Effect of Dietary of Supplementation Mannan-Riched Fraction (MRF) and Probiotic-Enhanced Liquid Acidifier on the Growth Performance, Serum Blood Biochemistry, and Intestinal Properties of Broilers

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Abstract. Numerous efforts have been undertaken to develop suitable alternatives in order to counteract the anticipated drawbacks associated with the ban of antibiotic growth promoters (AGPs). The research purpose is to carry out the possible effect of mannan-riched fraction (MRF) and probiotic enhanced water as natural growth promoters (NGPs) on performance, relative organ weight, serum blood biochemistry, intestinal properties, and intestinal micro flora. 320 one-day-old Arbor Acres broiler were randomly allocated to 4 dietary treatments and 4 replicates of 20 birds per cage. four treatments used for research were dietary with control (T0), basal diet + MRF 80 g (T1), Drinking water + 2 mL/L combination feed additive (T2), and basal feed + MRF 80 g + drinking water 2 mL/L combination feed additive (T3). The results showed that using mannan riched fraction (MRF) and combination with probiotic-enhanced liquid acidifier presented significant difference (P > 0.05) on body weight gain at 1-28 days and intestinal properties. On the blood biochemistry, the effect of supplementation began to reduce the amount of glutamic oxaloacetic transaminase (GOT) and glutamic pyruvic transaminase (GPT) at 21 days periods. To sum up, the addition of mannan-riched fraction and combination with probiotic enhanced liquid acidifier doesn’t impacted on growth performance, and serum blood biochemistry but give significant effect on intestinal properties of broiler.

1. Introduction

Poultry industry serves an essential role in supporting the availability of cheap animal protein sources that are easy to obtain in Indonesia. This condition is reflected based on the demand for poultry products nationally. In 2017, broiler production increased approximately 6.82% compared to 6.34% of the population in 2016 (equivalent to 1.6 billion heads) [1]. However, the poultry business mostly involves the use of antibiotics as a growth promoter. These antibiotics growth promoters (AGPs) have been included in poultry diets as feed additives for more than 40 years in Europe. Lately, the use of antibiotic compounds has decreased and several European countries has suppressed the use of antibiotics growth promoters (AGPs) as non-nutritive feed additives. Numerous efforts have been undertaken to develop suitable alternatives to counteract the anticipated drawbacks associated with the ban of AGPs. According to the newest regulation, Indonesia has banned the use of antibiotics in poultry production. Two main reasons underlying this regulation are due to the, residual effect from antibiotics can be toxic to
consumers. Secondly, antibiotics can create resistant microorganisms in the body of humans or livestock (especially pathogenic bacteria).

The use of antibiotics are still prevalent in the poultry business. As a result the quality of meat is dependent on the feed and the used of antibiotics by farmers as feed additives. Different substances often referred to as natural growth promoters (NGPs) are supposed to achieve high consumer acceptance since they do not usually pose any risk that will lead to bacterial.

Although the amount of antibiotic used as growth promoters is relatively small, it improves the feed efficiency to help farmers obtain more enormous profits. Using feed additives is one method to improve the quality of feed [2]. The antibiotics are provided as a growth promoter; however, they cause bacterial resistance and residue in the carcass. Alternative feed additive such as mannan-riched fraction (MRF) and probiotic enhanced liquid acidifier has been the center of attention for many studies during the past five years due to its beneficial effect on feed efficiency. MRF belongs to the family of prebiotics using new techniques such as nutrigenomics. Both prebiotics and probiotics replaces use of the antibiotics because they are safer and act as a natural growth promoter (NGPs) in the broiler.

Research in several countries used prebiotics and probiotics combined for poultry to enhance their overall performance and health. The use of prebiotics combined with probiotics, acidifier’s even electrolytes in Indonesia has so far reported to their ability to maintain health, prevent digestive tract disorder by utilizing the microbes for balancing and increasing the population of non-pathogenic bacteria. The addition of probiotics, prebiotics, and acidifier is expected to detoxify toxins and their metabolites to improve absorption of nutrients and reduce cholesterol level in blood.

