Proximate and amino acid composition of quail meat treated with mega floral booster addition

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Abstract. This study evaluated the effect of Mega Floral Booster (MFB) as probiotic supplement on the quality properties such as the carcass yield, physicochemical properties and nutritional composition of quail meat. Mega flora booster is the multi-probiotic animal feed additive. The treatment is divided to four treatments based on percentage of MFB inclusion: MFB-0.00 (control), MFB-0.05 (0.05% of MFB), MFB-0.20 (0.20% of MFB) and MFB-0.35 (0.35% of MFB). The 18 of quail species Coturnix japonica (Japanese quail) used as the main material in the study for each treatment. For the first until fourteen days, the quails are supplied with commercial feed only. After fifteen days, the quails begin provided with the MFB-0.00, MFB-0.05, MFB-0.20 and MFB-0.35 mixed with commercial feed. The quails for 42nd days slaughtered and deboned of breast and whole leg separated from the bone for analysis. Probiotic supplement (Mega Floral Booster) had no influence on proximate and amino acid composition. Chemical score and amino acid score was show tryptophan as amino acid limited. Essential Amino Acid index of breast meats presented MFB-0.20 (61.66%) higher than MFB-0.00 (60.26%). Thus, Mega Floral Booster is not affecting the nutritional quality of quail meats.

Keywords – proximate, amino acid, quail meat, mega floral booster.

1. Introduction

The quail is not an established branch, but occupies a relevant place in poultry breeding and contributes to the variety in poultry meat production according to [1]. Along the increase of the chicken meat production, there is also increase of the production meat from quails and other non-commercial bird species, reared under industrial conditions. The highest consumption of quail meats tends to encourage the quail farming thus increase of the feed additive or supplement usage.

Dietary supplementations of probiotic have been proposed to antibiotics in the poultry industry that can improve animal production performance, regulate intestinal micro-flora imbalance, and enhance immune function that stated by [2]. In a limited study, the meat quality attributes of probiotic-fed have been evaluated to ensure natural and wholesome characteristics. Some of studies reported that probiotic supplements to poultry able to improve meat quality attributes such as water holding capacity (WHC), tenderness, lipid oxidation stability, sensory properties, and microbial safety [3, 4, 5]. On the other studies were stated that no synergistic effect of probiotics on meat quality [2, 6]. Postmortem aging leads to considerable biochemical and physical changes in skeletal muscles through endogenous proteolytic system, results in an improvement in meat quality attributes such as tenderness, WHC, juiciness and flavor [2]. Therefore, the objectives of this study was to determine the...
nutritional composition include chemical composition (moisture content, ash, protein and fat), and amino acid composition between four treatments with different concentration of Mega flora booster in feed intake.

2. Materials and methods

*Coturnix* japonica species of quails (after 42nd days) were getting from collaboration with Animal Science final year students. The quails (1st day) were obtained from commercial hatchery in Terengganu (Surada Jaya Kemaman). For quail growth process compose to two phase, brooding process (1st until 14th days) and growing process (15th until 42nd days). During brooding process, the quails were weighed and divided for some group, and supplied with commercial feed (Permula Ayam Daging 201C by Gold Coin Feedmills (M) Sdn Bhd) in brooding room. At growing process, pens were randomly assigned to four treatment of Mega Floral Booster (MFB) with different percentage 0.0% (MFB-0.00), 0.05% (MFB-0.05), 0.20% (MFB-0.20) and 0.35% (MFB-0.35) mixed with 100%, 99.95%, 99.98% and 99.65% of commercial feed. MFB was the advanced probiotic formula, fortified with multi strain of microbes (*Bacillus* natto, *Lactobacillus* and yeast) and methionine, organic acid, enzyme protease and amylase manufacture by CPEX (Japan) Group. The proper design of building area required to avoid any infection that may occur along the experiment. The quails (in large amounts) was separate to three different part (in small amount) for each treatment; part A, part B and part C with twelve of quails for each part to minimize the rate of mortality. The 20g of feed was given two times morning and evening.

