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Research Article

Comparative study on the efficiency of various feed additives on growth performance of broiler

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Abstract
Present experiment was carried out at Department of Poultry Husbandry, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University, Tandojam to observe the influence of various feed additives on growth performance of broiler. Total 150 day old chicks were purchased from local hatchery and divided into 5 groups, i.e, T1 Control, T2 (basal diet with Enramycin -0.15 gm/kg), T3 (basal diet with enzymes (XAP -0.1 gm/kg), T4 (basal diet with probiotics -0.06 gm/kg), and T5 (basal diet with prebiotic -0.1 gm/kg), group, respectively. Current investigation was performed at Sindh Poultry Vaccine Centre Karachi. The findings of present study showed that average feed consumption was observed highest in T4 group followed by T2, T5, T3 and T1 group. Results for liver weight was observed significantly higher ($P<0.05$) in T4 followed by T5, T2, T3 and T1 groups. Whereas maximum FCR (feed conversion ratio) was observed in T4 and poor in T1 group. While maximum dressing percentage was observed in T4 group followed by T5, T3, T2 and T1. The results showed that live weight was observed higher in T1 group followed by T2, T4, T5 and T3. While higher gizzard weight was observed in T3 group followed by T5, T1, T4 and T2 group. The weight of intestine was observed maximum in T2 followed by T5, T3, T4 and T1 group. In our study significantly higher ($P<0.05$) fat pad was observed in group T1 followed by T2, T3, T4 and T5 group. While maximum moisture percentage was recorded in T4 group as followed T5, T2, T2 and T1 group. Whereas the results for crude protein was observed higher in T4 group followed by T5, T3, T2, and T1 group. It is concluded that among different feed additives probiotic (T4) and prebiotic (T5) groups improved the production performance, increase nutrient digestibility and is more economical than other feed additives.

Keywords: Broiler; Feed additives; Digestibility; Production; Economics

Introduction

A feed additive is a supplement of food for those animals and poultry birds that cannot take sufficient nutrients from daily provided meals include vitamins and minerals. Poor animal growth can be may occur to lack of basic nutritional components in diet (Merck Manual, 2014). However, Feed additives can be divided into two main groups, nutrient feed additives (NFA) and non-nutrient feed additives (NNFA [1]. Basic feed additives add in

poultry diets contain growth promoter antibiotics, probiotic, prebiotic antioxidants, organic acids, acidifiers, and enzymes. As a prophylactic and growth promoter, the utilization of antibiotic mixtures has practiced in profitable poultry farming. However, due to high usage of antibiotic across worldwide, consumer concern for drug residues in poultry meat [2, 3]. Pre-biotics can be defined as food for probiotics or beneficial bacteria in the gastrointestinal system. Prebiotics can be alter gut microflora, change the immune system, inhibit colonic cancer, decrease pathogen in vision such as *Salmonella Entritidi*s and *E. coli* and also reduce cholesterol and odor compounds. *Bifidobacterium* and *lactobacillus* are useful bacteria for the gut health and they also help in the digestion of carbohydrate. [4]. Probiotics "a live microbial supplementation of diet which certainly affects the host animal by enhancing its intestinal microbial balance". Probiotic supplementation has been shown to improve productive parameters [5]. Optimistic effects of Probiotic feeding, support to stabilize a beneficial intestinal micro flora, improve restriction to enteric pathogens such as salmonella and campylobacter species, and leading in a healthy environment of gastro intestinal tract functions of intestine, performance of birds, feed conversion, and weight gain [6]. By reviewing and observing of various usages of different feed additives, it is necessary to classify the most beneficial feed additives which are use in animal and poultry birds diet. To obtain this objective for commercial importance, this investigation was carried to analyze the effect of various feed additives on the growth performance of broiler.

Materials and methods

This investigation was performed to differentiate the various feed additives efficiency on broiler growth. In this study total one hundred fifty day old broiler chicks were brought from local hatchery and shifted to experimental center of Sindh Poultry Vaccine Centre, Karachi.

