Effect of New Feed Additive on Growth Performance and Immunoglobulin of Broilers

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Abstract. Recently postbiotics and inulin combinations used as a new feed additives. Within current study, we examined the effect of new feed additives on growth performance and immunoglobulin of broiler. 216 one day-old male chicks were distributed into six treatments, six replicates/six birds in cage system, negative control (NC) without additive, positive control (PC) basal diet + antibiotic, Basal diet + 0.15% postbiotic + 1.0% inulin (T1), Basal diet + 0.3% postbiotic + 1.0% inulin (T2), Basal diet + 0.45% postbiotic + 1.0% inulin (T3), Basal diet + 0.6% postbiotic + 1.0% inulin (T4) and nourished for six weeks. Results demonstrated that birds that fed T3 and T1 had greater (p<0.05) body weight in the starter and finisher phase than negative control birds. The outcomes from the current study exhibited that the immune response increased especially at the starter phase for both types of immunoglobulin. We conclude that combinations of postbiotic and inulin are potential substitutes for antibiotic in poultry industry as growth promoters.

1. Introduction

The evacuation of antibiotic growth promoters from poultry feeds has forced the poultry industry as well as growers to look for alternatives for due to chance components of cross-resistance securing by destructive bacteria. Recently postbiotics used as a new feed additive and it is potential replacements for antibiotic growth promoters [1]. Salmonellosis and campylobacteriosis in particular became a nuisance forcing the elimination of the total poultry herds as well as causing perilous zoonotic diseases in humans [2]. Nowadays antibiotic which utilized as growth promoters barred in numerous countries because of health concerns by the public [3]. Nonetheless, commercial probiotics have consistently failed to meet the anticipated capability and their efficacy is uncertain. In addition, the use of probiotics could lead to the occurrence of antibiotics gene resistance that could be transferred between organisms [4]. These justify the need to search for suitable and safe alternative to probiotics. Postbiotic, a metabolite of probiotics exhibits probiotic effect without living cells. Despite the efficacies of postbiotics and inulin, the synergistic impacts of prebiotic and postbiotic combinations have not been elucidated. This study examined the influence of postbiotic produced by Lactobacillus plantarum RG14, and inulin combinations on growth performance and immunoglobulin. These natural additives which include bacteriocin, lactic acid, acetic acid and so on are nutritionally practical substitutes for growth promoters in animal feeds [5, 6, 7]. Studies have shown that probiotics supplementation could have many effects like alteration of the intestinal microbiota, inspiration of the immune system, reduction in inflammatory reactions,
improvement of growth performance [8] as well as influencing on the gut immune system thru the stimulation of specific bacteria absorption [9]. Therefore, this finding is aimed examining the effects of combining postbiotic and inulin on growth rate and immune responses in broiler chickens.

2. Materials and Methods

2.1 Postbiotics and Inulin

The stock culture of *Lactobacillus plantarum* RG14 was set and labelled by Kareem et al. [10]. The inulin (Frutafit IQ) was provided by Connell Bros. Company (Malaysia) Sdn. Bhd.

Gas Chromatography-Mass Spectrometry (GC-MS) Analysis

The profile of compounds in postbiotic from *L. plantarum* was analysed by GC-MS. The compounds in the extract were quantitatively measured by GCMS. A 1.5 mL extract was injected in the GCMS spectrophotometer. The GC-MS (shimadzu QP2010 plus) with EI electron impact ion source of 70eV using a BPX5 fused silica capillary column (25 m × 0.33 m I.D, film thickness 0.25 μm). The temperature condition was programmed from 40 °C (1 min) to 250 °C at 10 °C/ min. Peak areas and retention times were measured by electronic integration. The relative amount of individual components was expressed as percentage by peak area normalization. Identification of extract components was based on computer matching of mass spectra with NIST 08 mass spectral library of the GC-MS QP2010 Plus system.