At the end of the feeding (42nd days), the six of quails per pen were randomly taken for each treatments (totally 18 for each treatments). The quails were slaughtered, scalded (60-65 °C for 15 seconds), de-feathered, eviscerated and packed in blast freezer (overnight) according Genhev (2008). Then, the quails were deboned nutritional composition includes proximate composition, and amino acid composition.

Proximate composition was determined according to [7] standard methods. The determination of moisture (oven drying method), total protein, fat (ether extract method) and ash (muffle furnace technique) content were performed for breast quail meats.

Amino acid composition was determined according to [7] the analysis preparation of amino acid composition, meat sample was dried by using oven drye at 70-80°C, meat sample was analyze in triplicates. Amino acid analysis of meat was determined by using High Performance Liquid Chromatography (HPLC) based on Waters auto Tag™ OPA Pre Column Derivation method. The test samples was analyzed with three hydrolyses in three (6N HCl, peroramic acid + 6N HCl and 4.2N NaOH). 6N HCl at 110°C for 24 hours and derivatized with AccQ reagent (6-aminoquinolyl-N-hydroxysuccinimidyl carbamit) before conducting the chromatographic separation by using an AccQ Tag™ reversed phase (3.9 x 150mm) analytical column (Waters®). The amino acid analysis will be perform on a HPLC system consist of Waters 1525 Binary HPLC Pump, 717 Plus Autosampler (Waters®) and Water 2475 Multi Fluorescence detector (wavelength excitation 250nm, emission 395nm). Chromatographic peaks was integrate, identify and quantify using Breeze™ software version 3.20 by comparing it to identify standards (Amino acid standard H, Pierce, Rockford,Illinois). Methionine and cysteine was determined from the same method of acid hydrolysis after treatment using performic acid oxidation. Samples hydrolyzed with 4.2N NaOH for determination of tryptophan.

Chemical score: chemical score was conducted by comparing the essential amino acid content amino acid of egg [8]). Essential amino acid content of egg according to [9] were lysine 6.98, methionine + cysteine 5.79, isoleucine 6.29, leusine 8.82, valine 6.85, fenilalanine + tyrosine 9.89, threonine 5.12 and tryptophan 1.49/100g protein. Amino acid score: amino acid score was determined by comparing the essential amino acid content of sample and type of amino acid content that was suggested for human needed [10]. The type of amino acid content suggested for 2-5 years old used for determining this score (FAO, 1985) was histidine 1.9, lysine 5.8, methionine + cysteine 2.5, threonine 3.4, isoleucine 2.8, leusine 6.6, valine 3.5, fenilalanine + tyrosine 6.3and tyrtophan 1.1g/100g. Essential amino acid (EAA) index: essential amino acid (EAA) index was used to determine the
chemical score. The score for every amino acid was converted to log10. The average score was given to get the index score [8].

The statistical analysis from this experiment was conducted by using SPSS statistic 17.0 software. Data was analyzed by using analysis of variance (ANOVA). The software was used to calculate the overall mean and standard deviation of the data and to determine the significant different of the proximate analysis and amino acid analysis. Besides that, SPSS is use to form the graph and find the liner equation for certain graph. Turkey test was used to determine significance of difference ($p<0.05$) of four samples.

3. Results and discussions
Japanese quail composed of chemical composition include moisture content, protein, carbohydrate, fat and ash in wet weight basis (%) had been presented in Table 1. Treatment of Mega Floral Booster (MFB) on chemical composition of breast quail meats hadn’t significant difference. Although the treatments not have significant difference but MFB-0.20 was presented the high level of moisture content (75.00 %), protein (22.86 %), ash (1.25 %) and low level of fat (1.70 %) compared to chemical compositions of MFB-0.00, MFB-0.05 and MFB-0.35.

