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Effect of Dietary Supplementation of Jengkol (*Pithecellobium jiringa*) Skin Extract on Blood Biochemistry and Gut Flora of Broiler Chicken

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Abstract: This study was aimed to determine the effect of Jengkol (*Pithecellobium jiringan*) skin extract in ration on blood glucose, uric acid and total gut *E. coli* count of broiler chicken. One hundred day old commercial broiler chicks were randomly allocated to four treatment groups as T1, T2, T3 and T4 with 25 birds per treatment group replicated five times with five birds per replicate in a Complete Randomized Design (CRD). The birds in the control group (T1) were given normal basal diet without the addition of jengkol skin extract, while as other groups (T2, T3, T4) were supplemented with 0.01, 0.02 and 0.03% jengkol skin extract respectively. The blood samples were randomly collected from five birds per replicate at the end experimental period (5th week) and analyzed for the estimation of blood glucose and uric acid. The total *E. coli* count of gut contents was analyzed using Total Plate Count method. The results revealed that blood glucose was non-significantly ($p>0.05$) increased in the groups fed Jengkol at various levels when compared to the control. Further, a significantly ($p<0.05$) proportional decreasing trend in blood uric acid levels was found with increase in the level of dietary Jengkol, with highest reduction of 8.76 ± 0.35 mg/dl in the group supplemented with 0.03% Jengkol (T4) compared to 11.53 ± 1.20 mg/dl in the control group. Moreover, the total gut *E. coli* also decreased significantly ($p<0.05$) in the groups fed Jengkol in the diet (T2, T3 and T4). In conclusion, dietary inclusion of Jengkol had beneficial effect with regard to its ability in reducing the blood uric acid levels and total gut *E. coli* count of broiler chicken.

Key words: Broiler chicken, uric acid, microflora, blood glucose, Jengkol

INTRODUCTION

Pithecellobium jiringan, commonly known as Jengkol in Indonesia has South-East Asian origin and belongs to the family of leguminosae. This plant has traditional medicinal usage and its parts such as seed and pod have been used for treating different kind of diseases. In 2009, Jengkol production in Indonesia reached 62.475 tons/year (SNA, 2010). Its seeds are thin-skinned and fruits shiny brown in color. Jengkol can cause odor in urine after being processed by digestive tract, especially when eaten fresh. Jengkol was known to prevent diabetes and is a diuretic and good for heart health. Jengkol plant is also expected to have the ability to absorb water, thus making it useful in conserving water. The most important part of this plant are the seeds, which contains several active compounds for therapeutic effects and are good source of natural antioxidants that could destroy excess free radicals and prevent oxidative damage. The chemical constituents contained in the seeds and skin extract are mainly group of fatty acids having strong antioxidant activity to neutralize free radicals and radical scavenging activity to prevent oxidative damage (Vimala *et al.*, 2003). Jengkol seeds contain protein, amino acids, fats, minerals such as potassium, phosphorus, iron, some vitamins such as vitamin A, B and C. Jengkollic acid is amino acid which

has a sulfur atom composed of two cysteine amino acids bound by a methyl group (Oey, 1989). Jengkol skin extract contains alkaloids, flavonoids, tannins, saponins, glycosides and triterpenoids which act as antibacterial, antibiotic, anti-inflammatory and antioxidant (Nurussakinah, 2010). There is not enough literature available regarding use of Jengkol in poultry, so this study was aimed to evaluate the effect of dietary supplementation of Jengkol in broiler chicken.

MATERIALS AND METHODS

Experimental design: The research trial was conducted at Faculty of Animal Husbandry, Padjadjaran University, Indonesia from April 19 to May 24, 2014. A total of one hundred day old commercial broiler chicks were utilized for the study. The chicks were reared in cages with coefficient of variation as 6.854%. The experimental ration was prepared as per NRC (1994) having protein content 23% and metabolizable energy 3200 kcal/kg. The chicks were randomly allocated to four treatment groups as T1, T2, T3 and T4 with 25 birds per treatment group replicated five times with five birds per replicate in a Completely Randomized Design (CRD). The birds in the first group (T1) were given normal basal diet without the addition of jengkol skin extract, while as other groups (T2, T3, T4) were supplemented with 0.01, 0.02 and

0.03% jengkol skin extract, respectively. The test diets and water were supplied *ad libitum*.

