Original Research Article

Economic costanalysis of including probiotics in the feed of caged broilers

Comment [M1]: Economic analysis of feeding probiotics to caged broilers

Abstract

Comment [M2]: Rewrite this section giving backround, objectives, methodology and results in brief along with conclusion and future scope of study.

As part of the Sam Higginbottom University of Agriculture, Technology and Sciences in Prayagraj, this experiment was carried out at the Small Animal Lab that is part of research unit. In this study, we investigate the "**Economic cost analysis of including probiotics in the feed of caged broilers"**.

Comment [M3]: Delete

Each of the four groups (T_0, T_1, T_2, and T_3) contained eight replicates, which meant that each group contained twenty-four chicks. A total of 96 day-old chicks were randomly divided into these groups.

Comment [M4]: Four groups and eight replicates, meaning 32 chicks??

Comment [M5]: 96 or 128?

T_0control (untreated) group was fed the basal diet, T_1 was given *Bacillus coagulans* at a concentration of 40 parts per million in addition to the basal diet, T_2 was given *Bacillus subtilis* at a concentration of 50 parts per million mixed in with the basal diet, and T_3 was given the basal diet at a concentration of 20 parts per million together with *Bacillus licheniformis* and *Bacillus coagulans*. After a 35-days (five week) trial period, an analysis of the economic effects of adding probiotics in feed was calculated.The major difference was noted due to a decrease in FCR as birds achieved more weight, leading to increased body weight and resulting in a higher price per kg. It was also noted that adding probiotics to the feed doesn't increase the variable cost, and treatment groups had a lower variable cost than the control group. From the above study, it was found that maximum profit was obtained in T3,i.e., Rs. 5771.32, followed by T_0 (Rs. 5297.3) and T_2 (Rs. 5074.92), whereas the T1group had the least revenue. Therefore, it can be concluded that mixing probiotics in poultry feed increases profit without much affecting the production cost.

Comment [M6]: FCR decreased?

Keywords: Cost, Economics, FCR, Probiotics, Profit and Revenue.

1. INTRODUCTION

Comment [M7]: In this section, emphasis on economic aspest is missing

Among the agricultural and veterinary industries, poultry is experiencing rapid expansion. Poultry production spends a significant amount on feed, which accounts for 70% of the total. Poultry growers are seeing a decline in their profit margins due to the ever-increasing cost of compounded feed and other poultry feed additives. Consequently, the most crucial requirement for optimal genetics for economically viable chicken production is balanced and effective feeding. A number of feed additives, including growth promoters, synthetic hormones, and antibiotics, have been widely

Comment [M8]: Rewrite

utilized to increase the output of chickens. Nevertheless, AGPs used in poultry have the potential to impact human health through residues in chicken products and the development of antibiotic-resistant microorganisms. Using AGPs in chicken feed is illegal in many European nations. As a result, a lot of studies have focused on finding alternatives that can meet the needs of consumers and international markets without compromising production or being hazardous to animals or humans. One of these approaches that stands out is adding probiotics to animal feed. Feed additives containing probiotics reduce the risk of gastrointestinal diseases by increasing the human immune response, secreting antimicrobial compounds, and preventing the competitive exclusion of harmful bacteria **[1].** These products have been shown to have no residue in animal products and have been found to enhance animal performance and health. This has been supported by various studies conducted by **[2-6].** The reason behind this improvement is that these products enhance the digestibility of the animals' diet, as demonstrated by **[7].** This leads to better utilization of nutrients and, consequently, higher productivity, as indicated by studies conducted by **[8-10]**. Probiotics can be administered to chickens either by mixing them with feed or by adding them to drinking water **[11].**The growth of pathogen bacteria, including *Escherichia coli* and *Salmonella sp.*, can be inhibited by lactic acid bacteria probiotics, which have been shown to have a favorable effect **[12-16].** In addition to producing lactic acid and bacteriocins, lactic acid bacteria have the ability to colonize the intestines and survive**[17].** The probiotic and antimicrobial properties of *Lactobacillus casei* make it a promising candidate for use as a functional probiotic in animal feed **[18].**You can treat your birds/animals with probiotics in both feed and water, but it's important to note that probiotics in water can make them gain weight and reduce the feed conversion value. You can find out if it's more profitable to give broiler probiotics in water by doing an economic study. Finding out how much money broiler farms make by switching from antibiotic growth promoters (AGPs) to probiotics like *Bacillus Subtilis*, *Bacillus Coagulans* and *Bacillus licheniformis* in order to increase feed conversion and weight was the main motivation for this research.