Housing and management

The environmentally controlled housing system was utilized, where 1 sq/ft floor space for each bird was provide. The shed was prepared before arrival of chicks according to the standard requirements. The brooding temperature during 1st week was maintained 95 ^{0}F and regularly reduced till 70 ^{0}F was maintained during research time. The light was provided 24 hrs in the farm. Rice husk used as bedding material at the depth 3-5 inches. Litter was dried under sun light for 24 hrs than spread on the floor with addition of limestone to reduce the chances of diseases in the shed. The routine practice of litter turning was carried out two times a day to reduce growth of harmful gaseous in the poultry house.

Experimental design

Iso-caloric and iso-nitrogenous basal diet was given to each group for 42 days. Control group was provided basal diet without any feed additives while, experimental group were feed basal diet added with probiotic, prebiotic, AGP and enzymes. The feed and water were available at the rate of libitum during the experiment. The chicks were divided in 6 groups with 3 different replications and each replicate contain 10 chicks.

- T1 Control (basal diet)
- T1 Control basal diet with AGP (Enramycin 4%) -0.15gm/kg
- T2 basal diet with enzymes (XAP) -0.1 kg/mg
- T4 basal diet with Probiotics (Bacillus Subtilis) -0.6 kg/mg
- T5 basal diet with Prebiotic (Xylo oligo saccharides)- 0.1gm/kg

In this study at the end of experiment, two chicken were selected on random basis from each replicate, weighted, slaughtered and de

feathered to find out the carcass weight and carcass yield. After the observation of slaughter weight weight of organs and fat pad the data was recorded. The relative fat pad were also find out on 42 days of investigations

Digestibility

The 3 birds from each replication were transferred to separate pen during 36 day of experiment. One bird from each group was transferred to separate pen during the age of 36 d. After the adaption period of three days; fecal samples were collected 3 times in a day and samples for further examination were stored at -20 ^{0}C. Feces were dried under oven at 65 ^{0}C for 24 hrs. For proximate analysis samples were examine by AOAC (2000) method.

Data analysis

For this study a complete randomized model were used to analyzed that for various parameters. The collected data was tabulated and fed on computer. After that data was analyzed by one –Anova (JMP, Software, SAS Institute Inc., Cary, NC).

Result

Feed intake

The result concerning feed intake of broiler chickens, added with various feed additives are presented in figure 1. Results showed that the higher feed intake was noted (4106.2 g/bird) in T4 group, followed by T2 (4083.1g/bird), T5 (4075.1g/bird), T3 (4059.1g/bird) and in T1 (3969.3 g/bird) group, respectively. The statistical data indicated that there was no significant difference between the all replications.

