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Effect of different feeding level of chitosan on feed intake and weight gain of yellow feather Chinses Broiler

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Abstract: **This experiment was conducted to investigate the effects of supplementation of different levels of chitosan on the growth performance parameters and feed intake of fast growing yellow feather Chinese broilers. One hundred and sixty broiler birds at the age of 57 days were randomly assigned to four treatments and one control (eight replicates per treatment with four broilers per replicate). The control diet had no chitosan, and the treatment diets contained 0.005% 0.0125% 0.5% and 0.625% chitosan. They were after one week treatment. The results showed as that compared with the control, body weight, feed efficiency, and weights gain was increase in all chitosan groups, although not much significant. The results showed that the maximum daily weight was higher in group five and lower in one, highest for total feed intake was group three and group two have lower total feed intake, for average feed intake group three was highest and group two was low in feed intake, average weight gain was observed higher in group five and lower was investigated in group two while for FCR group three have higher FCR and group five have lower among all others group. These results suggest that a low level of dietary chitosan diet for broilers tended to have better growth performance.**

Keywords: **body weight; yellow feather; broiler chickens; chitosan; feed intake; feed conversion.**

1. INTRODUCTION

Globally, production of the primary poultry products (meat and eggs) has been rising rapidly. Poultry meat, like other meats, milk, and eggs, has a protein component usually defined as 'high quality'. While on the other hand poultry meat is a cheap source of essential nutrients for human. Due to ban of antibiotics growth promotors' nutritionists and researchers are struggling to find alternatives growth promoters for animals. Chitin is a polysaccharide of animal origin found abundantly in nature and characterized by a fibrous structure (Goy et al. 2009). Chitosan is originated from chitin, a polysaccharide formed by N-acetyl-D glucosamine units found in insects, marine diatoms, algae, fungi and crustacea, by deacetylation, demineralisation, deproteinization and decolouration (Keser et al. 2011). Several studies have been conducted on chitosan as an animal feed supplement but they have given variable results. It was reported previously that dietary supplementation of chitosan could improve animal growth performance (Xu et al. 2014). Dietary chitosan at low concentrations of 0.5–1 g/kg tended to enhance growth rate due to increased nitrogen utilization and amino acid digestibility (Shi et al. 2005). In addition, body weight gain (BWG) of broilers fed with supplementation of chitosan at 0.6 g/kg was better than that of the control group (Khambualai et al. 2008). However, another study reported a negative impact of chitosan on growth performance (Zhang et al. 2008). Effects of dietary chitosan on the growth performance in broiler chickens are still controversial. Chitosan has been regarded as an additive with multifunctional activities for instances, chitosan acted as antimicrobial material against foodborne pathogens (Kong et al. 2010). The addition of 0.2%

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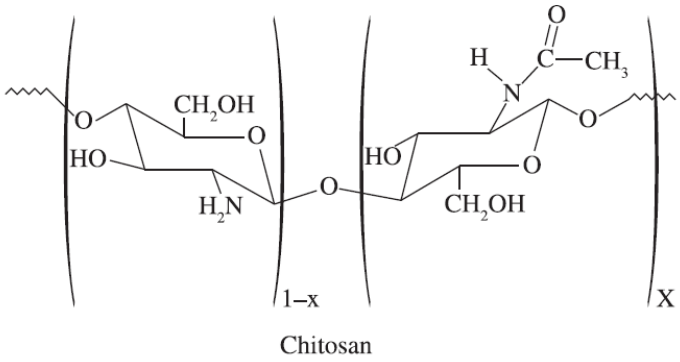
chitosan in diet could significantly decrease colonization of *Salmonella Typhimurium* in vitro and in broilers (Menconi et al. 2014). Chitosan statistically reduced levels of total cholesterol, low-density lipoprotein cholesterol in plasma and total triglyceride in rat liver (Xu et al. 2007). The addition of 10% w/w chitosan to the broiler litter reduced total and organic nitrogen loss as well as concentrations of ammonia-producing bacteria and fungi compared to the control litter group without chitosan (Cook et al. 2011). The percentages of antimicrobial resistance to bacteria in livestock including broilers were high in Thailand (Chuanchuen 2013). Therefore, possible alternative additive to replace antibiotic in improving growth performance and gut function but reducing ammonia volatilization in broiler production was needed (Attia et al. 2011). This study aimed to investigate the effects of two levels of dietary chitosan on growth performance in yellow feather Chinese broiler. The study is very important because it will provide knowledge on the suitable feeding level of chitosan for the maximum growth performance broiler chicken.