2. MATERIALS AND METHODS

As part of the Sam Higginbottom University of Agriculture, Technology and Sciences in Prayagraj, this experiment was carried out at the Small Animal Lab that is part of research unit. In this study, we investigate the "**Economic cost analysis of including probiotics in the feed of caged broilers**". Each of the four groups (T_0, T_1, T_2, and T_3) contained eight replicates, which meant that each group

Comment [M9]: antibiotic growth promoters (AGPs)

Comment [M10]: Not clear

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Comment [M12]: c

Comment [M13]: Contradictory to what has been mentioned in Abstract section

Comment [M14]: Rewrite giving the parameters studied during the study, methods of estimating those parameters. Aslso give statistical procedures followed.

Comment [M15]: Rewrite indicating location of the study giving the latitude and longitude

Comment [M16]: Rewrite giving the objective protion in Introduction section.

contained twenty-four chicks. A total of 96 day-old chicks were randomly divided into these groups. T_0control (untreated) group was fed the basal diet,T_1 was given *Bacillus coagulans* at a concentration of 40 parts per million in addition to the basal diet, T_2 was given *Bacillus subtilis* at a concentration of 50 parts per million mixed in with the basal diet, and T_3 was given the basal diet at a concentration of 20 parts per million together with *Bacillus licheniformis* and *Bacillus coagulans*. After a 35-days (five week) trial period, an analysis of the economic effects of adding probiotics in feed was calculated.

3. RESULTS AND DISCUSSION

Comment [M17]: Not written properly. Rewrite the whole section consulting relevant references emphasizing the economic aspect of the present study.

Table1:Variablecostoftreatment

Description	T_0	T_1	T_2	T_3
Transport (Rs)	12.5	12.5	12.5	12.5
Feed additive (Rs)	0	0.18	1.58	0.30
DOC broiler (Rs)	768	768	768	768
Feed (Rs)	1533.6	1440	1382.76	1313.88
Total (Rs)	**2314.1**	**2220.68**	**2164.08**	**2094.68**

The provided table outlines the breakdown of costs associated with different treatments ($Treatment_0$, $Treatment_1$, $Treatment_2$, and $Treatment_3$), along with a $Treatment_0$ (control group), across various categories. Here's a detailed explanation of each category:

Transport (Rs):

- Transport represents the cost of transportation for each treatment group as well as the control group.
- The cost of transportation is consistent across all groups at Rs 12.5.

Comment [M18]: This portion should be in Methodology part.

Feed additive (Rs):

- Feed additive displays the cost of feed additives (probiotics) for each treatment group and the control group.
- The cost of feed additives varies across treatments:
  - $Treatment_0$(Control): No cost (Rs 0)
  - $Treatment_1$: Rs 0.18

- $Treatment_2$: Rs 1.58
- $Treatment_3$: Rs 0.30

DOC broiler (Rs):

- DOC indicates the cost associated with Day Old Chicks (DOC) for each treatment group and the control group.
- The cost of DOC broiler remains constant across all groups at Rs 768.

Feed (Rs):

Feed represents the cost of feed for each treatment group and the control group.

The cost of feed varies across treatments:

- $Treatment_0$: Rs 1533.6
- $Treatment_1$: Rs 1440
- $Treatment_2$: Rs 1382.76
- $Treatment_3$: Rs 1313.88

Total (Rs):

Total Rupees sums up the total variable costs for each treatment group and the control group.

It includes the costs of transportation, feed additives, DOC broiler, and feed.

The total cost varies across treatments:

- $Treatment_0$: Rs 2314.1
- $Treatment_1$: Rs 2220.68
- $Treatment_2$: Rs 2164.08
- $Treatment_3$: Rs 2094.68

Each row in the table provides a detailed breakdown of the variable costs associated with transportation; feed additives, DOC broiler, feed, and the total cost for each treatment group and the control group. This breakdown allows for a comprehensive comparison of costs across different treatments and the control group.

