THE EFFECT OF DIET CONTAINING MANGOSTEEN PEEL EXTRACT (*GARCINIA MANGOSTANA* L.*)* AND SUPLEMENTED WITH ZINC AND COOPER ON THE QUALITY OF SENTUL CHICKEN CARCASS

Tuti Widjastuti[1*], Iwan Setiawan[1], Abun Abun[1], Indrawati Y. Asmara[1]

[1]Faculty of Animal Husbandry, University Padjadjaran, West Java, Indonezia

Abstract

Sentul chicken is a specific local chicken from Ciamis region in West Java and a dual-purpose type that can utilized for eggs and meat production. One of the alternatives to improve performance is by giving the diet added with a mangosteen (Garcinia mangostana L.) peel extract. Mangosteen peel extract contains xanthone compounds as antioxidants and antimicrobials. This research aims to determine the optimal level of mangosteen peel extract (Garcinia mangostana L.) with supplemented Zn and Cu on carcass quality of Sentul chicken. The number of chickens used 100-day old Sentul chicken that kept until 12 weeks. The experimental design used was Complete Randomized Design (CRD) with 5 treatment levels of mangosteen peel extract with supplement Zn and Cu with 4 replications respectively with 5 chicks in each replicate. The treatments consisted of P0 (only basal feed), P1 (basal diet + 60 mg/kg extract and Zn-Cu supplements), P2 (basal diet + 120 mg/kg extract and Zn-Cu supplements), P3 (basal diet + 180 mg/kg extract and Zn-Cu supplements) and P4 (basal diet + 240 mg/kg extract and Zn-Cu supplement). The investigated parameters were final body weight, carcass weight, dressing percentage, and the meat cholesterol content of Sentul chicken. The results showed that using 120-180 mg/kg mangosteen extract with supplemented Zn and Cu significantly increased final body weight, carcass weight, and reduced meat cholesterol content compared to basal diet, but with the addition of 240 mg/kg diet final body weight and carcass weight decreases. The study concludes that the addition of mangosteen peel extract with supplemented Zn and Cu to 180 mg/kg diet resulted in optimal carcass quality.

Key words: mangosteen peel extract, supplemented Zn and Cu, carcass quality, Sentul chicken

INTRODUCTION

Sentul local chicken is a specific one which comes from Ciamis region in West Java with grey feathers as its distinctive feature, with a variation of grey and brown yellows feathers and orderly arranged feathers on its breast like dragon scales [1]. Ciamis people also call Sentul chicken as 'Kulawu Chickens', kulawu means grey since the plumage colors of Sentul chickens are dominated by grey [2]. Sentul chicken is a dual purpose type, that could be used for eggs and meat production. In another way, this bird is very good to genetically improve chicken meat breeds, because has a compact body and white skin color [3]. Effort to increase the productivity of Sentul chickens, need other alternatives to improve the quality of carcass Sentul chicken. Feed additives added to the diet are intended to improve the feed consumption, digestibility, and endurance of chicken livestock. Chickens growth rate and productivity could be increased by using synthetic antibiotics as feed additives, but this leads to residual traces in carcasses therefore to antibiotic resistance of microorganism in human consumers' organisms, that could be harmful. An alternative substitute for antibiotics in chicken nutrition would be the natural feed additive based on mangosteen peel extract.

The nutrient content contained in the mangosteen peel is: 0.63% crude fat, 0.71% protein, ash 1.01%, total sugar 2.10%, and carbohydrates 35.61% [4]. Mangosteen peel