| No. | Compound Name                          | Retention time | Area (%) | Height (%) | Molecular Formula |
|-----|----------------------------------------|----------------|----------|------------|-------------------|
| 1   | Acetic acid                            | 8.46           | 62.50    | 44.31      | C2H4O2            |
| 2   | Lactic acid                            | 20.66          | 30.04    | 25.08      | C3H6O3            |
| 3   | 2-furancarboxaldehyde, 5-methyl         | 24.08          | 1.63     | 3.83       | C6H6O2            |
| 4   | Furfural                               | 15.33          | 1.30     | 3.51       | C5H4O2            |
| 5   | Propionic acid                         | 14.59          | 0.14     | 0.56       | C3H6O2            |
| 6   | Benzeneacetaldehyde                    | 19.26          | 1.07     | 4.70       | C8H8O             |
| 7   | Pyruvic acid                           | 18.54          | 0.44     | 3.11       | C3H4O3            |
| 8   | Ethanone                               | 17.62          | 0.12     | 1.07       | C6H6O2            |
| 9   | 6-Methyl-3-pyridazinone                | 17.95          | 1.35     | 5.43       | C5H6N2O           |
| 10  | Citraconic acid anhydride              | 18.96          | 0.80     | 5.29       | C5H4O3            |
| 11  | Butyric acid hydrazide                 | 20.15          | 0.14     | 1.22       | C4H10N2O          |
| 12  | 4-Aminocyclohexanol acetate            | 26.66          | 0.34     | 1.15       | C8H15NO2          |
| 13  | Acetone, methylallyl                   | 28.19          | 0.13     | 0.64       | C6H10O            |

2.2 Identification of volatile components by GC-MS

The GC-MS analysis was carried out in the Department of Chemistry, Faculty of Science, Universiti Putra Malaysia. The distinguished top peaks were matched with the National Institute of Standards and Technology (NIST 08 and NIST 08s) library and by immediate correlation with distributed data or published information. The analyses were done in triplicates. The major significant organic compounds were detected (Table 1). The spectrum range of the obscure components was contrasted and the spectrum range of the known component parts put away in the NIST 08s library. The compound’s name, molecular
weight, molecular formula and structure of component of the material were determined. The relative rate measure percentage of every component part was ascertained by contrasting its average top peak area with the total areas. Programming software used to handle mass spectra and chromatograms were a GC-17A Ver. 3.

Table 2: Composition and nutrient contents of starter diets

| Ingredients                  | negativ control | Positive control | T1  | T2  | T3  | T4  |
|------------------------------|-----------------|------------------|-----|-----|-----|-----|
| Yellow Corn                  | 50.00           | 50.00            | 50.00| 50.00| 50.00| 50.20|
| Soybean meal 44              | 29.45           | 29.45            | 29.43| 29.56| 29.63| 29.72|
| Wheat pollard                | 7.41            | 7.40             | 5.72 | 5.43 | 5.17 | 4.72 |
| Crude protein oil            | 3.08            | 3.08             | 3.36 | 3.40 | 3.44 | 3.44 |
| Fish meal (55%)              | 7.45            | 7.45             | 7.60 | 7.58 | 7.58 | 7.58 |
| L-Lysine                     | 0.10            | 0.10             | 0.25 | 0.25 | 0.25 | 0.25 |
| DL-Methionine                | 0.20            | 0.20             | 0.20 | 0.20 | 0.20 | 0.20 |
| Monodicalcium phosphate21    | 1.00            | 1.00             | 1.00 | 1.00 | 1.00 | 1.00 |
| Calcium carbonate            | 0.70            | 0.70             | 0.68 | 0.68 | 0.68 | 0.68 |
| Choline chloride             | 0.06            | 0.06             | 0.06 | 0.06 | 0.06 | 0.06 |
| Salt                         | 0.25            | 0.25             | 0.25 | 0.25 | 0.25 | 0.25 |
| Mineral premix B             | 0.10            | 0.10             | 0.10 | 0.10 | 0.10 | 0.10 |
| Vitamin premix C             | 0.06            | 0.06             | 0.06 | 0.06 | 0.06 | 0.06 |
| Antioxidant D                | 0.01            | 0.01             | 0.01 | 0.01 | 0.01 | 0.01 |
| Toxin binder E               | 0.14            | 0.14             | 0.14 | 0.14 | 0.14 | 0.14 |
| Antibiotic                   |                 |                  |     |     |     | 0.01 |
| postbiotic RG14              |                 |                  | 0.15| 0.30| 0.45| 0.60 |
| Inulin                       |                 |                  | 1.00| 1.00| 1.00| 1.00 |
| Total                        | 100             | 100              | 100 | 100 | 100 | 100 |
| Calculated nutrient content  |                 |                  |     |     |     |     |
| (g/kg)                       |                 |                  |     |     |     |     |
| Crude protein (%)            | 21.93           | 21.93            | 21.93| 21.93| 21.93| 21.93|
| ME (MJ/Kg)                   | 12.83           | 12.83            | 12.83| 12.83| 12.83| 12.83|