Probiotics are the hot prospects for feed additives that can be provided to animal in both solid and liquid forms. The used of prebiotics are to balance pH, lactic acid bacteria colony, and decreasing the nutrient of pathogen bacteria that can survive in the intestines [2]. The role of prebiotics has a synergistic effect in which lactic acid bacteria (LAB) can inhibit the growth of pathogenic microbes especially Escherichia coli and Enterococcus sp. The activator of the prebiotics increases the number of feed intake for the growth of the internal organ of chicken [3]. Therefore, the purpose of this research is to investigate the possible effect of mannan-riched fraction (MRF) and probiotic enhanced liquid acidifier on growth performance, relative organ weight, serum blood biochemistry, intestinal properties, and intestinal micro flora on broilers.

2. Materials and methods

2.1. Broiler

320 (male and females) one-day-old Arbor Acres broiler were randomly allocated to four dietary treatments and 4 replicates of 20 (10 males and 10 females) birds per cage. The chickens were sacrificed every 21, 28, and 35 days (eight chicken were sacrificed) with a total of 32 broilers. The chicks were placed in rice hull-littered floor pens for five weeks feeding trial, including 0-2 weeks, 3-4 weeks and five weeks. Broilers were provided ad-libitum feed and water.

2.2. Prebiotic

A prebiotic "was used throughout this experiment derived from the surface of cell wall membrane e of a specific strain of yeast - Saccharomyces cerevisiae 1062. MRF contains a greater concentration of mannan reactive units (alpha 1,3 mannan).

2.3. Probiotic-enhanced liquid acidifier

The feed additive used in this research was probiotics-enhanced liquid acidifier consists citric acid, sodium chloride, potassium chloride, acetic acid, sodium citrate, ethyl vanillin, zinc sulphate, iron sulphate, magnesium sulphate, dried Aspergillus niger fermentation extract, and dried Bacillus subtilis fermentation extract.
Table 1. Experimental diet

| Feed nutrient          | Starter (1-21 days) | Finisher (22-35 days) |
|------------------------|---------------------|-----------------------|
| Yello corn             | 57.11               | 69.66                 |
| Dehulled soybean meal  | 36.53               | 26.65                 |
| L-Lysine               | 0.1                 | 0.1                   |
| DL-methionine          | 0.55                | 0.55                  |
| Dicalcium phosphate    | 1.67                | 1.55                  |
| Limestone              | 1.13                | 1.02                  |
| Salt                   | 0.3                 | 0.3                   |
| Soy oil                | 2.81                | 0.06                  |
| Vitamin premix*        | 0.05                | 0.05                  |
| Mineral premix**       | 0.05                | 0.05                  |
| Choline                | 0.1                 | 0.1                   |
| **                      | 100                 | 100                   |

|                | Dry matter (%)     | ME (Kcal/kg)       | Ash (%)       | Crude protein (%) | Fat (%) | Crude fibre (%) | Ca        | P           | Copper (ppm) | Zinc (ppm) |
|----------------|--------------------|-------------------|---------------|------------------|---------|-----------------|-----------|------------|--------------|------------|
|                | 87.00              | 3050              | 9.00          | 22.00            | 6.00    | 3.00            | 1.00%     | 0.70%      | 30           | 120        |

*vitamin premix (per kg of diet): vitamin A 12,500 IU; Vitamin D3, 2,500; Vitamin E 20 IU; Vitamin K3 2.5 Mg; Vitamin B1, 2Mg; Vitamin B2, 5 Mg; Vitamin B3, 3Mg; Vitamin B12, 0.012 Mg; Niacin 35 Mg; Patheronic acid 12Mg; Folic Acid 1Mg; **Mineral premix (Per kg of diet); Fe 70 mg, Zn, 90 mg; Cu, 10 mg; Mn, 80 mg

The treatment use four treatments, and four replicates. The treatments were:

**T0**: Basal diet + without feed additive (control)
**T1**: Basal diet + MRF (Actigen™) 80g
**T2**: Drinking water + 2 ml / L Combination feed additive (Acid-Pak 4-way®)
**T3**: Basal diet + MRF (Actigen™) 80g + Drinking water 2 ml / L Combination feed additive (Acid-Pak 4-way®)

2.4. Data Analysis
Data are analyzed using the analyses of variance using one-way anova with Completely Randomized Design (CRD) in SAS (version 9.4, SAS Institute Inc.,) and continued with Duncan Multiple Range Test (P < 0.05) separated the differences between the means of groups.