[*]Corresponding author:
tuti_widjastuti@yahoo.com
The manuscript was received: 03.09.2019
Accepted for publication: 25.03.2021

also contains xanthone compounds that function as antioxidants, antiviral, antifungal and antimicrobial, and not found in other fruits. Xanthone compounds consist of mangostin, mangostenol A, mangostinone A, mangostinon B, trapezi folixanthone, tovophyllin B, alpha mangostin, beta mangostin, garcinon B, mangostanol, flavonoid epicatechin and gartanin [5]. Inclusion of mangosteen peel meal in diets is problematic because of its antinutrient content in the form of tannins [6]. High tannin content will inhibit feed absorption and chicken growth. To reduce tannin levels in mangosteen peel, an extraction procedure must be carried out. Extraction is a sepa diet process of solid or liquid material with the help of solvent. The solvent used should be able to extract the desired substance without dissolving other materials. The process of extracting the peel of mangosteen fruit to obtain antioxidant substances usually use a macediet process, which is a simple extraction method to extract simplicia containing soluble chemical components in the solvent fluid [7]. Candra stated that giving mangosteen peel extract 120 mg/ kg was able to increase the carcass percentage by 68.58 [8]. Xanthone compounds contained in the peel of mangosteen can improve the structures of intestinal villi in the process of nutrient absorption. Antibacterial herbs are able to suppress the growth of pathogenic bacteria in the intestine [9]. Mangosteen peel also has an anti-microbial power against bacteria such as Staphylococcus aureus [10]. Antioxidant compounds (xanthones) contained in mangosteen peel can also prevent or neutralize free radicals due to air pollution in the environment. An increase in ambient temperature over a comfortable temperature zone range causes oxidative stress, leading to the occurrence of free radical attack on the cell membrane. Free radicals are an atom, a molecule, or a compound in which it contains one or more unpaired electrons, making it highly reactive [11]. Research [12] on mangosteen peel extract analyzed with GCMS (Gas Cromatographic Mass Spectrometry) states that mangosteen peel extract contains organic unsaturated methyl ester compounds which are easily oxidized so that the chain link must be transformed into a chain of bonds with mineral metal catalysts Cu and Zn. The minerals Cu and Zn are cationic minerals that will work on enzymes involved in growth and the immune system, but their biological availability to the animal body is affected by the presence of phytic acid in diets [13]. Copper is a mineral element that is needed in the metabolic process, hemoglobin formation and physiology in the animal body [14]. Although needed in small amounts in the organism, any excess will be able to interfere with health and gastrointestinal disorders [15]. The need for mineral Cu in poultry is 5 ppm and mineral needs of Zn are 40 ppm [16]. The results showed that 120 mg/kg providing of mangosteen peel extract had a significant effect on growth performance in broiler chickens [8]. While the results of Abidin's study [17], the use of mangosteen peel extract 41 to 120 ml/kg did not affect the feed conversion of Sentul chicken. Mangosteen peel extract is a natural feed additive, used in order to improve the quality of diets in supporting quality of carcass Sentul chicken growth phase. This research aims to determine the optimal level of mangosteen peel extract (Garcinia Mangostana L.) with supplemented Zn and Cu on carcass quality of Sentul chicken.

MATERIAL AND METHOD

The study used 100 day- old Sentul chickens with the average body weight of 27.8 grams (coefficient of variation 8.27%). The Sentul chickens were kept in deep litter system until the age of 12 weeks, 20 pens were used, sized 90 cm x 90 cm x 60 cm (length x width x height). Each pen consisted of 5 chickens. The feed ingredients of the basal diet were yellow corn (56.00%), rice bran (21.50%), fish meal (9.25%), soybean meal (12.00%), bone meal (0.75%), and CaCO3 (0.50%). Diets were prepared based on protein and metabolisable energy requirements for the local chicken growth phase, ie. 17% protein and 2750 Kcal/kg [18]. Mangosteen peel extract is made in the laboratory by maceration method using ethanol solvent for 2 days, then filtered and