Table2:Totalofrevenueandprofitfor96broilerchickenstreatment

Description	T_0	T_1	T_2	T_3
Final of body weight production (kg)	40.06	34.40	38.10	41.40
Final of body weight sell/kg (Rs)	190	190	190	190
Total of Revenue (Rs)	7611.4	6536	7239	7866
Total of cost (Rs)	2314.1	2220.68	2164.08	2094.68
Profit (Rs)	5297.3	4315.32	5074.92	5771.32

Final body weight production (kg):

Final body weight productionshows the average final body weight production in kilograms for each treatment group at the end of the treatment period. It indicates the weight gain achieved by the broiler chickens.

Final body weight sell/kg (Rs):

The selling price per kilogram of broiler chickens remains constant at Rs 190 across all treatment groups. This indicates the price at which the broiler chickens are sold.

Total Revenue (Rs):

Total Revenuerepresents the total revenue generated from selling broiler chickens for each treatment group. It is calculated by multiplying the final body weight production by the selling price per kilogram.

Total Cost (Rs):

Total Costdisplays the total cost incurred for treating 96 broiler chickens in each treatment group. The costs include transportation, feed additives, DOC broiler, and feed, as shown in the previous tables.

Profit (Rs):

Profitshows the profit generated from the sale of broiler chickens for each treatment group. It is calculated by subtracting the total cost from the total revenue, indicating the financial gain from the broiler chicken treatment.

Each row in the table provides detailed information about the final body weight production, revenue, cost, and profit for each treatment group, facilitating comparison and analysis of the effectiveness and profitability of different treatments.

Discussion: Probiotics of the type T2, T3, T4, and T5 administered by feed or water can enhance body weight while decreasing feed conversion**[19].** Adding 0.25 g probiotic/liter through drinking water yields the highest production performance results and the most profitable economic analysis. Therefore, for optimal agricultural performance and profit, farmers can administer 0.025 g probiotic/liter through water, and study by **[20]**during the study period, 60% of broiler farms were found to be in operation. When it came to economic losses, broiler flocks were the worst hit, with the exception of two farms (B1 and B6), caused by factors such as reduced body weight gain, and increased feed conversion ratio (FCR), mortality, chemotherapy, and chemoprophylaxis. There was no subclinical form of coccidiosis documented in farm B6, loss due to chemotherapy was higher compared to poor FCR, whereas in farm B6 no subclinical form of coccidiosis was recorded. Chemotherapy was higher than low FCR in farm B2, and mortality was the main cause of loss in farm B1 due to concomitant infection of inflammatory bowel disease.

Comment [M19]: Groups??

Comment [M20]: Decrease or increase?

Comment [M21]: Not relevant portion. Not clear

Comment [M22]: Not clear

4. SUMMARY AND CONCLUSION

Comment [M23]: Is this not similar to Abstract?

From the above study it was found that maximum profit was obtained in T_3 i.e., Rs. 5771.32 followed by T_0 (Rs. 5297.3) and T_2 (Rs. 5074.92) whereas T_1 group had least revenue. The major difference was noted due to decreased in FCR as birds achieved more weight leading to increased Body weight and resulting in more price per kg. It was also noted that adding Probiotics in the feed doesn't increased the variable cost and treatment groups had variable cost less than the Control group.

Therefore, from the above study it can be concluded that mixing probiotics in poultry feed increases the profit/revenue without much affecting the production cost. Hence, probiotics can be included in poultry feed however large scale studies in future are recommended.

Comment [M24]: Rewrite

REFRENCES

Comment [M25]: References; rewrite this section as per the style of the Journal. Only relevant references should be given. Add the references which needs to be added in Materials and Methods portion. Add references on economic of broiler farming.