Processing: The jengkol was processed as per the method of Hamdani (2009). The Jengkol was dissolved in 70% ethanol. The macerat obtained was subjected to vacuum evaporation with the aid of rotary evaporator. The extract was then heated to 500°C temperature to vaporize ethanol remnants and viscous extract was obtained and used for the study.

Collection of samples: Blood samples were collected at the end of experimental period i.e., 5th week from randomly selected five birds from each treatment group. 3 ml of blood from each bird was collected using needle and syringe into a labeled sterilized bottle containing ethylenediamine tetra-acetic acid (EDTA) and samples were used for estimation of blood glucose (Bergman and Felig, 1984) and uric acid (Anonymous, 2014). In order to evaluate the gut *E. coli* count, 1 ml small intestines were exposed and ligated at both sides. The contents were collected aseptically. Samples were weighed (1 gm), transferred to sterile tubes and homogenized with sterile 0.9% normal saline solution (1:1). Then the solutions were mixed on vortex. Serial dilutions of samples were made up to sixth dilution. 0.1 ml of each dilution was poured and spread uniformly on McConkey's agar. Plates were incubated at 37°C for 48 h. The typical convex pink colonies were counted by Total Plate Count method (Quinn *et al.*, 1992). The average number of colonies was multiplied by reciprocal of the dilution factor and expressed as cfu/g of contents.

Statistical analysis: Data collected were subjected to analysis of Variance (ANOVA) of Steel and Torrie (1980) and Duncan's multiple range test (Duncan, 1955) was used to test the significance of difference between means. Differences were considered significant at $p < 0.05$.

RESULTS AND DISCUSSION

The data of blood glucose, uric acid and total gut *E. coli* is presented in Table 1. The results revealed that dietary inclusion of Jengkol in broiler chicken showed non-significant ($p > 0.05$) increase in the blood glucose levels of various treatment groups (T2, T3 and T4) when compared to the control group (T1). The effect on blood glucose could be attributed to the active compounds present in Jengkol. It contains flavonoids and tannins (Elysa, 2011). Flavonoids are antioxidants that can protect the progressive destruction of pancreatic β cells as a result of oxidative stress (Song *et al.*, 2005). Moreover, tannin is known to stimulate the glucose uptake by increasing the tissue sensitivity to insulin and prevent adipogenesis (Muthusamy *et al.*, 2008). Both these effects help to increase the blood glucose levels.

Glucose is one of the major metabolites closely related to the sustainability of energy supply for the implementation of physiological and biochemical functions in the body (Klasing, 2000). Glucose is the main carbohydrate needed as a precursor for the energy citric acid cycle and is a substrate that is easily used by most of the body's cells for energy purposes (Hazelwood, 2000). In the present study, the use of Jengkol increased the blood glucose levels in broiler chicken, thus imparted them with more energy to carry out various physiological and biochemical functions of the body than the control group.

The results revealed that blood uric acid levels decreased significantly ($p < 0.05$) in the groups supplemented with Jengkol when compared to the control. A proportional decreasing trend in blood uric acid levels was found with increase in the level of Jengkol in the diet, with highest reduction of 8.76 ± 0.35 mg/dl in the group supplemented with 0.03% Jengkol (T4) compared to 11.53 ± 1.20 mg/dl in the control group (T1). Increase in level of uric acid in the blood, a condition known as Hyperuricemia, predisposes birds to gout. The clinical manifestations of gout results from deposition of monosodium urate or uric acid crystals from supersaturated body fluids (Becker *et al.*, 2005). One of the factors contributing to hyperuricaemia is overproduction of uric acid by hydroxylation of xanthine which is catalyzed by xanthine oxidase. Jengkol contains flavonoids which have been shown to possess high activity for inhibiting xanthine oxidase, thus decreasing uric acid levels in blood (Belal Omar *et al.*, 2007). Thus, the Jengkol has beneficial health effects in terms of reducing the blood uric acid levels and decreasing the susceptibility of birds to gout.

