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Effect of sodium butyrate supplementation on growth performance in commercial broiler

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Abstract
A total of 200, day old broiler chicks were divided into 4 treatments consisting of 5 replicates in each group and ten chicks in each replicate. Basal diet (T_1) prepared following BIS (2007) [2] standards and the experimental diets were prepared by incorporating antibiotic 0.02% of BMD (T_2), 0.1% sodium butyrate in pre-starter, 0.05% in starter and 0.025% in finisher (T_3) and 0.02% of antibiotic BMD and 0.1% sodium butyrate in pre-starter, 0.05% in starter and 0.025% in finisher (T_4). The results revealed that sodium butyrate and combination of sodium butyrate along with antibiotic BMD resulted in significant improvement ($p \leq 0.05$) in body weight, feed intake, feed efficiency and no significant improvement in survivability.

Keywords: Sodium butyrate, growth performance, survivability

Introduction
Antibiotics as growth promoters in animal diet is a widespread technique to improve animal performance. However, due to the emergence of bacterial strains that are resistant, this approach has received harsh criticism in the field of animal nutrition (Witte, 2000) [12]. Antibiotic residues in associated food can have a direct impact on human health (Boerlin and Reid-Smith, 2008) [1].
Nutritionists in the animal nutrition field are encouraged to look into antibiotic alternatives in order to ensure animal performance without endangering human health as a result of the ban on the use of antibiotic growth promoters in feeds (Kabploy *et al*., 2016) [5] and the growing concern over food safety and quality. Because of these factors, using organic acids and their salts is typically regarded as safe and advantageous for gut health (Moquet *et al*., 2016) [8].
Short-chain fatty acid butyrate is produced as a byproduct of the microbial fermentation of dietary fiber (Hamer *et al*., 2008) [4]. The favorable effects of butyrate or its sodium salts as a feed additive on growth performance and intestinal integrity are well documented (Qaisrani *et al*., 2015) [10].
Zhao *et al*. (2022) [14] investigated the effects of chemically protected sodium butyrate on growth performance. They observed that diet containing chemically protected sodium butyrate compared to the control diet has significantly increased ($p<0.05$) the body weight and feed conversion ratio, but there was no significant difference in feed intake.
Lan *et al*. (2020) [6] conducted an experiment on effects of dietary sodium butyrate (300 mg / kg, 600 mg / kg and 1200 mg / kg) supplementation along with control. No significant differences were observed in the body weight, feed consumption and feed conversion ratio among treatments compared to control group.

Materials and Methods
A total of two hundred, day-old commercial broiler chicks were procured commercially from Venkateshwara hatcheries. Chicks were weighed; wing banded and allocated to four experimental groups each consisting of five replicates with ten chicks each. Basal diet (control) T_1 was prepared without antibiotics from day one to 42 days of experimental period as per BIS (2007) [2] standard. For the treatment groups T_2, were fed with basal diet (control) along with 0.02% of antibiotic BMD from day one to 42 days and for the treatment groups T_3, were fed with basal diet (control) along with 0.1% sodium butyrate in pre-starter, 0.05% in starter and 0.025% in finisher upto 42 days. For the treatment groups T_4 were fed with basal diet along with 0.02% of antibiotic BMD and 0.1% sodium butyrate in pre-starter, 0.05% in starter and 0.025% in finisher with upto 42 days.

Standard vaccination schedule was followed for immunizing the birds. Feed and water were provided ad libitum. Birds were reared under standard managemental practices.

Results

The results of the effect of sodium butyrate supplementation on body weight, feed intake feed conversion ratio and survivability in commercial broilers is presented in Table 1, Table 2, Table 3 and Table 4, respectively.

At the end of sixth week, the average body weight of birds (g / bird) under different treatment groups T_1, T_2, T_3 and T_4 were 2093.7, 2084.3, 2281.0 and 2277.4, respectively. Where, the treatment groups T3 and T4 showed significantly ($p \leq 0.05$) higher average body weight than the groups T_1 and T_2. There was no significant difference ($p > 0.05$) in body weight among groups T_3 and T_4 and also among T_1 and T_2 from first week till the end of the experiment as shown in the Table 1. The cumulative average feed intake at the end of first week and second week was 106.38, 108.67, 134.81, 136.77 and 388.37, 394.28, 437.28, 433.31 in groups T_1, T_2, T_3 and T_4, respectively. Where, the treatment groups T3 and T4 showed significantly ($p \leq 0.05$) higher cumulative feed intake than the groups T_1 and T_2. There was no significant difference ($p > 0.05$) in feed intake among treatment groups T_3 and T_4 and also among T_1 and T_2 during the first two weeks of the experiment as shown in Table 2.