mangosteen peel filtrate is evaporated with a Rotary evaporator Bunchi R-300 with a temperature of 60 0C which aims to separate 96% ethanol with mangosteen peel extract then dried in an oven with temperature of 800 C to get mangosteen peel extract powder. The treatment consisted of the use of mangosteen peel extract with supplement Zn and Cu, Zn and Cu supplement concentrations used in accordance with the needs of chickens are Zn 40 mg/l and Cu 5 mg/l. ie: P0 (Only basal diet), P1 (basal diet + 60 mg/kg extract and Zn-Cu supplements), P2 (basal diet + 120 mg/kg extract and Zn-Cu supplements), P3 (basal diet + 180 mg/kg extract and Zn-Cu supplements), and P4 (basal diet + 240 mg/kg extract and Zn-Cu supplements). Experiments were conducted using Completely Randomized Design, consisting of 5 treatments and 4 replications. Data were analyzed using Varian Analysis and differences between treatments using Duncan Multiple Range Test. The measured parameters were Final body weight, carcass weight, dressing presentage and the meat cholesterol content of Sentul chicken. Determination of meat cholesterol levels was carried out by the CHOD-PAP (Cholesterol Oxidase Phenylperoxidase Amino Phenozonphenol) method. Meat samples were taken from the chest and thighs [19].

RESULTS AND DISCUSSIONS

The effect of mangosteen peel extract with Zn and Cu supplements on final body weight, carcass weight, dressing percentage, and the meat cholesterol content of Sentul chicken, is shown in Table 1 and Fig. 1.

Table 1 The Final Body Weight, Carcass weight, Dressing Percentage and The Meat Cholesterol Content of Sentul Chicken

Variables	P0	P1	P2	P3	P4
Final Body Weight (g)	723.25[a]	838.00[b]	876.75[b]	808.25[b]	729.00[a]
Carcass Weight (g)	470.50[a]	548.25[b]	579.00[b]	541.75[b]	475.50[a]
Dressing Percentage (%)	65.06[a]	66.65[b]	67.75[b]	67.05[b]	65.22[a]
Meat Cholesterol (mg/100g)	124.71[a]	118.36[a]	111.65[b]	110.12[b]	96.00[c]

Note : Similar superscripts in the same row show not significant difference (P>0.05)
P0 (Only basal diet)
P1 (basal diet + 60 mg/kg extract and Zn-Cu supplements)
P2 (basal diet + 120 mg/kg extract and Zn-Cu supplements)
P3 (basal diet + 180 mg/kg extract and Zn-Cu supplements)
P4 (basal diet + 240 mg/kg extract and Zn-Cu supplements)

Final Body Weight

The final body weight in Sentul chicken due to the use of mangosteen peel extract with supplement of Zn and Cu, varied between 723.25 – 876.75 g. The result of variance analysis showed that addition of mangosteen peel extract with supplement Zn and Cu in the basal diet has a significant effect (P<0,05) on final body weight of Sentul chicken. Effect of adding mangosteen peel extract supplemented with Zn and Cu to the diet from 60 to 180 mg/kg was significantly higher than the control treatment (P0) and adding 240 mg/kg diet. The body weight on treatment P1, P2, and P3 did not show any significant effect. This means the addition of mangosteen peel extract with supplement Zn and Cu until 180 mg/kg gives a positive response to final body weight. It is known that mangosteen peel meal containing xanthone active substances that serves as antioxidants that could reduce cell damage, especially caused by free radicals. It is also reach in antimicrobials that are allegedly able to improve the structure of intestinal villi in the process of absorption of nutrients and are able to suppress the growth of pathogenic bacteria in the intestine, resulting in higher final body weight. Following the opinion of Lannag et al. [20], Xanthone compounds are also able to suppress oxidative stress that increases the

rate of better chickens. The addition of Cu and Zn supplementation in mangosteen peel extract can control and improve the right environmental conditions and lead the beneficial microbial population in the digestive tract to produce a better final weight on Sentul chickens.