3. Result and discussion

3.1. Growth performance
According to the Table 2 showing the growth performance, diets containing MRF and probiotics-enhanced liquid acidifier level was presented significant difference (P>0.05) on body weight gain at 1-
28 days for all treatment (T1, T2, and T3) increased compared with control (1138.73, 1128.63, 1192.09 vs. 1001.12 g/bird; P < 0.05). The treatment (T3) presented greater than all treatment since it combination mix both give in drinking water and experimental diet may stimulation the increasing of body weight gain. Compared with Brennan et al., [8] stated the used of MRF give significant difference (P< 0.05) on body weight gain at 21 d and 35 d compared than control (877 g (MRF 400 g / tonne (21 d); 50 g / tonne (35d)) vs 819 g control). The result due to the rearing condition, the broiler will increase the body weight gain when the environment (bedding are clean) [4].

Table 2. Effect of MRF and probiotics-enhanced liquid acidifier on the body weight and body weight gain of broiler

| Day | T0  | T1  | T2  | T3  | SEM  |
|-----|-----|-----|-----|-----|------|
| 1   | 43.72 | 43.65 | 43.65 | 43.78 | 0.30 |
| 21  | 718.40 | 713.70 | 704.39 | 715.92 | 37.20 |
| 28  | 1212.20 | 1245.20 | 1220.20 | 1235.70 | 37.60 |
| 35  | 1842.55 | 1889.30 | 1842.00 | 1775.25 | 70.60 |

Mean values not sharing the same superscripts in a row differ significantly (P < 0.05); T0= control; T1= MRF 80g/100kg; T2=Drinking water + 2 ml / L (Acid-Pak 4-way®); T3=MRF 80g/100kg + Drinking water 2 ml / L (Acid-Pak 4-way®)

The result continued to the Table 3 showing the feed intake was no significant difference (P > 0.05) at whole periods. The feed intake result shown on the table 3 at 1-28 days treatment (T1) better than control (2018.40 vs 1874.60 g/bird), 21-35 days (T1, and T2) give best result compared than control (2414.40, and 2273.40 vs 2264.70 g/bird) and followed by result at 1-35 days (T1, and T2) better than control (T0) (2810.80, and 2690.10 vs 2668.60 g/bird). The feed intake increased may due correlating with body weight and body weight gain, when both of thus variable growth increase the feed intake will also increase. The increase may due to rearing condition, the way of feed give ad-libitum made broiler eat more. The mortality result on table 3 showed the used of MRF combination with probiotic liquid acidifier on treatment (T2 and T3) give no significant differences (P > 0.05) reduces to 1.31% compared to control 3.94%. The result may include the composition in the feed additive can prevent factors dead factors such as coccidian. Contrary to these findings, it was reported from study [5] cannot help to reduce mortality in male birds at 0-21 d and 0-42 d (3.38 vs 0.28 (control)) and (4.51 vs 1.69 (control)) because the experimental the chicken reared under stocking density stress (43 kg live weight per m2 floor space).
Table 3. Effect of MRF and probiotics-enhanced liquid acidifier on the feed intake, feed/gain, and mortality of broiler

| Treatments | Day   | T0    | T1    | T2    | T3    | SEM |
|------------|-------|-------|-------|-------|-------|-----|
| Feed intake, g/bird | 1-21  | 909.80| 979.10| 855.40| 807.30| 21.06|
| Feed intake, g/bird | 1-28  | 1874.60| 2018.40| 1822.90| 1727.80| 53.70|
| Feed intake, g/bird | 21-35 | 2264.70| 2414.40| 2273.40| 2102.00| 70.00|
| Feed intake, g/bird | 1-35  | 2668.60| 2810.80| 2690.10| 2499.00| 76.80|
| Feed intake, g/bird | 1-21  | 1.33  | 1.49  | 1.22  | 1.22  | 0.09 |
| Feed intake, g/bird | 1-28  | 1.73  | 1.72  | 1.54  | 1.44  | 0.23 |
| Feed intake, g/bird | 21-35 | 1.52  | 1.58  | 1.54  | 1.49  | 0.37 |
| Feed intake, g/bird | 1-35  | 1.48  | 1.54  | 1.50  | 1.44  | 0.14 |
| Feed intake, g/bird | 1-35  | 3.94  | 5.26  | 1.31  | 1.31  | 4.36 |

Mean values not sharing the same superscripts in a row differ significantly (P < 0.05); T0 = control; T1 = MRF 80g/100kg; T2 = Drinking water + 2 ml / L (Acid-Pak 4-way®); T3 = MRF 80g/100kg + Drinking water 2 ml / L (Acid-Pak 4-way®)