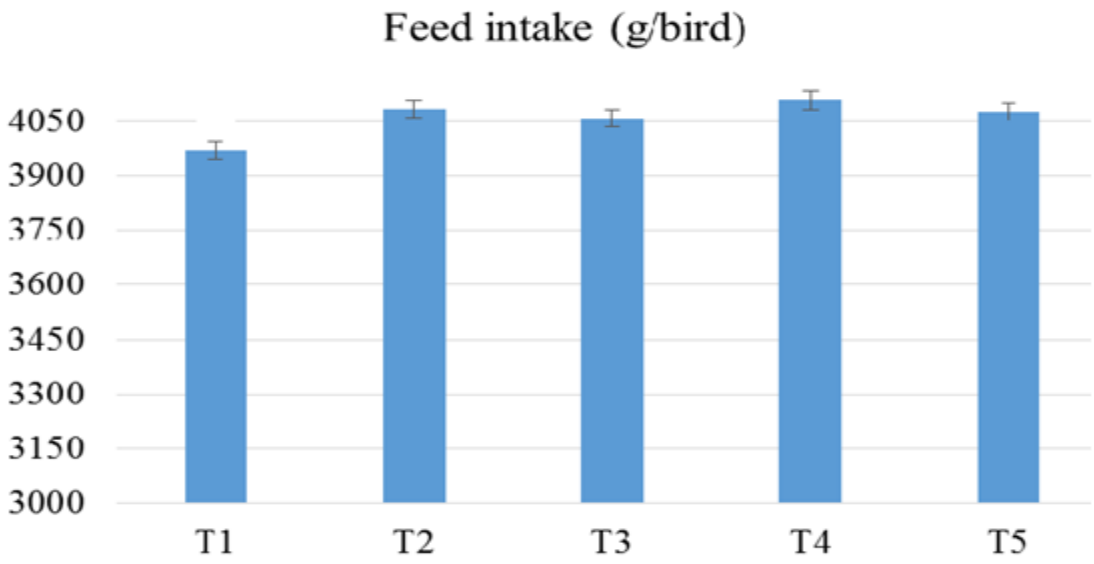

Figure 1. Effect of various feed additives on feed intake (g/bird)

[a,b,c] Super scripts with same letters showed non-significant (P>0.05) difference.
T1 = Control, T2 = AGP, T3 = Enzymes, T4 = Probiotic, T5 = Prebiotic

Live body weight

The findings of our study for live body weight g/bird containing various feed additives are presented in figure 2. It was observed that the maximum (2233 g) the body weight was recorded in the T4 replication, while lower followed by T5 (2205 g), T2 (2137 g), T3 (2102 g) and in T1 (1961 g) group, respectively. Statistical analysis revealed that T4 group was significantly different from T1 and T3, but non-significant with T2 and T5 group, respectively.

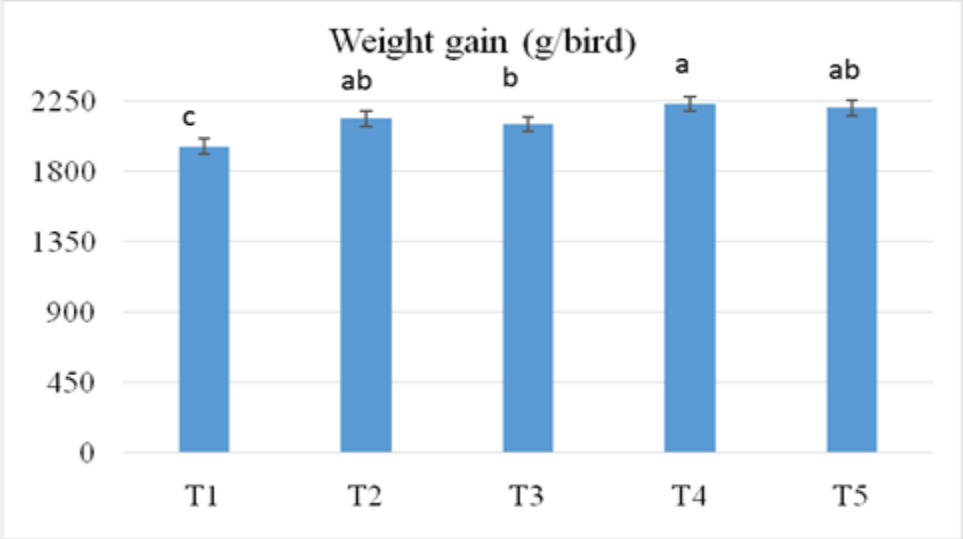

Figure 2. Effect of various feed additives on live body weight (g/bird)
[a,b,c] super scripts with different letters showed significant (P<0.05) difference.
T1 = Control, T2 = AGP, T3 = Enzymes, T4 = Probiotic, T5 = Prebiotic

Feed conversion ratio (FCR)

FCR of broilers are presented in figure 3. The findings indicated the significantly difference (P<0.05) between the replicates. Findings showed that better (1.84) FCR was noted in T4 replicate and poor (2.02) poor in T1 group. The analysis of variance showed that Group T4 and T5 replications were found significantly higher differed from each other, while these were observed non-significant differed from the groups of T1, T2 and T3 groups, respectively.