A Negative control: (basal diet), Positive control: (basal diet + neomycin and oxytetracycline), T1: (0.15% RG14 + 1.0% inulin), T2: (0.3% RG14 + 1.0% inulin), T3: (0.45% RG14 + 1.0% Inulin), T4: (0.6% RG14 + 1.0% Inulin). B Mineral mix contains Fe 100 mg, Mn 110 mg, Cu 20 mg, Zn 100 mg, I 2 mg, Se 0.2 mg, Co 0.6 mg. C Vitamin premix contains retinol 2 mg, cholecalciferol 0.03 mg, α-tocopherol 0.02 mg, menadione 1.33 mg, cobalamin 0.03 mg, thiamine 0.83 mg, riboflavin 2 mg, folic acid 0.33 mg, biotin 0.03 mg, panthothenic acid 3.75 mg, niacin 23.3 mg, pyridoxine 1.33 mg. D Antioxidant contains butylated
hydroxyanisole (BHA). The toxin binder contains natural hydrated sodium calcium aluminium silicates. The diets were formulated using feed live International software (Thailand). Metabolizable energy.  

### Table 3: Composition and nutrient contents of finisher diets

| Ingredients            | Dietary treatments<sup>A</sup> | negative control | Positive control | T1    | T2    | T3    | T4    |
|------------------------|-------------------------------|------------------|------------------|-------|-------|-------|-------|
| Yellow Corn            |                               | 54.70            | 54.69            | 54.70 | 54.69 | 54.80 | 54.85 |
| Soybean meal 44        |                               | 29.10            | 29.10            | 29.21 | 29.28 | 29.37 | 29.41 |
| Wheat pollard         |                               | 5.73             | 5.72             | 3.63  | 3.31  | 2.99  | 2.78  |
| Crude protein oil      |                               | 3.44             | 3.44             | 3.77  | 3.82  | 3.83  | 3.85  |
| Fish meal (55%)        |                               | 3.58             | 3.58             | 3.88  | 3.91  | 3.89  | 3.90  |
| L-Lysine               |                               | 0.19             | 0.19             | 0.25  | 0.25  | 0.25  | 0.25  |
| DL-Methionine          |                               | 0.20             | 0.20             | 0.20  | 0.20  | 0.20  | 0.20  |
| Monodicalcium phosphate|                               | 1.24             | 1.24             | 1.35  | 1.37  | 1.35  | 1.30  |
| Calcium carbonate      |                               | 1.22             | 1.22             | 1.24  | 1.25  | 1.25  | 1.25  |
| Choline chloride       |                               | 0.05             | 0.05             | 0.06  | 0.06  | 0.06  | 0.06  |
| Salt                   |                               | 0.25             | 0.25             | 0.25  | 0.25  | 0.25  | 0.25  |
| Mineral premix<sup>B</sup> |                           | 0.10             | 0.10             | 0.10  | 0.10  | 0.10  | 0.10  |
| Vitamin premix<sup>C</sup> |                         | 0.06             | 0.06             | 0.06  | 0.06  | 0.06  | 0.06  |
| Antioxidant<sup>D</sup> |                               | 0.01             | 0.01             | 0.01  | 0.01  | 0.01  | 0.01  |
| Toxin binder<sup>E</sup> |                              | 0.15             | 0.15             | 0.15  | 0.15  | 0.15  | 0.15  |
| Antibiotic             |                               | 0.01             |                  |       |       |       |       |
| postbiotic RG14        |                               | 0.15             | 0.30             | 0.45  | 0.60  |       |       |
| Inulin                 |                               | 1.00             | 1.00             | 1.00  | 1.00  |       |       |
| Total                  |                               | 100              | 100              | 100   | 100   | 100   | 100   |