3.2. Relative organ weight (%)
The result was not significant difference (P > 0.05) for all organ weight at 21, 28, and 35 days. However, the immune organ such as thymus are better compared to control (table 4) at 21 days for all treatment (0.38, 0.31, and 0.33 vs. 0.30). The bursa of fabricius in 35 days presented better than control compared to control (table 5) (3.03, 3.30, and 3.74 vs. 2.86). In the experiment, the increased bursa of fabricius could have an initial positive signal for the development of broiler immune systems. However, as broiler age more, the bursa of fabricius will disappear according to the maturation of the immune system of the broiler. The weight of bursa fabricius (percentage of live weight) using MOS 0.1% and 0.2% are not significance difference (P > 0.05) (0.28 and 0.32 vs 0.29 (control)) at finisher periods of broiler [6]. The exact explanation may due to prebiotic helps protect proliferating immature bursal B cells and thymic T lymphocytes from oxidative stress [6]. The studies from the used MOS in relative organ weight of male broiler at level 1g/kg were not significant influenced (P > 0.05) (0.19 (MOS) vs. 0.20) it because the activities from MOS sometimes not occur [5]. In addition, the bursa of fabricius is an organ of the immune system and is responsible for maturation of B-lymphocytes [10].

Table 4. Effect of MRF and probiotics-enhanced liquid acidifier on the relative organ weight of broiler

| Treatments | Day | Item  | T0  | T1  | T2  | T3  | SEM |
|------------|-----|-------|-----|-----|-----|-----|-----|
| — — (Organ weight / body weight ) x 100 — — | 21  | Liver | 3.31| 3.16| 2.62| 3.24| 0.41 |
| — — (Organ weight / body weight ) x 100 — — |     | Spleen| 0.10| 0.10| 0.12| 0.12| 0.02 |
| — — (Organ weight / body weight ) x 100 — — |     | Bursa | 0.22| 0.21| 0.32| 0.20| 0.09 |
| — — (Organ weight / body weight ) x 100 — — |     | Thymus| 0.30| 0.38| 0.31| 0.33| 0.11 |
### Table 5. Effect of MRF and probiotics-enhanced liquid acidifier on the intestinal microflora of broiler

| Bacterial  | Day | T0  | T1  | T2  | T3  | SEM  |
|------------|-----|-----|-----|-----|-----|------|
| **Jejunum** | 21  | -   | -   | -   | -   | Log cfu/g, DM |
| Lactobacillus |     | 2.47| 2.72| 1.83| 2.66| 0.87 |
| Coliforms |     | 2.44| 1.51| 1.55| 3.50| 1.73 |
| **Ileum** |     |     |     |     |     |      |
| Lactobacillus |     | 2.34| 2.83| 1.73| 2.08| 0.79 |
| Coliforms |     | 2.62| 3.33| 3.52| 2.43| 0.09 |
| **Jejunum** | 28  | -   | -   | -   | -   | Log cfu/g, DM |
| Lactobacillus |     | 3.17| 3.35| 2.98| 3.44| 0.63 |
| Coliforms |     | 2.85| 3.04| 3.21| 3.00| 1.73 |
| **Ileum** |     |     |     |     |     |      |
| Lactobacillus |     | 4.36| 2.33| 3.81| 3.40| 1.09 |
| Coliforms |     | 3.23| 2.74| 3.03| 3.11| 1.59 |
| **Jejunum** | 35  | -   | -   | -   | -   | Log cfu/g, DM |
| Lactobacillus |     | 4.56| 4.44| 3.96| 3.57| 1.25 |
| Coliforms |     | 2.34| 2.12| 2.77| 3.32| 1.56 |
| **Ileum** |     |     |     |     |     |      |
| Lactobacillus |     | 4.32| 4.78| 4.56| 4.72| 0.35 |
| Coliforms |     | 2.56| 2.78| 2.54| 2.31| 1.13 |

Mean values not sharing the same superscripts in a row differ significantly ($P < 0.05$); T0= control; T1= MRF 80g/100kg; T2=Drinking water + 2 ml / L (Acid-Pak 4-way®); T3=MRF 80g/100kg+ Drinking water 2 ml / L (Acid-Pak 4-way®)