1. Corcionivoschi, N., Drinceanu, D., Stack, D., Ștef, L., Julean, C. and Bourke, B. The effect of probiotics on animal health. Review. Scientific Papers Animal Science and Biotechnologies. 2010; 43(1): 35-35.
2. Fuller, R. Probiotic in man and animals. J. Appl. Bacteriol. 1989; 66: 131-139.
3. Jin, L.Z., Ho, Y.W., Abdullah, N. and Jalaludin, S. Probiotics in poultry: modes of action. World's Poultry Science Journal. 1997; 53(4):351-368.
4. Zulkifli, I., Abdullah, N., Azrin, N.M. and Ho, Y.W. Growth performance and immune response of two commercial broiler strains fed diets containing Lactobacillus cultures and oxytetracycline under heat stress conditions. British poultry science. 2000; 41(5):593-597.
5. Ferreira A J P, Pizarro L D C R and Leme I L. Probióticose prebióticos. Spinosa, H.S.; Gorniak, S.L.; Bernardi, M.M.(Eds.) Farmacologiaaplicada à medicinaveterinária. 3. ed.RiodeJaneiro:GuanabaraKoogan. 2002;574–578.
6. PattersonJAandBurkholderKM.Applicationofprebioticsandprobioticsinpoultryproduction.PoultryScience. 2003;82:627–31.
7. Apata D F. Growth performance, nutrient digestibility andimmuneresponseofbroilerchicksfeddietssupplementedwithacultureofLactobacillusbulgaricus.JournalofScienceFoodAgriculture. 2008;88:1253–58.
8. KabirSML,RahmanMMandRahmanMB.Thedynamicsof probiotics on growth performance and immune response inbroilers.InternationalJournalofPoultryScience. 2004;3: 361–64.
9. MountzourisKC,TsirtisikosPandKalamaraE.Evaluationoftheefficacyofaprobioticcontaining*Lactobacillus*,*Bifidobacterium*,*Enterococcus*and*Pediococcus*strainsinpromotionbroilerperformanceandmodulationcecalmicrofloracompositionandmetabolicactivies.PoultryScience. 2007; 86:309–17.
10. Mountzouris K C, Tsirtisikos P and Palamidi I. Effects ofprobioticinclusionlevelsinbroilernutritionongrowthperformance, nutrient digestibility, plasma immunoglobunis,and cecal microflora composition. Poultry Science. 2010; 89: 58–67.
11. Utomo A M. Effect of probiotic giving with *Lactobacillussp*.and*Saccharomycescerevisiae*againstbroilerweightgain.(Thesis),AirlanggaUniversity.Surabaya. 2012.

12. HudaK,LokapirnasariWPandSoeharsonoS.Additionofprobiotic *Lactobacillus acidophilus*and*Bifidobacterium sp*to the analysis of laying hens infected by *Escherichia coli*.MimbarAgribusiness. 2019; 5:176–82.
13. Najwan R, Lokapirnasari W P and Huda K. Effect of theadditionofprobiotic*Lactobacillusacidophilus*and*Bifidobacterium*totheproductionoflayinghensinfectedwith *Escherichiacoli*.Briliant. 2019;4:125–31.
14. WardhaniHCP,LokapirnasariWPandSoepranianondoK.Useofcombinationprobiotic*Lactococcuslactis*and*Lactobacillusacidophilus*asasubstituteofantibioticsinchickenlayerinfectedby*Escherichiacoli*onbusinessanalysis.MimbarAgribusiness. 2019;5:183–92.
15. Rahman N F N, Lokapirnasari W P, Soepranianondo K, HidanahS and Sarmanu S. The effect of using *Lactobacilluscasei* and *Bifidobacterium sp*. probiotics on feed conversionratioandfeedconsumptioninlayinghensinfectedwith*Escherichiacoli*.Briliant. 2019;4:167–73.
16. Nouri, M., Rahbarizadeh, F., Ahmadvand, D., Mousakhani, F., Sadeghzadeh, E., Lavasani, S. and Khodami, V.V. Inhibitory effects of Lactobacillus salivarius and Lactobacillus crispatus isolated from chicken gastrointestinal tract on Salmonella enteritidis and Escherichia coli growth. 2010.
17. Salminen S, Wright A V and Ouwehand A. 2004. Lactic acidBacteria: microbiologycal and functional aspects, revised andexpanded.3rded.MarcelDekker,Inc.NewYork. 2004; 177.
18. AmaravadhiSC,MallamM,ManthaniGPandKomireddyKR.Effectofdietarysupplementationofprobioticsandenzymesonthehaematologyofrabbitsrearedundertwo housingsystemsVeterinaryWorld. 2012;5:748–53.
19. Andriani, A.D., Lokapirnasari, W.P., Karimah, B., Hidanah, S. and Al-Arif, M.A., 2020. Potency of probiotic on broiler growth performance and economics analysis. Indian Journal of Animal Sciences. 2020; 90(8): 1140-1145.
20. Pant, S., Bhatt, P. and Singh, A.K. Economic impact assessment and disease prevalence of coccidiosis in broilers around tarai region. 2019; 548-655.