| Calculated nutrient content<sup>F</sup> (g/kg) | Crude protein (%) | 19.89 | 19.89 | 19.89 | 19.89 | 19.89 | 19.89 |
|                                              | ME<sup>G</sup> (MJ/Kg) | 12.98 | 12.98 | 12.98 | 12.98 | 12.98 | 12.98 |

<sup>A</sup>Negative control: (basal diet), Positive control: (basal diet + neomycin and oxytetracycline), T1: (0.15% RG14+1.0% inulin), T2: (0.3% RG14+1.0% inulin), T3: (0.45% RG14+1.0% Inulin), T4: (0.6% RG14+1.0% Inulin). <sup>B</sup>Mineral mix contains Fe 100 mg, Mn 110 mg, Cu 20 mg, Zn 100 mg, I 2 mg, Se 0.2 mg, Co 0.6 mg. <sup>C</sup>Vitamin premix contains retinol 2 mg, cholecalciferol 0.03 mg, a-tocopherol 0.02 mg, menadione 1.33 mg, cobalamin 0.03 mg, thiamine 0.83 mg, riboflavin 2 mg, folic acid 0.33 mg, biotin 0.03 mg, panthothenic acid 3.75 mg, niacin 23.3 mg, pyridoxine 1.33 mg. <sup>D</sup>Antioxidant contains BHA. <sup>E</sup>Toxin binder contains natural hydrated sodium calcium aluminium silicates. <sup>F</sup>The diets were formulated using feed live International software (Thailand). <sup>G</sup>Metabolizable energy.

### 2.3 Animals and Experimental Design

Two hundred-sixteen male chicks (COBB) at day old were sourced from a commercial farm allocated to six treatments; each treatment had six replicates with six bids/per replicate. The treatments comprises NC;
without additive, PC; basal diet + antibiotics (neomycin and oxytetracycline), Basal diet + 0.15% postbiotic RG14 + 1.0% inulin (T1), Basal diet + 0.3% postbiotic RG14 + 1.0% inulin (T2), Basal diet + 0.45% postbiotic RG14 + 1.0% inulin (T3), Basal diet + 0.6% postbiotic RG14 + 1.0% inulin (T4) and nourished for six weeks. Based on our previous findings Kareem et al. [11] 1.0% inulin was chosen, this level was the best treatment in comparison to other levels for growth performance. Feed and water were provided ad libitum for 42 days of age. Starter diets from first day to 21 days and finisher diets from day 22 till end of the day offered (Tables 2 and 3). The experimental animals received humane care as outlined and approved by Institutional Animal Care and Use Committee for Scientific Purposes of the Research Policy, of Universiti Putra Malaysia.

2.4 Samples and data collection

At the first day birds were wing banded then individually weighed recorded as body weight (BW), feed intake (FI), body weight gain (BWG), and the feed conversion ratio (FCR) were verified weekly. Twelve birds randomly selected from each treatment, two birds per replicate to measure plasma immunoglobulin after slaughtering at week three and week 6.