The weekly cumulative feed conversion ratio of birds (g / bird) at the end of sixth week under different treatment groups were 1.902 (T_1), 1.898 (T_2), 1.709 (T_3) and 1.705 (T_4). Where, the treatment groups T_3 and T_4 showed significantly ($p \leq 0.05$) better weekly cumulative feed conversion ratio than the groups T_1 and T_2. There was no significant difference ($P > 0.05$) in weekly cumulative feed conversion ratio among treatment groups T_3 and T_4 and also among T_1 and T_2 from first week till the end of the experiment as shown in Table 3.

The results of the effect of sodium butyrate on percent survivability in commercial broilers are presented in Table 4. Where, the survivability (%) values were 98, 98, 100 and 98 in groups T_1, T_2, T_3 and T_4, respectively. The statistical analysis revealed no significant ($p > 0.05$) difference in survivability (%) of birds among control and other treatment groups. The results of the present study is in agreement with Zhao *et al*. (2022) [14] experimental findings, where the effects of chemically protected sodium butyrate were tested for growth performance in broilers. It was noticed that diet containing chemically protected sodium butyrate compared to the control diet has significantly increased ($p < 0.05$) the body weight and improved feed conversion ratio whereas no impact on feed intake.

The findings of the present study is in agreement with Wu *et al*. (2018) [13] conducted a similar study on influence of butyrate loaded clinoptilolite dietary supplementation on growth performance in broiler chickens for 42 days and recorded that birds supplemented with butyrate loaded clinoptilolite showed significant increase in body weight gain and feed intake ($p < 0.05$) compared with clinoptilolite and butyrate loaded clinoptilolite groups but, found no difference in FCR when compared to control.

Levy *et al*. (2015) [7] findings is in agreement with present study. They conducted a series of trials and evaluated the impact of butyric acid on broilers growth performance and survivability. At any inclusion level of butyric acid, survivability was unaffected.

The better FCR in the current experiment is related to considerably increased body weight, improved gut health and high nutritional digestibility in broilers andthe increased feed intake is due to increase in the pancreatic amylase activity and lipase activity caused due to inclusion of sodium butyrate in the broiler diet which directly influences the gain in bodyweight (Roberts *et al*., 2015) [11].

Pires *et al*. (2021) [9] is in disagreement with the present study, they recorded the addition of sodium butyrate to the diet which had no statistical differences on final weight, feed intake and the feed conversion ratio among birds of different treatments ($p > 0.05$).

The study performed by Lan *et al*. (2020) [6] is in disagreement with the current experiment who conducted to check sodium butyrate enhancing effect on growth performance in broilers. The findings of the experiment showed no significant differences on body weight and feed conversion ratio among the treatments.

The results of the present study are in concurrence with Edmonds *et al*. (2014) [3] experiment to check the effect of humic and butyric acid supplementation on mortality in broilers and recorded that the combination of humic acid and protected butyric acid significantly ($p \leq 0.05$) improved livability of birds.

Table 1: Effect of sodium butyrate supplementation on weekly cumulative body weight (g / bird / week) (Mean ± SE) in commercial broilers.

Experimental group	Diet	Weeks					
		I	II	III	IV	V	VI
T_1	Basal diet without antibiotic	140.38 ± 2.04^b	342.18 ± 5.05^b	709.62 ± 10.05^b	1098.1 ± 17.45^b	1615.1 ± 26.73^b	2093.7 ± 38.68^b
T_2	Basal diet+ 0.02% Bacitracin disalicylate (BMD)	142.68 ± 2.29^b	347.26 ± 5.94^b	711.30 ± 10.66^b	1107.2 ± 17.35^b	1594.4 ± 25.78^b	2084.3 ± 16.29^b
T_3	Basal diet+ 0.1% sodium butyrate in pre-starter, 0.05% in starter and 0.025% in finisher	169.50 ± 3.48^a	387.42 ± 5.00^a	772.64 ± 10.16^a	1219.1 ± 14.24^a	1837.3 ± 22.95^a	2281.0 ± 25.67^a
T_4	Basal diet+ 0.02% Bacitracin disalicylate (BMD)+ 0.1% sodium butyrate in pre-starter, 0.05% in starter and 0.025% in finisher	171.28 ± 3.16^a	384.46 ± 4.86^a	760.22 ± 8.21^a	1202.2 ± 17.25^a	1842.9 ± 25.76^a	2277.4 ± 28.87^a

