightly feed intake by the experimental pigs has been depicted in Table 4. The feed intake of experimental pigs of all the groups were increasing along with increase in body weight. The lowest feed conversion was found in E2 (1%) group, which could be attributed due to feed flavor and is in good agreement with the result of Lanjewar *et al.* (2009) and Korniewicz (2007).

**4. Average Feed Conversion Ratio of Experimental Pigs**

There was significant difference (P<0.05) in feed conversion ratio between the treatment groups and it was observed that E1, E2, E3 significantly differ from control group. The improved feed conversion efficiency may be due to inclusion of turmeric powder in the diet that may result in an improved gut environment and microflora. The result of the present experiment in respect of feed conversion efficiency was in good agreement with Galib *et al.* (2011), Cullen *et al.* (2005), Onu   *et al.* (2011) and Kumari *et al.* (2007)*.*

**5. Economics of Pig Production**

It was observed that cost/kg gain in live weight (Table 5) was lowest in 1% incorporated turmeric powder group i.e. E2 group (Rs 53.56) followed by E1 (Rs 57.48) followed by E3 (Rs 63.79) followed by Control (Rs 66.27). Growth efficiency in early stages is the important factor in profit complex. Sincethe cross bred pigs grow at a faster rate, thereby at this stage the calculation of cost/kg grain is an important factor. The result of present experiment revealed that at growing stage (20-40 kg), the pigs grew efficiently when diet containing 1% turmeric powder is fed along with the ration. Broiler fed with 0.3 percent of Turmeric powder was economical due to its improved weight gain in less feed consumption, efficient feed conversion ratio and higher water intake than other treatment as well as control. Namagirilakshmi (2005) and Durrani *et al*. (2006) reported that supplementation of turmeric powder in broiler diet at 0.5 per cent level had lowered the cost (Rs. 23.10 and Rs. 30.00) of production par live weight compared to control (Rs. 24.62 and Rs. 34.00)

**TABLE 1: PERCENT CHEMICAL COMPOSITION OF TURMERIC POWDER:**

|  |  |
| --- | --- |
| **PARTICULARS** | **TURMERIC POWDER** |
| DM | 90.6 |
| OM | 93.26 |
| CP | 6.9 |
| EE | 5.3 |
| CF | 2.07 |
| NFE | 78.99 |
| TA | 6.74 |
| Ca | 0.05 |
| P | 0.2 |

**Table 2: Ingredients of Pig Grower Ration:**

|  |  |
| --- | --- |
| **Ingredients** | **Quantity (kg)** |
| **Control** | **E1** | **E2** | **E3** |
| Maize | 60 | 60 | 60 | 60 |
| Wheat Bran | 14 | 14 | 14 | 14 |
| De-oiled GNC | 10.5 | 10.5 | 10.5 | 10.5 |
| Soyabean Meal | 7.5 | 7.5 | 7.5 | 7.5 |
| Fish Meal | 5 | 5 | 5 | 5 |
| Mineral Mixture | 2.5 | 2.5 | 2.5 | 2.5 |
| Salt | 0.5 | 0.5 | 0.5 | 0.5 |
| Turmeric | - | 0.5 | 1.0 | 1.5 |

**TABLE 3: PERCENT CHEMICAL COMPOSITION OF EXPERIMENTAL (GROWER) RATION (on DM basis):**

|  |  |
| --- | --- |
| **PARTICULARS** | **INGREDIENTS** |
| DM | 90.89 |
| OM | 91.95 |
| CP | 16.7 |
| EE | 4.19 |
| CF | 4.46 |
| NFE | 66.6 |
| TA | 8.05 |
| Ca | 2.83 |
| P | 0.79 |