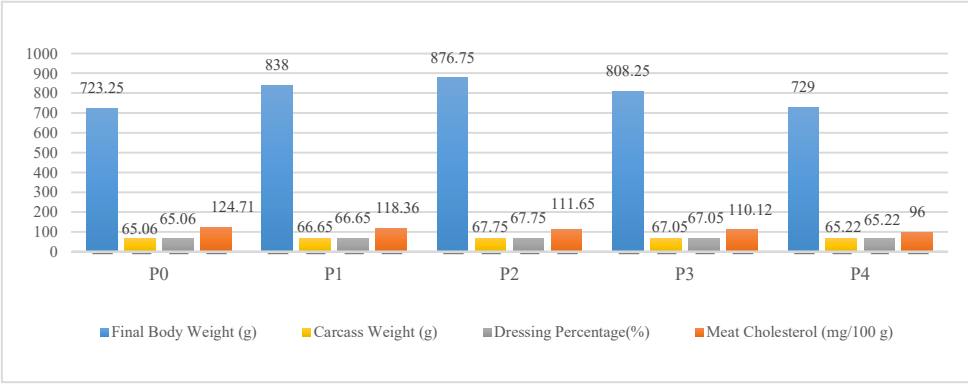

Fig. 1. Sentul chicken average of mangosteen peel extract in final body weight, carcass weight, dressing percentage, meat cholesterol

Carcass weight and Dressing percentage

The increased level of mangosteen peel extract with supplemental Zn and Cu in the diet, induced an average carcass weight varying from 470.50 – 579.00 grams and a dressing percentage within the 65.06 – 67.75% limits. The usage of the experimental factor generated a significant effect ($P < 0.05$) on carcass weight and dressing weight. By adding a level of 120 -180 mg extract/kg diet, carcass weight and dressing percentage experienced a significantly higher increase than P0 and P4 treatment. The extract of mangosteen peels through the antioxidants within also played a role in growth and increased bodyweight of Sentul chicken, supported also by the presence of minerals Zn and Cu. Therefore, carcass weight and dressed percentage increased. This suggests that the xanthone content found in mangosteen skin extract works accordingly to its function as an *antioxidant*, *antiproliferative*, and *antimicrobial*. The xanthones improve the structure of intestinal villi in the process of absorption of nutrients and can suppress the growth of pathogenic bacteria in Sentul chicken intestine. Higher the xanthones uptake by chickens, the better the nutrients absorbed, the better the growth will be, ultimately inducing optimal carcass weight. According to Lannang et al. [20], xanthones in mangosteen peel have antioxidants that can suppress oxidative stress due to environmental pollution. Antioxidants convert free radicals into compounds that are relatively stable and stop the chain reaction from free radical damage so that will has an impact on the rate of chicken growth [21].

Meat Cholesterol

The cholesterol content in the meat of Sentul chicken aged 12 weeks ranged from 96.00 - 124.71 mg/100g. Cholesterol from native chickens according to Zaboli et al. [21] ranges from 100 mg to 120 mg/100g meat. The cholesterol content in the blood is considered safe if it does not exceed 225 mg/dl [23]. The results of the statistical analysis showed that the addition of mangosteen peel extract with Zn and Cu supplements in the basal diet markedly reduced the meat cholesterol content. The basal diet diet without mangosteen peel extract with supplement Zn and Cu (P0) and the diet added with mangosteen peel extract and Zn and Cu at the level of 60 mg/kg (P1) did not have a significant effect on the cholesterol content of Sentul chicken meat.

On the contrary, higher the xanthones contents consumed by chickens (treatments P2, P3 and P4), the lower the cholesterol content of meat. The extract of mangosteen peel contains several active compounds including alkaloids, triterpenoids, saponins, flavonoids, tannins, and polyphenols. Polyphenols that have the ability as antioxidants are xanthone compounds. Flavonoid is one of the phytochemical groups that have the same structure, namely polyphenols, whose mechanism can reduce cholesterol levels due to HMG-CoA (*Hydroxy Methyl Glutatyil-CoA*) reductase activity, reduce the activity of the enzyme *acyl-CoA cholesterol acyltransferase (ACAT)*, and reduce cholesterol absorption in the digestive tract [24]. Apart from xanthone, mangosteen peel contains *α-mangosteen*, a pigment that can improve secretion of pancreatic lipase and α-amylase; enzymes that play a significant role in the antiobesity mechanism [25]. Alpha-mangostin which is thought to increase the activity of the lipoprotein lipase enzyme which will increase the catabolism of VLDL (*Very Low Density Lipoprotein*) As a result the total cholesterol level decreases [25].