^{a,b}Means in the same column with no common superscript differ significantly ($p \leq 0.05$)

Table 2: Effect of sodium butyrate supplementation on weekly cumulative feed intake (g/bird / week) (Mean ± SE) in commercial broilers.

Experimental group	Diet	Weeks					
		I	II	III	IV	V	VI
T_1	Basal diet without antibiotic	106.38 ± 1.45[b]	388.37 ± 7.44[b]	951.43 ± 21.49	1626.3 ± 20.57	2752.5 ± 46.49	3899.3 ± 82.98
T_2	Basal diet+ 0.02% Bacitracin disalicylate (BMD)	108.67 ± 1.09[b]	394.28 ± 4.93[b]	952.57 ± 13.10	1637.8 ± 28.07	2716.2 ± 45.43	3868.4 ± 33.71
T_3	Basal diet+ 0.1% sodium butyrate in pre-starter, 0.05% in starter and 0.025% in finisher	134.81 ± 3.75[a]	437.28 ± 7.50[a]	999.78 ± 15.72	1698.6 ± 33.88	2839.2 ± 70.49	3820.0 ± 61.52
T_4	Basal diet+ 0.02% Bacitracin disalicylate (BMD)+ 0.1% sodium butyrate in pre-starter, 0.05% in starter and 0.025% in finisher	136.77 ± 2.55[a]	433.31 ± 8.44[a]	977.49 ± 15.33	1688.8 ± 30.93	2851.9 ± 23.54	3804.4 ± 55.87

[a,b]Means in the same column with no common superscript differ significantly ($p \leq 0.05$)

Table 3: Effect of sodium butyrate supplementation on weekly cumulative feed conversion ratio (Mean ± SE) in commercial broilers.

Experimental group	Diet	Weeks					
		I	II	III	IV	V	VI
T_1	Basal diet without antibiotic	1.122 ± 0.002[a]	1.309 ± 0.007[a]	1.433 ± 0.004[a]	1.546 ± 0.010[a]	1.753 ± 0.013[a]	1.902 ± 0.020[a]
T_2	Basal diet+ 0.02% Bacitracin disalicylate (BMD)	1.120 ± 0.002[a]	1.307 ± 0.004[a]	1.431 ± 0.003[a]	1.543 ± 0.007[a]	1.755 ± 0.011[a]	1.898 ± 0.004[a]
T_3	Basal diet+ 0.1% sodium butyrate in pre-starter, 0.05% in starter and 0.025% in finisher	1.083 ± 0.006[b]	1.277 ± 0.008[b]	1.374 ± 0.004[b]	1.447 ± 0.008[b]	1.584 ± 0.006[b]	1.709 ± 0.002[b]
T_4	Basal diet+ 0.02% Bacitracin disalicylate (BMD)+ 0.1% sodium butyrate in pre-starter, 0.05% in starter and 0.025% in finisher	1.081 ± 0.004[b]	1.276 ± 0.003[b]	1.366 ± 0.003[b]	1.458 ± 0.008[b]	1.587 ± 0.006[b]	1.705 ± 0.002[b]

[a,b]Means in the same column with no common superscript differ significantly ($p \leq 0.05$)

Table 4: Effect of sodium butyrate supplementation on weekly survivability (%) (Mean ± SE) in commercial broilers.

Experimental group	Diet	Survivability%
T_1	Basal diet without antibiotic	98.00 ± 2.00
T_2	Basal diet + 0.02% Bacitracin disalicylate (BMD)	98.00 ± 2.00
T_3	Basal diet+ 0.1% sodium butyrate in pre-starter, 0.05% in starter and 0.025% in finisher	100 ± 0.00
T_4	Basal diet+ 0.02% Bacitracin disalicylate (BMD)+ 0.1% sodium butyrate in pre-starter, 0.05% in starter and 0.025% in finisher	98.00 ± 2.00

Conclusion

Based on the above result it was concluded that the body weight (g) and feed conversion ratio of the birds fed with sodium butyrate and a combination of bacitracin methylene disalicylate (BMD) + sodium butyrate had significant difference ($p \leq 0.05$) compared to the control and bacitracin methylene disalicylate (BMD) from first week till the end of the experiment (42nd day).