**Table 4: Fortnightly change in Feed Intake (FI), Average Daily weight gain (ADG), Feed Conversion Ratio (FCR) of all groups**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group** | **1st Fortnight** | **2nd Fortnight** | **3rd Fortnight** | **4th Fortnight** | **Avg. FCR** |
| **FI** | **ADG** | **FCR** | **FI** | **ADG** | **FCR** | **FI** | **ADG** | **FCR** | **FI** | **ADG** | **FCR** |
| **Control** | 17.44±0.07 | 4.995±0.003 | 3.49 | 20.22±0.34 | 5.5±0.34 | 3.68 | 24.12±0.35 | 5.67±0.21 | 4.26 | 27.00ad±0.52 | 5.83a±0.1 | 4.63 | 4.01a±0.26 |
| **E1** | 17.56±0.01 | 6±0.26 | 2.93 | 20.43±0.36 | 6.5±0.22 | 3.14 | 24.04±0.32 | 6.83±0.31 | 3.52 | 26.00a±0.37 | 7.17b±0.17 | 3.63 | 3.23b±0.15 |
| **E2** | 18.67±0.008 | 6.17±0.4 | 3.03 | 22.05±0.6 | 7±0.26 | 3.15 | 25.08±0.15 | 8.5±0.22 | 2.95 | 26.92c±0.49 | 8.995c±0.003 | 2.99 | 3.03c±0.04 |
| **E3** | 17.17±0.006 | 5.83±0.31 | 2.94 | 21.52±0.44 | 6.33±0.33 | 3.4 | 25±0.1 | 7±0.37 | 3.57 | 26.82d±0.48 | 7.33bd±0.21 | 3.65 | 3.4d±0.16 |

**Table 5: COST OF FEEDING PER KG LIVE WEIGHT GAIN OF PIGS OF DIFFERENT TREATMENT GROUPS**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Treatment** | **Feed consumed (Kg)** | **Feed cost per kg (Rs)** | **Cost of feeding (Rs)** | **Total body weight gain (Kg)** | **Cost of feeding per kg live weight gain** |
| C | 88.78 | 16.55 | 1469.31 | 22.17 | 66.27 |
| E1 | 88.04 | 17.3 | 1523.09 | 26.5 | 57.48 |
| E2 | 92.7 | 18.05 | 1673.24 | 30.67 | 53.56 |
| E3 | 90.49 | 18.8 | 1701.21 | 26.67 | 63.79 |

**CONCLUSION**

It is concluded that turmeric powder had significant effect in all treatment groups but best result was observed in E2 group which was given 1% turmeric powder. The findings of this study that significant difference (P<0.05) was observed between the groups in respect of DM intake per 100 kg body weight. The E2 group differed significantly (P<0.05) from the other groups in respect of final body weight, total gain and rate of mean daily gain in body weight. Thus, it can be concluded that turmeric at the rate of 1% can be included in pig diet at grower stage which will help to improve feed intake, growth, feed conversion and economics of production in pig.

**Disclaimer (Artificial intelligence)**

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Details of the AI usage are given below:

1.

2.

3.