Chitosan

Fig.1: Schematic representations of the chemical structures of the chitosan (Goy et al. 2009).

2. MATERIALS AND METHODS

The experimental protocol followed relevant guidelines and regulations on the use of animals for scientific purposes and was certified by the Guangdong Ocean University Animal Care and Use Committee.

Feed Formulation

Feed formulation was made by traditional handmade method. First we weigh the ingredients separately according to given formula in table 1 and 2. After that mixed the micro-ingredients thoroughly and then add one by one ingredients together. We mixed many times just to ensure the proper mixing of all micro as well as macro-ingredients well. Than weigh the all mash feed in different bags and kept it in cool place to avoid oxidation and spoilage of feed.

Table 1: Ingredient composition and chemical analysis of basal diet

Sr. No	Ingredients	Percentage used in Formula
1	Corn	58.70
2	Soybean meal	27.00
3	Wheat bran	0.9
4	Corn DDGS	7.09
5	Peanut Oil	1.00
6	$CaHPO_4$	1.50
7	Shell meal	1.36
8	Common salt	0.30
9	Methionine	0.15
10	Premix	2.00

Gross energy, MJ/kg 16.7, Crude protein 183.3 g/kg, Crude fat 5%, Crude fibre 3%, Ash 6%, Calcium 1%, and Phosphorus 0.45%.

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Birds, diets and environment

The chicks were vaccinated with the Newcastle plus Infectious Bronchitis vaccine at the hatchery. One hundred and sixty, fifty seven days old yellow feather broilers were allocated into 5 groups of 8 replicates (4 chicks in a replicate) in a complete randomized design. Group 1 (G1) received 0.005% chitosan in the basal diet while chicks in group 2 (G2) received 0.125% chitosan in the basal diet. Groups 3 (G3) received 0.5% chitosan in the basal diet and group 4 (G4) and group 5 (G5) were supplemented with chitosan 0.5% and 0.625% in the basal diet, respectively. Chickens were fed on manual made basal diet composed of corn-soybean meal as a major ingredient given in (Table 1). Feed and water were provided ad libitum. The basal diet met or exceeded the nutrient requirements recommended by Chinese poultry nutrition guidelines. The chitosan and all ingredients along with chicken used in this experiment was provided by agriculture college research funds committee. Its degree of deacetylation was determined to be 85% with molecular weight 500,000 dalton and particle size 60 mesh. Chicks in all groups were raised under the same condition in different wire cages house at a density of 4 birds/ft2. The neutral thermal temperature and optimum relative humidity was ensured. Regular cleaning and general sanitation were also ensured to prevent the outbreak of diseases and to get maximum weight gain. The experiment was conducted in June for one week. Average temperature and relative humidity during the experiment were 31± 2ºC and 66.8 ± 9.6%, respectively.

Sampling and measurements

Growth performance and feed intake

Feed intake was recorded daily during the experimental period. Broilers were weighed on the start of experiment and at the end of the trail after one week. Growth performance was determined in terms of average body weight gain (ABWG), daily weight gain, feed conversion ratio (FCR), while intake was determined by daily feed intake, and total feed intake in a whole experimental period.

Statistical analyses

The effect of the feeding treatments on each experimental parameter was analyzed using one-way ANOVA on the data set comprising 8 replicates per treatment. The number of subjects in each replicate varied and the assessment as previously described and specified in tables. When a significant ($p<.05$) F statistic was noted, treatment means were separated by Duncan's new multiple range tests.

3. RESULTS

Growth performance and feed intake

Results of our study are given in table 4 and graphical representation of data separately given in figure 2 to figure 6. As shown in Table 2, the ADG on day 57-64 were significantly better ($p<.05$) than those of others group, and FCR of chicks in all periods in group 3 were significantly better ($p<.05$) than those of other groups. However, there was no significant difference between the G1 and the chitosan groups G2. FCRs of birds in G2 were better from all other groups in all period. G3 was highest for total feed intake and group two have lower total feed intake, for average feed intake group three was highest and group two was low in feed intake.