Feed intake revealed (g) significant difference ($p \leq 0.05$) in the birds fed with sodium butyrate and a combination of bacitracin methylene disalicylate (BMD) + sodium butyrate compared to the control and bacitracin methylene disalicylate (BMD) group in the first two weeks of the experiment.

Survivability (%) of birds was non-significant ($p > 0.05$) among birds in different groups fed with sodium butyrate and bacitracin methylene disalicylate (BMD) compared to the control group till the end of the experiment (6th week).

References

1. Boerlin P, Reid-Smith RJ. Antimicrobial resistance: its emergence and Transmission. Animal Health Research Reviews. 2008;9(2):115-126.
2. BIS. Bureau of Indian Standards, Poultry feeds specification., 5th revision, Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi-11; c2007.
3. Edmonds MS, Johal S, Moreland S. Effect of supplemental humic and butyric acid on performance and mortality in broilers raised under various environmental conditions, Journal of Applied Poultry Research. 2014;23(2):260-267.
4. Hamer HM, Jonkers D, Venema K, Vanhoutvin S, Troost FJ, Brummer RJ. Review article: The role of butyrate on colonic function. Aliment. Pharmacology & Therapeutics. 2008;27(2):104-119.
5. Kabploy K, Bunyapraphatsara N, Morales NP, Paraksa N. Effect of Antibiotic Growth Promoters on Anti-oxidative and Anti-inflammatory Activities in Broiler Chickens. The Thai Journal of Veterinary Medicine. 2016;46(1):89-95.
6. Lan RX, Li SQ, Zhao Z, An LL. Sodium butyrate as an effective feed additive to improve growth performance and gastrointestinal development in broilers. Veterinary Medicine and Science. 2020;6(3):491-499.
7. Levy AW, Kessler JW, Fuller L, Williams S, Mathis GF, Lumpkins B, *et al*. Effect of feeding an encapsulated source of butyric acid (ButiPEARL) on the performance of male Cobb broilers reared to 42 d of age. Poultry Science. 2015;94(8):1864-1870.
8. Moquet P, Onrust L, Van IF, Ducatelle R, Hendriks W, Kwakkel R. Importance of release location on the mode of action of butyrate derivatives in the avian gastrointestinal tract. World's Poultry Science Journal. 2016;72(1):61–80.
9. Pires MF, Leandro NSM, Oliveira HF, Jacob DV, Carvalho FB, Stringhini JH, *et al*. Effect of Dietary Inclusion of Protected Sodium Butyrate on the Digestibility and Intestinal Histomorphometry of Commercial Laying Hens. Brazilian Journal of Poultry Science. 2021;23(2):01-08.
10. Qaisrani SNV, Krimpen MM, Kwakkel RP, Verstegen

MW, Hendriks WH. Diet structure, butyric acid and fermentable carbohydrates influence growth performance, gut morphology and cecal fermentation characteristics in broilers. Poultry Science. 2015;94(9):2152-64.
11. Roberts T, Wilson J, Guthrie A, Cookson K, Vancraeynest D, Schaeffer J, *et al*. New issues and science in broiler chicken intestinal health: Emerging technology and alternative interventions. Journal of Applied Poultry Research. 2015;24(2):257-266.
12. Witte W. Selective pressure by antibiotic use in livestock. International Journal of Antimicrobial Agents. 2000;16(1):19-24.
13. Wu W, Xiao Z, An W, Dong Y, Zhang B. Dietary sodium butyrate improves intestinal development and function by modulating the microbial community in broilers. PloS one. 2018;13(5):e0197762.
14. Zhao H, Bai H, Deng F, Zhong R, Liu L, Chen L, *et al*. Chemically Protected Sodium Butyrate Improves Growth Performance and Early Development and Function of Small Intestine in Broilers as One Effective Substitute for Antibiotics. Antibiotics. 2022;11(2):132.