CONCLUSIONS

The results showed that using 120-180 mg/kg mangosteen extract with supplemented Zn and Cu significantly increased final body weight, carcass weight, dressing percentage and reduced meat cholesterol content compared to basal diet. The addition of 240 mg extract/kg diet induced decreases of final body weight, carcass weight and dressing percentage. This study concludes that the addition of mangosteen peel extract with supplemented Zn and Cu to 180 mg/kg diet resulted in optimal carcass quality.

ACKNOWLEDGMENTS

Scientific studies have been conducted in the Grand Research Academic Leadership Project, Directorate of Research, Community Service and Innovation Padjadjaran University, Indonesia.

REFERENCES

[1] Widjastuti, T., Abun, I.S. (2017). The Use Of Turmeric (Curcuma Domestica Val) Meal In The Dietal Feed Additive On Hen-Day Production And Egg Quality Of Sentul Chicken. Scientific Papers Series D. Animal Science, Volume LX, pp. 131-135.

[2] Indrawati, Y. A., Widjastuti T., Abun I.S., Partasasmita R. (2018). The Growth Performances And The Gut Health Parameters Of Sentul Chicken Supplemented With A Various Dosage Of Tumeric Powder. Nusantara Bioscience. ISCA Journal Of Biological Science 10 (3), pp.

[3] Widjastuti, T., Sujana, E., Darana, S. (2012). The Yielding Characteristic of Sentul Chickens Fed Diet Containing Papaya Leaves Meal (Caraca Papaya L. Less). Scientific Papers, Animal Science, Series D. Vol. LV.

[4] Permana, A.W. (2010). Kulit Buah Manggis Dapat Menjadi Minuman Instan Kaya Antioksidan. Warta Peneltian Dan Pengembangan Pertanian. BBP2TP. Badan Litbang.Kementan RI.Indonesia. Vol. 32 (2).

[5] Qosim, Wahid, Ali. (2007). Kulit Buah Manggis sebagai Antioksidan. Artikel Tim Ahli Divisi TTG. Lembaga Pengabdian Masyarakat (LPM) Universitas Padjadjaran. Bandung.

[6] Rusli, R.K., Wiryawan, K.G., Toharmat, T., Jakaria And R. Mutia. (2015). Effect Of Mangosteen Pericarp Meal And Vitamin E Supplements On The Performance, Blood Profiles, Antioxidant Enzyme And HSP 70 Gene Expression Of Laying Hens In Tropical Environment. Int. J. Poult. Sci., 14, pp. 570-576.

[7] Ahmad, F. Gusnidar and Riski. (2006). Ekstraksi Bahan Humat dari Batubara dengan menggunakan 10 jenis Pelarut. J. Volum 4, pp.72-79

[8] Candra, A. (2014). Perbandingan Aktivitas Ekstrak Kulit Buah Manggis dan Berbagai Antioksidan terhadap Penampilan Broiler. Jurnal Penelitian Terapan. Vol. 15 (1), pp. 68-74.