Table 2: Growth performance and feed intake of broilers in the various treatments in each period of the study

Parameters	G-1	G-2	G-3	G-4	G-5	SE±	P-value
Daily Gain (kg)	0.118^{b}	0.073^{a}	0.085^{a}	0.121^{ab}	0.137^{b}	0.02	0.02
AWG(kg)	0.780^{ab}	0.292^{a}	0.340	0.847^{ab}	0.962^{b}	0.2	0.25
Daily feed intake	0.526^{b}	0.473^{ab}	0.566^{b}	0.482^{ab}	0.452^{ab}	0.04	0.01
Total feed intake	2.104^{a}	1.893^{b}	2.267^{ab}	1.929	2.169^{a}	0.1	0.27
FCR	1.320^{b}	1.600	1.927^{a}	1.081	1.207^{ab}	0.3	0.03

a,b Means in the same row with unlike superscripts were significantly different ($p<.05$).

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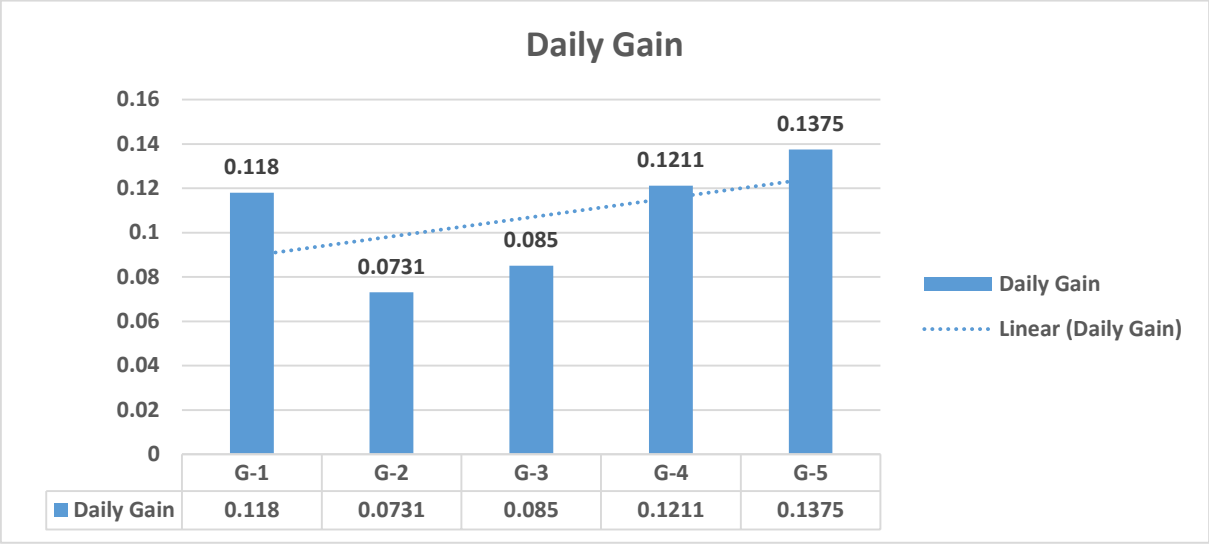