Table 1. Chemical composition of 42 days old of Japanese quail.

| Chemical composition | Treatments          |
|----------------------|---------------------|
|                      | MFB-0.00            |
| Moisture content (%) | 74.59±0.41          |
| Protein (%)          | 22.82±0.13          |
| Ash (%)              | 1.24±0.06           |
| Fat (%)              | 1.77±0.13           |
|                      | MFB-0.05            |
| Moisture content (%) | 74.38±0.50          |
| Protein (%)          | 22.78±0.17          |
| Ash (%)              | 1.24±0.04           |
| Fat (%)              | 1.78±0.12           |
|                      | MFB-0.20            |
| Moisture content (%) | 75.00±0.35          |
| Protein (%)          | 22.86±0.16          |
| Ash (%)              | 1.25±0.06           |
| Fat (%)              | 1.70±0.14           |
|                      | MFB-0.35            |
| Moisture content (%) | 74.51±0.42          |
| Protein (%)          | 22.80±0.30          |
| Ash (%)              | 1.14±0.10           |
| Fat (%)              | 1.72±0.34           |

Each value is expressed as mean ± SD.
*aMeans with the same letter within same row is not significantly different ($p>0.05$).

According to [12], the moisture content and protein of hand deboned meat of young quail were 73.01 % and 20.13% and spent quails were 70.28 % and 22.33 % slightly similar with moisture content in the [1] while [13] reported moisture content (75.63 %) and protein (20.18 %) with high fat content (5.02) and low ash (0.94) of quail meats. Reference [1] reported protein content, fat content and ash content were 23.38 to 22.23 %, 2.21 to 2.75 % and 1.51 to 1.61 % of 35 days old Japanese quails while chemical composition of quails reported by [14] was show the moisture, protein, fat and ash were 72.35 %, 21.65 %, 3.57 % and 2.47 % of 6 weeks of breast quails. Fat content in breast muscle in this result was lower than fat content that stated by [13] and [14] especially fat content of breast quail muscles treated with probiotic was lower.

Reference [15] was run the research on breast meat quality with different probiotic level and reported chemical composition was unaffected by probiotic feeding levels ($p>0.05$) in which moisture, protein, fat and ash contents were 75.5 to 75.9 g/100 g, 23.3 to 23.4 g/100 g, 1.5 to 2.1 g/100 g and 1.2 g/100 g, respectively. They were stated that probiotic supplementation could improve protein solubility (sarcoplasmic protein) of breast muscle from chicken in term on protein functionality. Reference [6] was found by treatment with (Bacillus subtilis, Bacillus natto and Bacillus licheniformis) tend to improve the muscle fiber (myofibrillar protein) and decreased of connective tissue in breast muscle cause protein content in breast muscle was high by treatment with probiotics. In increase of protein and moisture content tend to lower of fat content.

The dietary value of meat defined the composition and ratio among the different group of nutrients. Reference [1] stated the analysis of amino acids showed that quail meat was very rich in essential amino acids. According to most dieticians, the normally functioning non-trained human organism needs 8 essential amino acids includes lysine, valine, leucine, isoleucine, threonine, tryptophan, methionine and phenylalanine. Table 2 and 3 was showed amount of amino acid for quail meats under treatment and the amino acid composition (g/100 g protein) for different ages of quail meat analyses.
Breast quail meats of MFB-0.20 was higher than MFB-0.00 but lower than young and spent quails. If amino acid type was almost similar with amino acid type in human body determine the quality of protein will be higher [16].

| Essential Amino acid composition | MFB-0.00 | MFB-0.20 | Young quail [12] | Spent quail [12] |
|----------------------------------|---------|---------|----------------|----------------|
| Histidine                        | 2.13    | 2.34    | 4.07           | 3.93           |
| Methionine                       | 2.38    | 2.37    | 3.18           | 3.12           |
| Cysteine                         | 0.87    | 0.89    | 0.25           | 1.57           |
| Isoleucine                       | 3.51    | 3.66    | 5.37           | 5.81           |
| Leusine                          | 5.74    | 5.94    | 7.44           | 8.66           |
| Lysine                           | 6.09    | 6.20    | 7.12           | 7.70           |
| Phenylalanine                    | 2.96    | 3.09    | 5.48           | 5.25           |
| Threonine                        | 3.18    | 3.37    | 6.02           | 5.86           |
| Tyrosine                         | 2.74    | 3.19    | 2.85           | 2.68           |
| Valine                           | 3.67    | 3.88    | 7.12           | 7.77           |
| Tryptophan                       | 0.82    | 0.71    | ND             | ND             |
| Total EAA                        | 34.09   | 35.64   | 48.9           | 52.35          |