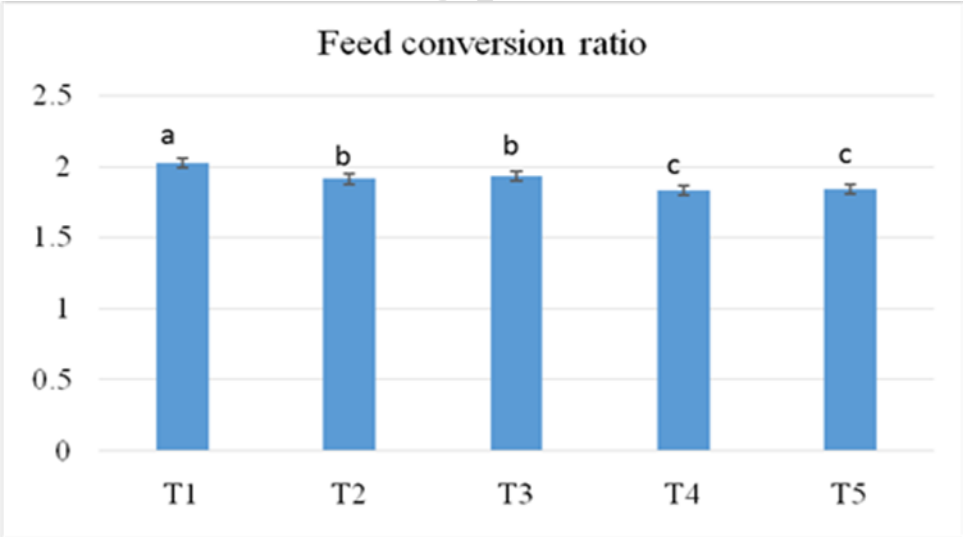

Figure 3. Effect of various feed additives on feed conversion ratio
[a,b,c] super scripts with different letters showed significant (P<0.05) difference.
T1 = Control, T2 = AGP, T3 = Enzymes, T4 = Probiotic, T5 = Prebiotic

Dressing percentage and relative organ and fat pad weight

The findings of dressing percentage, weight of organ and fat pad presented in (Table 1). The findings of the analysis of variance indicated non-significant difference, whereas for dressing percentage and relative organ weight, while results for relative fat pad between the groups showed significant difference (<P0.05). Higher dressing % was recorded in T4 group (65.1%) followed by T5 (64.7%), T3 (64.2%), T2 (62.4%) and in T1 (60.9%) group, respectively. Higher liver weight was recorded in T1 group (3.21) followed by T2, T4, T5 and T3 supplemented groups. While, higher (2.31) gizzard weight was noted in T3 supplemented group and lower (2.20) in T2 group. Higher relative weight (3.45) of intestine was noted in T2 group followed group T5 (3.43), T3 (3.42), T4 (3.40) and T1 (3.37) group. Furthermore, significantly maximum fat pad was noted in group T1 group (2.52) while minimum fat pad was observed in group (T5). Analysis of variance showed the T4 and T5 groups were find out significantly differed from the group of T1, while non-significant with T2 and T3 groups, respectively.

Parameter	Groups					
	T1	T2	T3	T4	T5	SEM
Dressing (%)	60.9	62.4	64.2	65.1	64.7	3.42
Liver	3.21	3.18	3.12	3.15	3.14	0.23
Gizzard	2.24	2.20	2.31	2.22	2.26	0.16
Intestine	3.37	3.45	3.42	3.40	3.43	0.27
Fat Pad	2.52^{a}	2.44^{ab}	2.41^{ab}	2.28^{b}	2.23^{b}	0.13

Table 1. Effect of various feed additive on dressing percentage, fat pad and relative weight of organs

Nutrient digestibility

The nutrients digestibility is presented in (Table 2). In present study analysis of variance showed (P<0.05) significant difference in the groups about crude protein and ether extract, but non-significant difference was observed for moisture, and crude fiber. Significantly higher percentage of crude protein were observed in T4 replicate (82.13%), after the T5 (80.39%), T3 (79.89%), T2 (70.41%) and in T1 (66.74%) group. However, maximum (71.47%) ether extract was recorded in T4 group and minimum (60.75%) in T1 group. Moreover, crude fiber was more (37.9%) in T3 group followed by T2 (36.3%), T4 (35.38%), T5 (35.23) and in T1 (29.74%) group. However, moisture percentage was high in T4 group and low in T1 group. Analysis of variance showed supplemented groups were non-significant with each other when compared with control group for ether extract. While, for crude protein T4, T3 and T5 groups were non-significant with each other, but significant with T2 and T1 groups.