2.5 Plasma immunoglobulin concentration

IgG and IgM concentrations from plasma were determined by Chicken IgG ELISA Kits and Chicken IgM ELISA Kits (Alpha Diagnostic International). Thereafter, 50 μl of standard and plasma (in duplicate) was pipetted into microtiter plate in pre designated wells and added detection reagent A 50 μl then shacked and incubated for 1 hour at 37 °C. Wells were washed with wash solution and aspirated four times to remove residual buffer. Later, 100 μl of reagent B was pipetted into each well and incubated at 37°C for 30 minutes. Wells were added 90 μl of substrate solution and covered with new plate sealer after that incubate in the dark place to protect from light at 37°C for 25 minutes. Finally, microplate reader (Model 3550-UV, Bio-Rad) was used to absorbance which was determined at 450 nm wavelength after using 50 μl stop solution for each well.

2.6 Statistical analysis

A completely randomized design was used for the experiment. Data generated were analysed expending the General Linear Model (PROC GLM) of the SAS, computer software version 9.4 [12]. Duncan was used to separating means in range test at p< 0.05 level of significance. For the linear and quadratic of the response to incremental concentration of postbiotic RG14 orthogonal polynomial contrasts were used.

3. Results and Discussion

3.1 Growth performance

Growth performance of broilers nourished with diets that include combination of inulin and postbiotic was exhibited in table 4. The supplementation of combinations of different levels of postbiotic and inulin in broiler significantly (p<0.05) increased the BW and BWG, whereas there were no significant differences (p>0.05) detected for all combinations at starter phase for FI and FCR. In the finisher phase, T1 and T3 obviously exhibited higher body weight in comparison to NC and PC groups. However, there were no significant differences (p>0.05) amongst the treatments which were nourished with different levels and combinations of inulin and postbiotic. In addition, no significant differences were established amongst all the treatments for FI and FCR in this phase.
3.2 Immune response

Two immunoglobulins, IgG and IgM, were used as indicators and their responses to combinations of postbiotic and inulin supplementations at two phases of growth periods are presented in Table 5. At the starter phase, IgG level was improved significantly (p<0.05) for birds nourished diets with postbiotic and inulin combinations as compared to the negative control. Moreover, birds fed T1, T2 and T3 had increased (p<0.05) for the IgG level in plasma as comparison to the negative and positive control. The IgG level for positive control was significantly higher (p<0.05) in distinction with the negative control. At the finisher phase, the highest IgG level was detected with birds nourished T2 diets. Birds nourished T1, T2 and T4 increased significantly (p<0.05) in IgG levels in comparison with the negative control.

Table 4: Effect of different levels of postbiotic and inulin combination on performance on broiler