The total gut *E. coli* also decreased significantly ($p < 0.05$) in the groups fed Jengkol in the diet (T2, T3 and T4) compared to control. As per Rahayu and Pukan (1998), the antibacterial activity of Jengkol is due to the presence of tannins in it. Tannins are proven to have antimicrobial activity (Sakanaka *et al.*, 2000; Elizondo *et al.*, 2010) and affect gastrointestinal bacteria colonization in chickens (Hara *et al.*, 1995; Hara, 1997). Davidson and Branen (1993) have also reported that tannins have antibacterial activity against *E. coli*. The main location of tannin activity on sensitive microorganisms is on the cell wall as it causes damage to the permeability of cell wall (Farida, 1998) resulting in its antibacterial activity. On the other hand, iron deprivation has been suggested by some authors as possible mechanism of tannin antimicrobial activity (Scalbert, 1991; Haslam, 1996; Mila *et al.*, 1996). Tannic acid works like a siderophore to chelate iron from the medium, making it unavailable for the microorganisms. Iron is essential for most pathogenic bacteria and tannic acid shows three times more affinity for iron than *E. coli* siderophores (Chung *et al.*, 1998). Further, Abun *et al.* (2008) have reported that addition of

Table 1: Blood glucose, uric acid and total gut *E. coli* of broiler chicken fed varying levels of Jengkol in the diet

| Parameter | Treatment | | | |
|-----------------------------|-------------------------|------------------------|-------------------------|------------------------|
| | T1 | T2 | T3 | T4 |
| Blood glucose (mg/dl) | 217.50±40.31 | 272.5±31.82 | 292.5±13.44 | 250±21.21 |
| Uric acid (mg/dl) | 11.53±1.20 ^a | 9.68±1.84 ^b | 8.884±1.34 ^b | 8.76±0.35 ^b |
| Gut <i>E. coli</i> (CFU/ml) | 1.44 ^b | 1.13 ^{ab} | 0.61 ^a | 0.67 ^a |

T1: Basal ration without Jengkol skin extract (JSE), T2: Basal ration+0.01% JSE, T3: Basal ration+0.02% JSE and T4: Basal ration+0.03% JSE

jengkol peel extract up to 0.03% in the ration didn't affect the number of beneficial gut bacteria viz. *Lactobacillus* species. This means that Jengkol has antibacterial activity against harmful gut bacteria without any effect on non-pathogenic *Lactobacillus* species.

Conclusion: It could thus be concluded that the dietary inclusion of Jengkol in broiler chicken had beneficial effects with regard to its ability in reducing the blood uric acid levels and total gut *E. coli* count, however, further studies in this regard with different inclusion levels are warranted.

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REFERENCES

Abun, 2008. Microflora relationship with Gastrointestinal Metabolism in Poultry and monogastric. Scientific papers. Faculty of Animal Husbandry, Padjadjaran University, Bandung, Indonesia.

Anonymous, 2014. Elecsys Brahms pct. Cobas, Roche Diagnostics, 9: 1-5.

Becker, M.A., S. Ralph, L.W. Robert, A.M. Patricia, E. Denise, A.P. William, S. Janet and J.R. Nancy, 2005. Febuxostat compared with allopurinol in patients with hyperuricemia and gout. *N. Engl. J. Med.*, 353: 2450-2461.

Belal Omar, Nornisah Mohamed, Rashidah A. Rahim and Habibah A. Wahab, 2007. World Congress on Medical Physics and Biomedical Engineering. 2006 IFMBE Proceed., 14: 178-182.

Bergman, M. and P. Felig, 1984. Self-monitoring of blood glucose levels in diabetes. *Principles and practice. Arch. Int. Med.*, 144: 2029-2034.

Chung, K.T., Z. Lu and M. Chou, 1998. Mechanism of inhibition of tannic acid and related compounds on the growth of intestinal bacteria. *Food Chem. Toxicol.*, 36: 1053-1060.

Davidson, P.M. and A.L. Branen, 1993. *Antimicrobial In Food*. Marcel Dekker Inc, New York.

Duncan, D.B., 1955. Multiple range and multiple F-test. *Biometrics*, 11: 1-42.

Elizondo, A.M., E.C. Mercado, B.C. Rabinovitz and Fernandez M.E. Miyakawa, 2010. Effect of tannins on the *in vitro* growth of *Clostridium perfringens*. *Vet. Microbiol.*, 145: 308-314.

Elysa, 2011. Uji Efek Ekstrak Etanol Biji Jengkol (*Pithecellobium Lobatum Benth.*) terhadap Penurunan Kadar Glukosa Darah Tikus Putih Jantan Galur Wistar yang diinduksi Alokstan. Skripsi. Sumatera Utara: Universitas Sumatera Utara.