Table 2. Effect of various feed additives on digestibility of broiler

Parameter	Groups					
	T1	T2	T3	T4	T5	SEM
Moisture	8.85	9.31	9.64	10.21	9.7	0.93
Crude protein	66.74[c]	70.41[b]	79.89[a]	82.13[a]	80.39[a]	4.56
Fat	60.75[b]	69.76[a]	70.14[a]	71.47[a]	70.40[a]	3.37
Crude fiber	29.74	36.30	37.90	35.38	35.23	2.22

[a,b,c] super scripts with different letters with in rows showed significant (P<0.05) difference

Economics

The economics of current study is shown in (Table 3). Total feed cost per bird in different control, antibiotic, enzyme, probiotic and prebiotic added group was 166.3, 176.28, 174.9, 178.9 and 176.1 rupees. Including other costs, the total expenditure for per bird in control group was 234.7, antibiotic 244.2, enzyme 242.9, probiotic 246.9 and in prebiotic 244.1 rupees. The total income of birds from different groups after marketing was more in probiotic group 272.06, followed by prebiotic 268.4, antibiotic 259.86, enzyme 256.2 and in control 239.12 rupees. Furthermore, the net profit getting after-market was higher in probiotic group 25.16, followed by prebiotic 24.3, antibiotic 15.6, enzyme 13.3 and in control 4.8 rupees per bird, respectively.

Table 3. Effect of various feed additives on economics of broiler

S. N	Particulars	Groups				
		T1	T2	T3	T4	T5
1.	Cost of day old chick (Rs/ bird)	47	47	47	47	47
2.	Total Feed Consumed (kg/bird)	3.96	4.08	4.05	4.01	4.07
3.	Cost of feed (Rs/ bird)	166.32	171.48	170.47	172.4	171.1
4.	Cost of feed additives (Rs/bird)	00	4.8	4.5	6.5	5
5.	Total cost of feed consumed	166.32	176.28	174.9	178.9	176.15
6.	Litter cost (Rs/ bird)	6	6	6	6	6
7.	Vaccination cost (Rs/ bird)	5	5	5	5	5
8.	Miscellaneous expenditure	10	10	10	10	10
9.	Total expenditure (Rs/ bird)	234.7	244.2	242.9	246.9	244.1
10.	Final weight of bird (kg)	1.96	2.13	2.10	2.23	2.20
11.	Broiler sale rate (Rs/kg)	122	122	122	122	122
12.	Total income (Rs/kg)	239.12	259.86	256.2	272.06	268.4
13.	Net profit (Rs/bird)	4.8	15.6	13.3	25.16	24.3

Discussion

Various types of feed additives, such as probiotic, prebiotic, yeast, enzymes and antibiotics can change the micro-ecology of intestine, more number of favorable microorganisms with reduction in the growth of harmful microorganism, in order to enhance the intestinal flora, efficient feed conversion ratio, improving immune function, and so on.

Result of various feed additives on broiler in the form of body weight and FCR were observed significantly more in pre and probiotic during comparison with all treatments and control replications. The findings of present investigation are according with the results of [7, 8], they had reported that addition of probiotic in broilers feed statistically better the growth performance in accordance with other