**Reference**

1. Bhowmik S, Chowdhury SD, Kabir MH, Ali MA. Chemical composition of some medicinal plant products of indigenous origin. The Bangladesh Veterinarian. 2008; 25(1):32-39.
2. BIS (1992). Bureau of Indian Standard
3. Chattopadhyay I, Biswas K, Bandhopadhyay U, Banerjee R. Tumeric and curcumin: biological actions and medicinal applications. Current Sci. 200487:44–53
4. Cullen SP, Monahan FJ, Callan JJ, O'Doherty JV. The effect of dietary garlic and rosemary on grower-finisher pig performance and sensory characteristics of pork. J Agric Food Res. 2005;44:57-67.
5. Dhagamwar V. Invasion of criminal law by religion, custom and family law. Economic and Political Weekly. 2003: 38:1483–1492
6. Dukpa. K., Robertson. I.D. & Ellis. T.M.  The seroprevalence of foot-and-mouth disease in the sedentary livestock herds in four districts of Bhutan. *Preventive Veterinary Medicine. 2011.* 100, 231–236.
7. Durrani FR, Ismail M, Sultan A, Suhail SM, Chand N, Durrani Z. Effect of different levels of feed added turmeric (*Curcuma longa*) on the performance of broiler chicks. Journal of Agricultural and Biological Science; 1:9-11.
8. Galib, A.M.; Al-Kassie, Ghassan, Y.; Butris, Saba, J. and Ajeena. The potency of feed supplemented mixture of hot red pepper and black pepper on the performance and some hematological blood traits in broiler diet. International Journal of Advanced Biotechnology Research. 2012. 2(1):53-57.
9. Gatenby R.M. & Chemjong P.B. Reproduction of pigs in the hills of eastern Nepal. *Tropical animal health and production.* 1992. 24, 135–142.
10. Kumari P, Gupta MK, Ranjan R, Singh KK, Yadava R. Curcuma longa as feed additive in broiler birds and its pathophysiological effects. Indian J Exp Biol. 2007. 45: 272-277.
11. Lanjewar R D, Zanzad A A, Ramteke B N, Lalmuanpuii P E, Taksande and Patankar R B. . Incorporation of Tulsi (Ocimum sanctum) leaves powder in diet of broilers for quality meat production. Vet. World. 2009. 2(9):340-342.
12. Moniruzzaman M, Kim H, Shin H, Kim H, Kim N, Chin S,.. Evaluation of dietary curcumin nanospheres in a weaned piglet model. *Antibiotics.* 2021. 10:1280.
13. Nahar N., Uddin M., Sarkar R.A., Gurley E.S., Uddin K.M., Hossain M.J.  Exploring pig raising in Bangladesh: Implications for public health interventions. *Veterinaria Italiana. 2012* **49**, 7–17.
14. Namagirilakshmi, S. (2005). Turmeric (Curcuma longa) as nutraceutical to improve broiler performance. MSc, thesis submitted to Tamil Nadu Veterinary and Animal Sciences University, Chennai, India
15. Onu, P. N. and Aniebo, A. O. (2011). Influence of Moringa oleifera leaf meal on the performance and blood chemistry of starter broilers. International Journal ofFood,AgricultureandVeterinarySciences,1(1),38–44
16. Park EJ, Jeon CH, Ko G, Kim J, Sohn DH (2000). Protective effect of curcumin in rat liver injury induced by carbon tetrachloride. *J Pharm Pharmacol 52*:437-440
17. Talukdar. Papori.; Talukdar . Dibyajyoti.; Sarma. Kalyan. and Saikia. Karuna. (2018). Prospects and Potentiality of Improving Pig Farming in North Eastern Hill Region of India: An Overview. *International Journal of Livestock Research,* Vol 9 (01)
18. Payeng, S, Borgohain, A. and Bora, J.R. (2013). Economics of Pig Production in Organized and Unorganized Sectors. *Indian Res. J. Ext. Edu, 13*(1): 101-106.
19. Prasad K.N., Verma A., Srivastava S., Gupta R.K., Pandey C.M. & Paliwal V.K. (2011) An epidemiological study of asymptomatic neurocysticercosis in a pig farming community in northern India. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **105**, 531–536.
20. Nath, B.G., Chandra, R., Toppo, S., Chatlod, R. and Mohanty, A.K. (2012). Characteristics and constraints of pig production under rural condition in Sikkim. *Online Journal of Animal and Feed Research, 2*(1): 145-148.
21. Singh M and Mollier R T. (2016). Pig Production Scenario in Nagaland: Current Status And Future Prospective. Proceedings of Meeting on Agriculture development and Agromet Advisory Services in Nagaland, ICAR Research Complex for NEH Region, Nagaland Centre, 21 November. P 86–95
22. Shyam, J., Tripathi, H. and Balaraju, B.L. (2017b). Economic Contribution of Backyard Piggery in the Livelihood Security of Tribal Families of Assam. *International Journal of Livestock Research*, *7*(2), 135-143.
23. Stevenson H. Status evaluation in the Hindu caste system. The Journal of the Royal Anthropological Institute of Great Britain and Ireland. 1954;84:45–65
24. Pegu, B.J., Ray, M.N., Bora, L., Haque, A., Kalita, K.P. and Borgohain, A. (2014). Constraints of piggery entrepreneurship in Dhemaji district of Assam. National seminar on Livestock production practices for small farms of marginalized groups and communities in India. January 28-30, pp. 41, Selesih, Mizoram.
25. [Papori Talukdar](https://ijlr.org/filter/?key=author&value=Papori%20Talukdar) [Dibyajyoti Talukdar](https://ijlr.org/filter/?key=author&value=%20Dibyajyoti%20Talukdar) [Kalyan Sarma](https://ijlr.org/filter/?key=author&value=%20Kalyan%20Sarma) [Karuna Saikia](https://ijlr.org/filter/?key=author&value=%20Karuna%20Saikia)
Vol 9(1), 1-14 International Journal of Livestock research
26. Prospects and Potentiality of Improving Pig Farming in North Eastern Hill Region of India: An Overview
27. Wang, L. Y.; Zhang, M.; Zhang, C. F.; Wang, Z. T. Diaryl derivatives from the root tuber of Curcuma longa. Biochem. System. Ecol., 2008, 36, 476-480.