Fig.2: Average daily gain

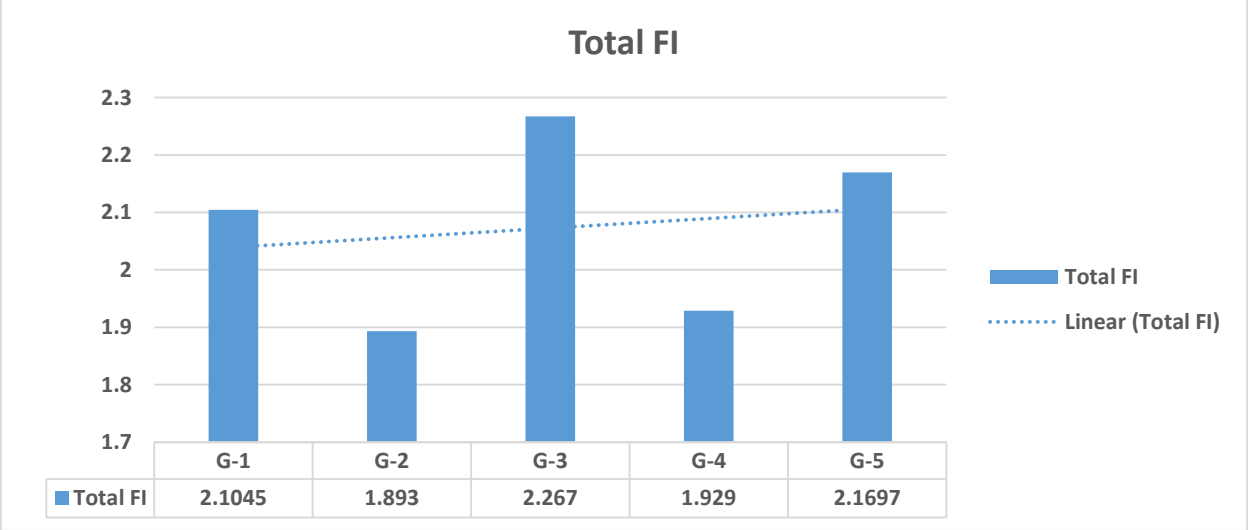

Fig.3: Total feed intake

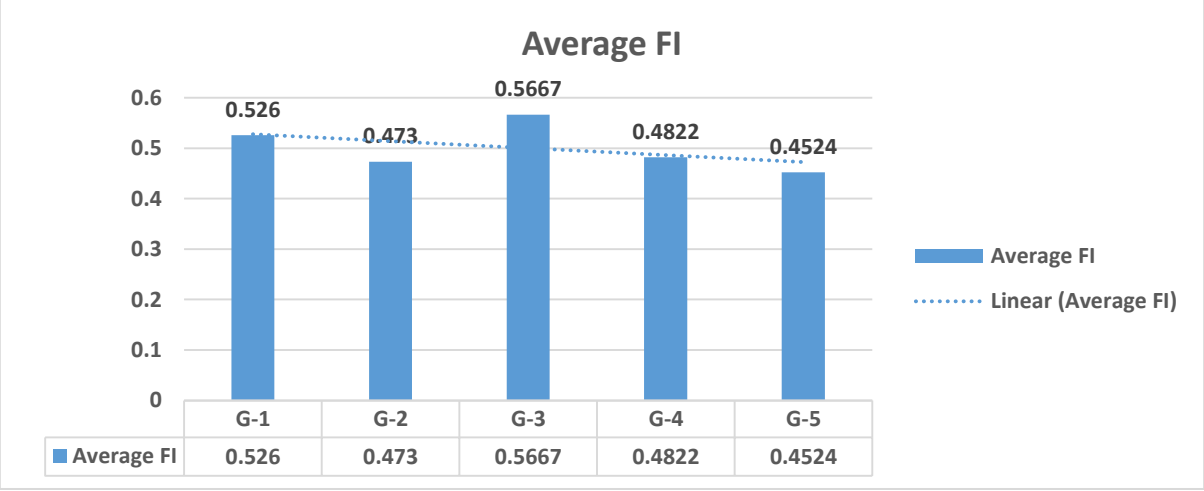

Fig.4: Average feed intake

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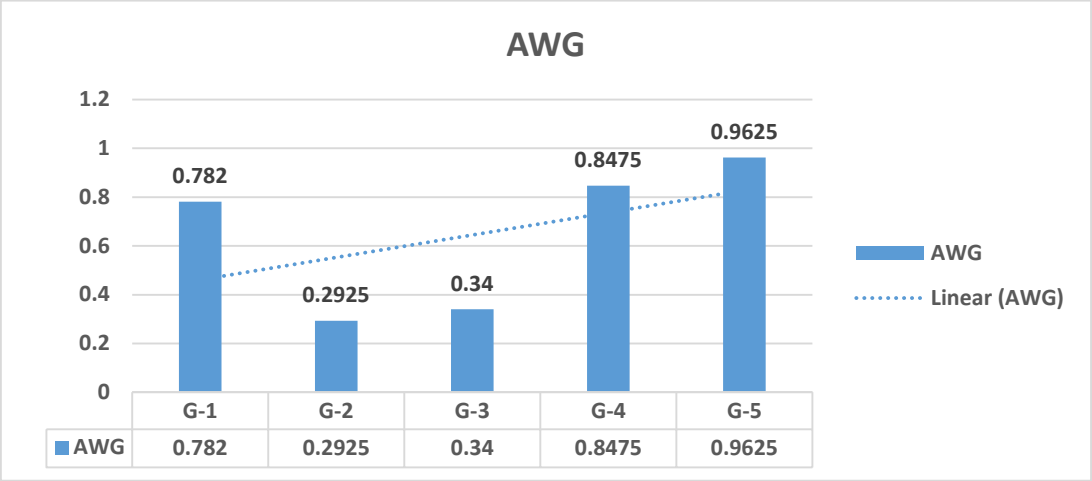