groups. Better production performance in probiotic group may be due to constancy of favorable microbial population in the gut, efficient feed intake and digestion and modifying the digestion of bacteria [9]. The mechanism that define the role of probiotics is focused on gastrointestinal tract, because, majority of these products are not absorbed and are non-efficient as growth promoters in germ-free animals. Thus, it can be speculated that there is a strong link among probiotics and intestinal micro flora. Hence, the useful effect of probiotic on microflora which result in improve performance can be interpreted in to, reduction of utilization of nutrients by microorganisms and reduction in host growth dependent microbial metabolites [10]. Moreover, sustaining the integrity of the intestinal mucosa leaded for high energy requirements, and least of pathogens and also intestinal metabolites can decrease intestinal cell turnover, resulting in more energy available for production. Finally, the reducing numbers of opportunistic pathogens and subclinical infections can also be correlated with application of probiotics [11]. Prebiotics support to substrate for beneficial bacteria chiefly situated in the hindgut. We think they might be can optimize the digestibility and performance parameters by building the fortunate environments for beneficial bacteria. However, they are solely fermented by beneficial bacteria such as *Lactobacillus*, *Bifidobacteria* and *Bacteroides*, hence because of higher ability to modulate the microbial community's composition in gut [12]. Current findings are also in favor with [13] which stated that dietary probiotic inhibit the growth of bacteria and produces enzyme which increases the feed intake and responsible to increased weight gain in probiotics fed birds another study showed same type of results [14] who have reported that rate of prebiotics were increase body weight gain, FCR and reduced mortality% during comparison with other supplemented groups. Furthermore, positive effects of prebiotics were also stated by [15]. Effect on performance by enzymes suggested by [16] performance effect of dietary enzymes is at least partially due to changes in composition and number of the intestinal microbial colonies. The present study recommended that the nutrient digestibility was significantly higher in prebiotic and probiotic supplemented group in comparison with control and different feed additive administrated groups. However, prebiotic support to stabilize the intestinal gut microflora in poultry birds, therefore efficient utilization of diet nutrients (protein and energy) improved feed intake and result in good performance criteria. According to our outcomes, various studies have shown the addition of pro and prebiotic in the broiler diet, that will cause for good performance by stimulating feed utilization and gut microflora [17] However, they also play a valuable role in digestion and nutrient retention by improving digestive enzyme activity and improving the breakdown of indigestible nutrients [18]. In recent study, no any significant effect of supplements was noted on dressing (%) and on relative weights of edible and non-edible organs, while fat pads were significantly reduced in prebiotic added replicate. The same type of outcome were reported by [19], who have showed that group relative fat pads significantly reduced in birds fed treated with prebiotic than other groups. Similarly, they did not observe significant effect of different feed additive supplements of dressing%, heart, liver and relative weight of gizzard. The outcome of our experiment reported by [20] also in agree with our findings, these scientists stated that application of chito-oligosaccharide in poultry diet reduced abdominal fat pad of broiler chicks. Moreover, [21] has reported no significant effect of the Mannan

oligosaccharides and prebiotic on the various carcass and internal organs weight of broiler. This is in favor with study of [22] who stated that weights of gizzard, liver and bursa of fabricius shows non-significance by adding of prebiotics, probiotics and antibiotics. It was concluded that between different feed additives probiotic (T4) and prebiotic (T5) groups better the production performance, increase nutrient digestibility and is more economical than other feed additives.