| Non Essential Amino acid composition | MFB-0.00 | MFB-0.20 | Young quail [12] | Spent quail [12] |
|--------------------------------------|---------|---------|----------------|----------------|
| Alanine                              | 3.95    | 4.16    | 4.70           | 5.04           |
| Arginine                             | 4.96    | 5.06    | 10.76          | 8.04           |
| Aspartic Acid                        | 6.69    | 7.07    | 6.57           | 6.80           |
| Glutamic Acid                        | 10.28   | 10.73   | 12.31          | 12.54          |
| Glysine                              | 3.13    | 3.38    | 7.77           | 6.65           |
| Proline                              | 2.54    | 2.77    | 4.14           | 3.83           |
| Serine                               | 2.83    | 3.05    | 4.87           | 4.75           |
| Total non-EAA                        | 34.38   | 36.22   | 51.12          | 47.65          |

In essential fraction in breast meat treated by MFB, leucine (5.74-5.9 %) lysine (6.09-6.20 %) similar in breast meat of young and spent quails lysine (7.12-7.70) and leucine (7.44-8.66) such results in [14]. Moreover, the data indicated that among all amino acid glutamic acid recorded the highest value in MFB-0.00 and MFB-0.20. On other hand presented that tryptophan was the lower compared with other content. Reference [12] also found the highest amino acid in young and spent quails was glutamic acid (12.31-12.54), respectively. However, the relatively higher content glutamic in the breast meat had a great importance when it comes to the taste and flavor of meat indicated by [17].

The quality of protein in foods was determined by the type of its amino acid and total of its essential amino acid. The quality of protein will be higher if its amino acid type almost similar with the amino acid type of human body. Chemical score, amino acid score and EAA index was using to identify the quality of quail meat. Reference [12] was reported chemical was a standard for protein quality which already done for long time before.

Amino acid content was compare with egg protein as a standard to get the chemistry score in range 0-100. As shown in Table 4, chemical score indicated that the first limiting amino acid of breast meat
quail treating with MFB-0.00 and MFB-0.20 was tryptophan (54.97 and 47.45) followed by valine (53.64 and 56.66 %) in six weeks breast quail meat. The first limiting amino acid of spent quail was methionine + cysteine (81.00%) was more higher followed by young quail (59.24 %), MFB-0.20 (53.54 %) and MFB-0.00 (51.64 %) as shown in Table 4.

Table 4. Chemical score of amino acids from breast quail meat.

| No | Type Of Amino Acid            | MFB-0.00 | MFB-0.20 | Young quail [12] | Spent quail [12] |
|----|-------------------------------|----------|----------|-----------------|-----------------|
| 1  | Methionine + cysteine         | 56.15    | 56.37    | 59.24           | 81.00           |
| 2  | Isoleucine                    | 55.85    | 58.12    | 85.37           | 92.37           |
| 3  | Leusine                       | 65.07    | 67.29    | 84.35           | 98.19           |
| 4  | Lysine                        | 87.29    | 88.88    | 102.01          | 110.32          |
| 5  | Threonine                     | 62.09    | 65.86    | 117.58          | 114.45          |
| 6  | Valine                        | 53.64    | 56.66    | 103.94          | 113.43          |
| 7  | Phenylalanine + Tyrosine      | 57.59    | 63.55    | 84.23           | 80.18           |
| 8  | Tryptophan                    | 54.97    | 47.45    | ND              | ND              |
|    | Score                          | 51.64    | 53.54    | 59.24           | 81.00           |

It is important to know more about the role of essential amino acid in source of protein for human need. Amino acid score was above 0 to 100 by compared the essential amino acid content of sample and type of amino acid content that is recommended for 2-5 years old. If the amino acid score counted above 100, it is calculated as 100. Amino acid score of MFB-0.00 (74.45 %) was higher than MFB-0.20 (64.27 %) while spent and young quail were the higher of amino acid score 100. First of amino acid limiting from quail meat by treat with MFB-0.00 and MFB-0.20 was tryptophan and the second amino acid limiting was leusine as shown in Table 5.