| Parameter | Dietary treatments | SEM<sup>B</sup> | Linear<sup>C</sup> | Quadratic<sup>C</sup> |
|-----------|-------------------|-----------------|-------------------|-----------------------|
|           | negativ e control | positiv e control | T1 | T2 | T3 | T4 | |
| 3 weeks of age | | | | | | |
| Initial BW | 48.81 | 46.86 | 48.22 | 47.50 | 46.81 | 47.61 | 0.28 | NS | NS |
| BW (g) | 763.44<sup>b</sup> | 785.97<sup>a</sup> | 814.83<sup>a</sup> | 790.56<sup>a</sup> | 803.81<sup>a</sup> | 815.17<sup>a</sup> | 5.19 | * | NS |
| BWG (g) | 714.64<sup>b</sup> | 739.11<sup>a</sup> | 766.61<sup>a</sup> | 743.06<sup>a</sup> | 757.00<sup>a</sup> | 767.56<sup>a</sup> | 5.13 | * | NS |
| FI (g) | 1033.3 | 1031.9 | 1109.7 | 1065.2 | 1034.7 | 1086.1 | 10.89 | NS | NS |
| FCR (g:g) | 1.45 | 1.40 | 1.45 | 1.43 | 1.37 | 1.42 | 0.01 | NS | NS |
| 6 weeks of age | | | | | | |
| BW (g) | 2068.82<sup>b</sup> | 2093.8<sup>b</sup> | 2239.5<sup>a</sup> | 2167.82<sup>ab</sup> | 2234.9<sup>a</sup> | 2105.9<sup>b</sup> | 14.2 | NS | * |
| BWG (g) | 1327.61<sup>bc</sup> | 1304.6<sup>c</sup> | 1426.8<sup>ab</sup> | 1350.71<sup>abc</sup> | 1447.6<sup>a</sup> | 1302.5<sup>c</sup> | 15.5 | NS | * |
| FI (g) | 2738.67 | 2770.6 | 2768.0 | 2687.67 | 2890.6 | 2796.6 | 20.6 | NS | NS |
| FCR (g:g) | 2.08 | 2.14 | 1.94 | 2.01 | 2.00 | 2.15 | 0.03 | NS | * |

<sup>a</sup><sup>b</sup>Means with different superscripts in the same row are differs significantly (P<0.05). *negative control: basal diet feed, positive control: basal diet feed+ neomycin and oxytetracycline, T1: (0.15% RG14+1.0% inulin), T2: (0.3% RG14+1.0% inulin), T3: (0.45% RG14+1.0% Inulin), T4: (0.6% RG14+1.0% Inulin).<sup>B</sup>SEM: standard error of the means (pooled). <sup>C</sup>Linear or quadratic response estimated using orthogonal polynomial contrasts (NS: non-significant; * P<0.05).
The immunoglobulin IgM level for birds nourished PC, T1, T3 and T4 was increased significantly (p<0.05) in comparison to the negative control at 21 days of age. At day 42, the highest IgM level was observed in the T3 birds and it was significantly higher than the NC, while there was no significant difference among the PC, T1, T3 and T4.

Table 5: The effects of different levels of postbiotic and inulin on immunoglobulins in the plasma of broiler chickens at 21 and 42 day of age

| Immunoglobulin | Dietary treatments A | SEM B | Linea r C | Quadratic c |
|----------------|----------------------|-------|------------|-------------|
|                | negative control     | positive control | T1 | T2 | T3 | T4 |
| IgG (mg/mL)    | Day 21               | 1977.5     | 1995.27c | 2010.55 ab | 2011.9 6a | 2011.07 ab | 1996.17 bc | 3.08 * * |
|                | Day 42               | 2059.3 4c | 2099.68bc | 2149.13 ab | 2167.0 6c | 2093.70 bc | 2154.34 ab | 11.15 * * |
| IgM (mg/mL)    | Day 21               | 2115.4 3c | 2585.42ab | 2533.44 ab | 2122.2 8c | 2778.73 a | 2640.23 ab | 50.03 * NS |
|                | Day 42               | 2808.0 3bc | 2929.60ab | 2987.97 ab | 2742.5 6c | 3078.67 a | 2901.70 abc | 30.64 NS NS |

abcd Means with different superscripts in the same row are differ significantly (P< 0.05). A Negative control: basal diet feed, positive control: basal diet feed+ neomycin and oxytetracycline, T1: (0.15% RG14+1.0% inulin), T2: (0.3% RG14+1.0% inulin), T3: (0.45% RG14+1.0% Inulin), T4: (0.6% RG14+1.0% Inulin). BSEM: standard error of the means (pooled). C Linear or quadratic response estimated using orthogonal polynomial contrasts (NS: non-significant; * P<0.05).