Authors' contributions

Conceived and designed the experiments: N Rajput, S Ali, M Naeem

Performed the experiments: I Akbar, RR Kaleri, M Mumtaz, L Rajput, Q Jogi

Analyzed the data: N Rajput, RR Kaleri,

Contributed materials/ analysis/ tools: N Rajput, I Akbar

Wrote the paper: I Akbar, RR Kaleri

References

1. Altafur Rahman, Ali M, Sultan S & Ahmed N (2007). Effect of dietary probiotic supplementation on performance of broilers. *Sarhad J Agric* 23(2): 2007.
2. Mathur S & Singh R. (2005). Antibiotic resistance in food lactic acid bacteria. *Inter J Food Microb* 105: 281-295.
3. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I & Petticrew M (2008). Developing and evaluating complex interventions: the new Medical Research Council Guidance. *Bmj* 337: a1655.
4. Dankowiakowska A, Kozlowska I & Bednarczyk M (2013). Probiotics, prebiotics and snybiotics in poultry-mode of action, limitation, and achievements. *J of Central Eur Agric* 14: 467-479.
5. Kabir SL, Rahman MM, Rahman M, Rahman M & Ahmed S. (2004). The dynamics of probiotics on growth performance and immune response in broilers. *Inter J Poult Sci* 3: 361-364.
6. Mountzouris K, Tsitrsikos P, Palamidi I, Arvaniti A, Mohnl M, Schatzmayr G & Fegeros K (2010). Effects of probiotic inclusion levels in broiler nutrition on growth performance, nutrient digestibility, plasma immunoglobulins, and cecal microflora composition 1. *Poultry Sci* 89: 58-67.
7. Gharib N, Rahimi S & Khaki P. (2012). Comparison of the effects of probiotic, organic acid and medicinal plant on Campylobacter jejuni challenged broiler chickens. *J of Agric Sci and Technol* 14: 1485-1496.
8. Houshmand M, Azhar K, Zulkifli I, Bejo MH & Kamyab A (2012). Effects of non-antibiotic feed additives on performance, immunity and intestinal morphology of broilers fed different levels of protein. *South African J of Ani Sci* 42(1): 22-32.
9. Anderson DB, McCracken JJ, Amirov RI, Simpson JM, Mackie RI, Vestegen HR & Gaskins HR (1999). Gut microbiology and growth promoting antibiotics in swine. Pig News and Information, 20:115N-122N.
10. Jin LZ, Ho YH, Abdullah N & Jalaludin S (2000). Digestive and bacterial enzyme activities in broilers fed diets supplemented with Lactobacillus cultures. *Poultry Sci* 79: 886–891
11. Dibner JJ & Richards JD. (2005). *Poultry Sci* 84: 634-643.
12. Chen K & Pachter L (2005). Bioinformatics for whole-genome shotgun sequencing of microbial communities. *PLoS comput Biol* 1(2): e24.
13. Chiang SH & Hsieh WM (1995). Effect of direct fed microorganism on broiler growth performance and litter ammonia level. *Asian-Austalian J Ani Sci* 8: 159-162.

14. Hooge DM & Connolly A (2009-2011). Meta-analysis summary of broiler chicken trials with dietary Actigen. *Inter J Poultry Sci* 10(2011): 819-824.
15. Cho JH & Kim IH (2014). Effects of lactulose supplementation on performance, blood profiles, excreta microbial shedding of Lactobacillus and Escherichia coli, relative organ weight and excreta noxious gas contents in broilers. *J of Ani Physiol and Ani Nutr* 98(3): 424-430.
16. Murphy JM, Sexton DM, Barnett DN, Jones GS, Webb MJ, Collins M, & Stainforth DA (2004). Quantification of modelling uncertainties in a large ensemble of climate change simulations. *Nat* 430(7001): 768-772.
17. Ciorba A, Bianchini C, Pelucchi S & Pastore A (2012). The impact of hearing loss on the quality of life of elderly adults. *Clin Interven in Aging* 7: 159.
18. Spring P, Wenk C, Dawson KA & Newman KE (2000). The effects of dietary mannan oligosaccharides on cecal parameters and the concentrations of enteric bacteria in the ceca of salmonella-challenged broiler chicks. *Poultry Sci* 79(2): 205-211.
19. Toghyani M, Girish CK, Wu SB, Iji PA & Swick RA (2016). Effect of elevated dietary amino acid levels in high canola meal diets on productive traits and cecal microbiota population of broiler chickens in a pair-feeding study. *Poultry Sci* 96(5): 1268-1279.
20. Zhou TX, Chen Y J, Yoo JS,. Huang Lee Y, Jang JH, Shin HD, Kim SO, Cho HJ & Kim IH (2009). Effects of chito oligosaccharide supplementation on performance, blood. *Poultry Sci* 87(2): 1132-1137.
21. Behrouz RD, Sajjad H & Afshin Z (2012). Effect of dietary supplementations of prebiotics, probiotics, synbiotics and acidifiers on growth performance and organs weight of broiler chickens. *Eur J Exper Biol* 2(6): 2125-2129.
22. Midilli M, Alp M, Kocabagli NH, Muglali OH, Turan N, Yilmaz H & Cakir S m(2008). *South African J of Ani Sci* 38: 21–27.