Fig.5: Average weight gain

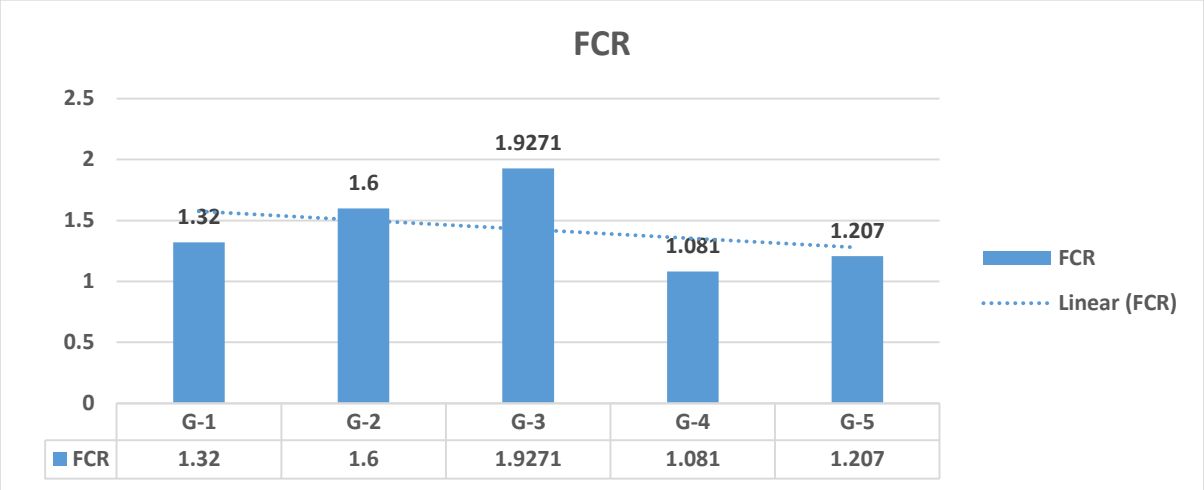

Fig.6: Feed conversion ratio

4. DISCUSSION

The addition of 0.125% chitosan in diet tended to promote FCR. Broiler chickens supplemented with either 0.5 or 0.625% chitosan in diet tended to have better growth and feed conversion efficiency since chitosan probably played a vital role in regulating intestinal microflora including enhancing digestion and absorption of protein (Shi et al. 2005). However, male Marshall Chunky broilers fed with 0.6 g/kg chitosan for 7 weeks of age could improve BWG and feed intake but had no difference in feed efficiency (Khambualai et al. 2009). It should be noted that the results of growth performance in broiler chickens from several studies were different, possibly owing to a variety of chitosan characteristics such as concentration, degree of acetylation and molecular weight (Goy et al. 2009; Khambualai et al. 2009). The broiler chickens were raised in wire cages therefore there may be some areas with poor ventilation. It could be seen that there were increase in weight gain among all the treatments in each group although there were differences in weight gain among all groups This is reflected in the variation of values in the final weight gained. Cumulatively, on group basis, group 3 performed better than all the groups followed by groups 2 and 1. Comparatively, there was no significant difference ($P>0.05$) between groups 2 and 3 but there was a significant difference ($P<0.05$) between group 3 and 1 and 3 to 3 and 4 and 5. All the groups experienced increase in weight gain from the beginning to the end of the feeding period although the level of gain varied among the groups. The daily feed intake could not be taken as a true reflection of the study since some of the feed was spilled making calculation difficult. This eventually affected the calculation for the feed conversion ratio. Despite the little challenges faced, all the groups saw some level of gain in their weight. It can therefore be concluded that the composition and type of feed have varying effects on the growth of chicken.

5. CONCLUSIONS

From the overall results, it is concluded that chitosan at 0.625% could be used as an effective alternative to antibiotics in broiler diets with an improvement of growth performance and feed intake.

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