[9] Velmurugan, S. And T. Citarasu. (2010). Effect Of Herbal Antibacterial Extracts On The Gut Floral Changes In Indian White Shrimp Fenneropenaeus Indicus. Rom. Bioteceh. Lett. 15, pp. 5709-5717

[10] Suksamrarn, A., S. Suwannapoch, N. Phakhodee, W. Thanuhiranlert, J. Ratananukul And P. Chimnoi. (2003). Antimycobacterial Activity Of Prenylated Xanthones From The Fruits Of Garcinia Mangostana. Chem Pharm Bull (Tokyo): 857-859

[11] Andayani, R., Lisawati, Y., Maimunah. (2008). Penentuan Aktivitas Antioksidan, Kadar Fenolat Total, Dan Likopen Pada Buah Tomat. Jurnal Sains Dan Teknologi Farmasi. Vol.13, No.1.

[12] Miryanti, A., L. Sapei, K. Budiono, Dan S. Indra. (2011). Ekstrak Antioksidan Dari Kulit Buah Manggis (Garcinia Mangostana L.). Laporan Penelitian Universitas Katolik Parahyangan. Bandung.
[13] Piliang W.G. (2000). Nutrisi Mineral. IPB Press. Bogor.
[14] Burns, M.J. (1981). Role Of Copper In Physiological Process. Auburn Vet. J. 38(1), pp. 12 – 13.
[15]Bartik M., A. Piskac. (1981). Veterinary Toxicology. New York: Elseiver Scientific Publishing Company, Dalam Widowati W., Saationo A., Dan Jusuf R., 2008. Efek Toksik Logam. Yogyakarta: Penerbit Andi.
[16] Scott, M.L.M.C. Nesheim And R.J. Young. (1982). Nutrition Of The Chickens. Second Ed. M.L.Scott And Associates, Ithaca, New York.
[17] Abidin, J. (2017). Pengaruh Penambahan Ekstrak Kulit manggis pada ransum terhadap Perform Ayam Sentul umur 0-10 Minggu. http:// pustaka.unpad.ac.id/archives/155186.
[18] Widjastuti Tuti. (1996). Penentuan Efisiensi Penggunaan Protein, Kebutuhan Protein Dan Energi Untuk Pertumbuhan Dan Produksi Telur Ayam Sentul Pada Kandang Sistem Cage Dan Sistem Litter. Disertasi. Program Pascasarjana, Universitas Padjadjaran.
[19] Richmond, W. (1983). Clinical Chemistry 19. Perancis. pp. 1350-1356.
[20] Lannang, A. M., J Komguem, F. N. Ngninzeko, J. G. Tangmouo, D. Lontsir, A. Ajaz, M. I. Choudhary, B. L. Sondengam And A. Ur-Rahman. (2006). Antioxidant Benzophenones And Xathones From The Root Bark Of Garcinia Smeathmannii. Bull. Chem. Soc. Ethiop. 20, pp. 247-252.
[21] Zaboli, G. Z. H. Bilondi and Amiri. (2013). The Effect of Dietary Antioxidant Supplements on Abdominal Fat Depositions in Broilers. Life Sci. J. 10, pp.328-333.
[22] Setiawan, D.V., I.H. Djunaedi, Dan E. Sudjarwo. (2011). Pengaruh Penambahan Tepung Kulit Manggis (Garcinia Mangostana L) Dalam Pakan Terhadap Performan Produksi Itik Mojosari Jantan. Artikel Universitas Brawijaya. Malang.
[23] Pilliang And Djojosoebagyo. (1990). Fisiologi Nutrisi I. Depdikbud. Bogor.
[24] Choi J.H., Rho M.C., Lee S.W., Choi J.N., Kim K., Song G.Y., Kim Y.K. (2008) Bavachin And Isobavachalcone, Acyl-Coenzyme A: Cholesterol Acyltransferase Inhibitors From Psoralea Corylifolia. Arch. Pharm. 31, pp. 1419–1423.
[25] Adnyana I.K, Abuzaid A.S, Iskandar E.Y, Kurniati N.F. (2016). Pancreatic Lipase And A-Amylase Inhibitory Potential Of Mangosteen (Garcinia Mangostana Linn.) Pericarp Extract. Int. J. Med. Res. Health Sci.;5(1), pp. 23–28.