### 3.3. Intestinal micro flora

Based on table 5 the used MRF and probiotic-enhanced liquid acidifier as a feed additive on intestinal microflora were not significant different ($P > 0.05$) on the Lactobacillus and Coliform at 21, 28, and 35 days both jejunum and ileum. At 28 days the Coliform in the ileum parts the all treatment are better than control (2.74, 3.03, 3.11 vs. 3.23 Log cfu/g, DM). However, the Lactobacillus at ileum parts (2.33, 3.81, and 3.40 vs 4.36 Log cfu/g, DM). At 35 days (table 7) the Lactobacillus were not significant difference for whole treatment but still better than control (4.78, 4.56, 4.72 vs 4.32 Log cfu/g, DM). At 28 days, the positive microbial population may starts to stabilize indicated the treatment may help the microbial
stable on bacterial fermentation, but at 35 d the condition began unstable at several cases. Prebiotics are extremely stable, and therefore the inclusion into animal feed or water seems a feasible method to increase and sustain the levels of beneficial bacteria such as *Bifidobacteria* and *Lactobacilli* resident in the host [7].

**Table 6.** Effect of MRF and probiotics-enhanced liquid acidifier on the serum blood biochemistry of broiler at 21 days of age

| Treatments¹ | Item¹ | T0   | T1   | T2   | T3   | SEM  |
|------------|-------|------|------|------|------|------|
|            | GOT (U/L) | 238.50 | 206.25 | 208.25 | 228.00 | 21.97 |
|            | GPT(U/L) | 2.00 | 1.50 | 2.25 | 2.75 | 0.61 |
|            | TP (g/dL) | 2.57 | 2.57 | 2.52 | 2.55 | 0.17 |
|            | ALB (g/dL) | 1.05 | 1.02 | 1.05 | 1.12 | 0.15 |
|            | GLB (g/dL) | 1.55 | 1.57 | 1.37 | 1.62 | 0.12 |
|            | (A/G) | 0.70 | 0.67 | 0.70 | 0.65 | 0.09 |
|            | TGL (mg/dL) | 140.25 | 141.75 | 142.00 | 144.25 | 97.65 |
|            | TCHOL (mg/dL) | 130.25 | 131.75 | 118.00 | 122.25 | 17.70 |
|            | BUN (mg/dL) | 1.27 | 1.05 | 1.06 | 1.27 | 0.25 |
|            | GLC (mg/dL) | 255.50 | 278.75 | 238.50 | 234.75 | 36.83 |

Mean values not sharing the same superscripts in a row differ significantly (P < 0.05); 1T0= control; T1= MRF 80g/100kg; T2=Drinking water + 2 ml / L (Acid Pak 4-way®); T3=MRF 80g/100kg+ Drinking water 2 ml / L (Acid Pak 4-way®)

**Table 7.** Effect of MRF and probiotics-enhanced liquid acidifier on the serum blood biochemistry of broiler at 35 days of age

| Treatments¹ | Item¹ | T0   | T1   | T2   | T3   | SEM  |
|------------|-------|------|------|------|------|------|
|            | GOT (U/L) | 329.50 | 300.80 | 265.80 | 343.30 | 115.20 |
|            | GPT(U/L) | 3.00 | 1.75 | 2.00 | 2.75 | 2.75 |
|            | TP (g/dL) | 2.97 | 2.97 | 2.92 | 2.95 | 0.29 |
|            | ALB (g/dL) | 1.27 | 1.27 | 1.77 | 1.77 | 0.18 |
|            | GLB (g/dL) | 1.70 | 0.77 | 0.67 | 0.72 | 0.11 |
|            | (A/G) | 0.77 | 0.77 | 0.67 | 0.72 | 0.11 |
|            | TGL(mg/dL) | 32.25 | 30.25 | 30.50 | 29.00 | 5.66 |
|            | TCHOL(mg/dL) | 128.50 | 128.75 | 114.50 | 123.50 | 12.38 |
|            | BUN(mg/dL) | 0.97 | 0.47 | 0.62 | 0.47 | 0.32 |
|            | GLC(mg/dL) | 251.00 | 205.00 | 213.75 | 227.00 | 29.10 |

Mean values not sharing the same superscripts in a row differ significantly (P < 0.05); 1T0= control; T1= MRF 80g/100kg; T2=Drinking water + 2 ml / L (Acid Pak 4-way®); T3=MRF 80g/100kg+ Drinking water 2 ml / L (Acid Pak 4-way®)