3.3 Growth Performance

The outcomes of this findings showed that the combinations of inulin and postbiotics improves the growth performance of broiler chickens. The outcomes of this study as presented were similar to our previous studies Kareem et al. [13] we showed birds fed combinations of postbiotics and inulin had higher (p<0.05) BW and BWG than negative control. Moreover, Humam et al. [5] who found that the final BWG and FCR significantly increased at (P<0.05) by supplementation of postbiotics produced by L. plantarum as compared to the control which added postbiotics and had no effect on FI in post weaning piglets. Nabizadeh, [14] also reported that the total BW and BWG were increased significantly when the diets were supplemented with 1% inulin. The dietary inulin treatments had no effect on feed intake in comparison to the control group in broiler chickens. Improved performances were observed in birds nourished with diet supplemented with the combination of postbiotic and inulin; and maybe due to the organic acids, bacteriocins, and vitamins present in the metabolites. Samanta et al. [15] reported that part of the effect of prebiotics and inulin on bacteria flora of the gastrointestinal tract is by synthesizing volatile fatty acids. Moreover, it was observed in a companion in vitro trial that postbiotics produced by L. plantarum showed inhibitory effect against various pathogens [16]. This could be a reason for improved performance observed in birds nourished diets augmented with fructans in this study. This study had also shown no beneficial effect of inulin supplements on performance and feed efficiency [17]. However, these findings disagrees with the report of Liu et al. [18] who found that probiotic, prebiotic and symbiotic significantly improves the feed efficiency in comparison with the negative control diets.
3.4 Plasma immunoglobulin

The study is aimed at examining whether supplementing combinations of postbiotic and inulin may enhance the immune responses of broiler chickens or not. Two immunoglobulin, IgM and IgG were used as indicators and their responses to that combinations supplementation at two stages of growth periods. The outcomes from the current study showed that the immune response increased especially at the starter phase for both types of immunoglobulin. This result was reliable with the report by Humam et al. [5], where nourishing postbiotics had a positive impact on the humoral immune response in broiler chicken. These findings are also in agreement with Yin et al. [19] who reported that supplementation with a prebiotic oligosaccharide galacto-mannan amplify the serum levels of IgA and IgG in comparison with the levels of antibiotic (lincomycin) in early-weaned pigs.

Qiu et al. [20] reported that one-day old broilers nourished diets containing Lactobacillus casei, Bifidobacterium bifidum, and Enterococcus faecium exhibited a more rapid rate of serum antigen specific to IgG production and an increase in total IgA in the jejunum than those nourished with a control diet. In addition, Zhuang et al. [21] reported enhanced serum level of IgM in ducks after being nourished with the probiotic at 21 of age. Yang et al. [22] also reported enhanced serum levels of IgA, IgM and IgG in broiler chickens after being fed with the probiotic Clostridium butyricum for 40 days.

On the other hand, Rezaei et al. [23] reported that there were no differences by supplementation of oligosaccharides in comparison with the control birds. Also Kim et al. [24] demonstrated that plasma IgG concentrations were not significantly different between prebiotics (FOS and MOS) and control group in broiler chickens.

Findings of this study indicates that IgG and IgM secretion is increased in the plasma of broiler chickens in response to postbiotic and inulin combinations administration. Postbiotics which includes short chain fatty acids and bacteriocins that can have role in balancing intestine microbiota constitutes an effective boundary against pathogenic bacteria and improving immune system in non-inflammatory manner. There’re prove of relationship between the composition of the colonizing microbiota and cytokine [13]. In this way, postbiotics can induce epithelial cell expression which potentiates IgG and IgM production through B-cell development.

4. Conclusions

This study showed that supplementation of postbiotic and inulin combinations in the diet of broiler chickens improved growth performance and immunoglobulin. However, all combinations influenced those parameters. While economically, postbiotic RG14 supplementation, 0.15%+1.0% inulin is preferred to be used as an optimal level. Thus, it is suggested that postbiotic RG14 0.15%+1.0% inulin could be used in the diet of broiler chickens as a new feed additive.

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