Table 5. Amino acid score of amino acid from breast quail meat.

| No | Type Of Amino Acid            | MFB-0.00 | MFB-0.20 | Young quail [12] | Spent quail [12] |
|----|-------------------------------|----------|----------|-----------------|-----------------|
| 1  | Histidine                     | 112.26   | 123.16   | 214.21          | 206.84          |
| 2  | Methionine + cysteine         | 130.04   | 130.56   | 137.20          | 187.60          |
| 3  | Isoleucine                    | 125.46   | 130.57   | 191.79          | 207.50          |
| 4  | Leusine                       | 86.95    | 89.92    | 112.73          | 131.21          |
| 5  | Lysine                        | 105.05   | 106.97   | 122.76          | 132.76          |
| 6  | Threonine                     | 93.50    | 99.18    | 177.06          | 172.35          |
| 7  | Valine                        | 104.97   | 110.89   | 203.43          | 222.00          |
| 8  | Phenylalanine + Tyrosine      | 90.41    | 99.76    | 132.22          | 125.87          |
| 9  | Tryptophan                    | 74.45    | 64.27    | ND              | ND              |
|    | Score                          | 74.45    | 64.27    | 100             | 100             |

Essential amino acid index is the geometrical mean of the ratio of all essential amino acid in the evaluated protein relative to their content in a highly nutritious reference protein such as whole egg. Essential amino acid (EAA) index were identifying for evaluating proteins in diets according to [19]. The data presented in Table 6 indicated the EAA index of quail meats MFB-0.00 was lower than quail meats of MFB-0.20. EAA index of spent quail had higher (97.60 %) followed by young quail (89.16 %), MFB-0.20 (61.66%) and MFB-0.00 (60.26%). Spent quail meat was most of a valuable source of protein with very good amino acid profile and EAA index than young quail, age of quail was affected
the quality of protein and amino acid associated with protein degradation [12] The breed of quail also influenced the composition of protein content and amino acid. From this analysis, quail meat from the treatment of MFB-0.20 was improving the amino acid profile and EAA index than MFB-0.00.

### Table 6. EAA index from breast quail meat.

| No | Type Of Amino Acid                  | MFB-0.00 | MFB-0.20 | Young quail [12] | Spent quail [12] |
|----|-------------------------------------|----------|----------|-----------------|-----------------|
| 1. | Methionine + cysteine               | 1.75     | 1.75     | 1.77            | 1.91            |
| 2. | Isoleucine                          | 1.75     | 1.76     | 1.93            | 1.97            |
| 3. | Leusine                             | 1.81     | 1.83     | 1.93            | 1.99            |
| 4. | Lysine                              | 1.94     | 1.95     | 2.01            | 2.04            |
| 5. | Threonine                           | 1.79     | 1.82     | 2.07            | 2.06            |
| 6. | Valine                              | 1.73     | 1.75     | 2.02            | 2.05            |
| 7. | Phenylalanine + Tyrosine            | 1.76     | 1.80     | 1.93            | 1.90            |
| 8. | Tryptophan                          | 1.74     | 1.68     | ND              | ND              |
|     | Average (N=7)                       | 1.78     | 1.79     | 1.95            | 1.99            |
|     | Score                               | 60.26    | 61.66    | 89.16           | 97.60           |

### 4. Conclusions

In conclusion, this study indicated that Mega Floral Booster (dietary probiotic supplement) had noticeable effect on nutritional characteristics of quail meat. Proximate composition (moisture content, protein, fat and ash) of quail meat not affected by difference percentage of MFB while MFB-0.20 show a high value in amino acid analysis include essential amino acid and non-essential amino acid.

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