Based on table 6 and 7 the used MRF and probiotic-enhanced liquid acidifier as a feed additive on serum blood biochemistry were not significantly different (P > 0.05) but the results on Glutamic oxaloacetic transaminase (GOT) at 21 days began to reduce. The treatment better compared to control (206.25, 208.25, and 228.00 vs. 238.50 U/L). The criteria for GOT were < 40 U/L for broiler. Continued to GPT the treatment were began reduced at 28 days compared to control (table 6) (1.75, 2.00, 2.00 vs 2.25 U/L). The indicator normal for broiler were at < 41 U/L. The amount of GOT and GPT were unstable at 35 days (table 7). The result may due to the treatment cannot help to reduce the amount of GPT and GOT. The GPT and GOT were the indicator in the liver that the treatment cause negative effect or not. The dietary treatments did not have significant effects on the activities of GOT and GPT because the ability from probiotics does not always occur it depends on the optimum dose, frequency, and duration of treatments [8].
Table 8. Effect of MRF and probiotics-enhanced liquid acidifier on the intestinal properties at 21, 28, and 35 days of age

| Treatments1 | Jejunum | T0 | T1 | T2 | T3 | SEM |
|-------------|---------|----|----|----|----|-----|
| 21 days     | VillusHeight | 442.75b | 593.00a | 597.50a | 569.50a | 57.57 |
|             | Crypt depth    | 83.50 | 134.75 | 143.75 | 121.75 | 46.50 |
|             | VH/CD          | 5.30  | 4.40  | 4.15  | 4.67  | 6.74  |
| 28 days     | VillusHeight | 378.00c | 617.00ab | 666.00a | 508.50bc | 63.72 |
|             | Crypt depth    | 105.00b | 140.00ab | 170.00ab | 136.25ab | 25.01 |
|             | VH/CD          | 3.60  | 4.40  | 3.91  | 3.73  | 1.34  |
| 35 days     | VillusHeight | 598.50b | 713.75a | 695.50a | 718.50a | 49.34 |
|             | Crypt depth    | 112.50b | 148.75ab | 149.00ab | 156.50a | 25.17 |
|             | VH/CD          | 5.32  | 4.79  | 3.99  | 4.59  | 3.45  |

Mean values not sharing the same superscripts in a row differ significantly (P < 0.05); 1T0= control; T1 = MRF 80g/100kg; T2 = Drinking water + 2 ml / L (Acid-Pak 4-way®); T3 = MRF 80g/100kg + Drinking water 2 ml / L (Acid-Pak 4-way®)

The result showed on table 8 the used MRF and probiotic-enhanced liquid acidifier as a feed additive on intestinal properties were significant different (P < 0.05) on the jejunum part. At 21 days, (table 6) Villus height were significant difference (P < 0.05) the treatment help to increase surface area of intestinal compared to control (593.00, 597.50, and 569.50 vs 442.75 µm). However, based on table 12 VH/CD whole are not significant difference (P > 0.05). The result may be correlated with the treatment of probiotics, and prebiotics that had helped to increase the surface area of the morphology of small intestine (jejunum). The used of MRF 7 d to 21 (400 g/tonne); 21 to 42 d (200 g/tonne) better than control (1267.3 vs 796.6) increase villus height of broiler (P < 0.05), villus height in jejunum tissue increase is a positive indicator of intestinal health and increased of absorptive area [4]. The level addition of a probiotic to broiler increased the villus height leading to increased intestinal surface area and therefore to increased digestion and absorption of nutrients in the basal diet [9]. The result (table 8) at 35 days the used of MRF and probiotic liquid acidifier give significant difference (P < 0.05) on villus height and crypt depth for whole treatment. The treatment (T3) give the greater compared to all treatment and control (718.50 vs 713.75 (T1), 695.50 (T2), and 598.50 (control) µm; villus height). It may the combination both of MRF and probiotic liquid enhanced acidifier helps to increase surface are at final days. While, the villus height increase it correlation with crypt depth also increase (148.75,
149.00, and 156.50 vs 112.50 (control) µm). The MRF given at uniform dose (200, 400 mg/kg) are not significant different in crypt depth ratio (42d) [10]. A larger area of crypt depth may positive and faster growing in tissue for helps maintenance energy requirements [11]. A shallow crypt is positive factors for the development of an immune status and efficient for the small intestine. With a lower renewal rate, the cells in the intestinal become mature and allowing more efficient digestive enzyme production and absorption [12].

4. Conclusion
The addition of mannan-riched fraction and combination with probiotic enhanced liquid acidifier doesn’t impacted on growth performance, and serum blood biochemistry but give significant effect on intestinal properties of broiler.

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