Farida, Wartika Rosa, 1998. *Tanin dan Pengaruhnya pada Ternak*. J. Peternakan Lingkungan, vol. 06 no. 3 October 2000.

Hamdani, S., 2009. Extraction method, <http://catatankimia.com/catatan/metoda-ekstraksi.html>.

Hara, Y., 1997. Influence of tea catechins on the digestive tract. *J. Cell. Biochem.*, 67: 52-58.

Hara, H., N. Orita, S. Hatano, H. Ichikawa, Y. Hara and N. Matsumoto, 1995. Effect of tea polyphenols on fecal flora and fecal metabolic products of pigs. *J. Vet. Med. Sci.*, 57: 45-49.

Haslam, E., 1996. Natural polyphenols (vegetable tannins) as drugs: possible modes of action. *J. Nat. Prod.*, 59: 205-215.

Hazelwood, R.L., 2000. *Pancreas in Sturkie Avian Physiology Ed C.C Whittow, Fifth Ed, Academic Press.*

Klasing, K.C., 2000. *Comparative Avian Nutrition, Department of Avian Science, College of Agricultural and Environmental Sciences University of California Davis California, USA. CAB International.*

Mila, I., A. Scalbert and D. Expert, 1996. Iron withholding by plant polyphenols and resistance to pathogens and roots. *Phytochem.*, 42: 1551-1555.

Muthusamy, V.S., S. Anand, K.N. Sangeetha, S. Sujatha, A. Balakrishnan and B.S. Lakshmi, 2008. Tannins present in *Cichorium intybus* enhance glucose uptake and inhibit adipogenesis in 3T3-L1 adipocytes through PTP1B inhibition. *Chemico-Biolog. Interact.*, 174: 69-78

National Research Council, 1994. *Nutrient Requirement of Poultry*. National Academy Press, Washington.

Nurussakinah, 2010. *Skrining Fitokimia dan Uji Aktivitas Antibakteri Ekstrak Kulit Buah Tumbuhan Jengkol (Pithecellobium jiringa (Jack) Prain) terhadap Bakteri Streptococcus mutans, Staphylococcus aureus, dan Escherichia coli*. Skripsi. Fakultas Farmasi Universitas Sumatera Utara.

- Oey, K.N., 1989. Zat-zat toksik yang secara alamiah ada pada bahan makanan nabati. *Cermin Dunia Kedokteran*, 58: 24-28.
- Quinn, P.J., M.E. Carter, B.K. Markey and G.R. Carter, 1992. *Clinical Veterinary Microbiology*. Mosby-year book Europe limited Lynton House, 7-12 Tavistock square, London, pp: 61-65.
- Rahayu, E.S. and K.K. Pukan, 1998. Kandungan Senyawa Alelokemi Kulit Buah Jengkol dan Pengaruhnya terhadap Beberapa Gulma Padi. Karya Ilmiah. FMIPA IKIP Semarang, Semarang.
- Sakanaka, S., L.R. Juneja and M. Taniguchi, 2000. Antimicrobial effects of green tea polyphenols on thermophilic spore-forming bacteria. *J. Biosci. Bioeng.*, 90: 81-85.
- Scalbert, A., 1991. Antimicrobial properties of tannins. *Phytochem.*, 30: 3875-3883.
- Song, Y., E.M. JoAnn, E.B. Julie, D.S. Howard and L. Simin, 2005. Associations of Dietary Flavonoids with Risk of Type 2 Diabetes and Markers of Insulin Resistance and Systemic Inflammation in Women: A Prospective Study and Cross-Sectional Analysis. *J. Am. College of Nutr.*, 24: 376-384.
- Standard National Agriculture, 2010. SNI Penguat Daya Saing-Sektor Industri Pertanian. [http://www.bsn.go.id/files/170411/genapsnibuku/BAB 10. pdf](http://www.bsn.go.id/files/170411/genapsnibuku/BAB%2010.pdf) (diakses 14 November 2011).
- Steel, R.G.D. and J.H. Torrie, 1980. *Principles and Procedures of Statistics*, McGraw Hill Book Company.
- Vimala, S., Mohd A. Iliham, Abdul A. Rashih and S. Rohana, 2003. *Nature's Choice to Wellness, Antioxidant Vegetables/Ulam*. Forest Research Institute Malaysia, FRIM Kuala Lumpur Malaysia.