UTILISING Zn AND Cu PRODUCT IN THE CORN MEAL SUBSTRATE AT *Saccharomyces cerevisiae* BIOPROCESS AND ITS IMPLEMENTATION ON INTERNAL QUALITY OF BROILER

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ABSTRACT

This research was conducted to find out the effect and optimal percentage of adding Zn and Cu proteinat supplement product of fermentation by *Saccharomyces cerevisiae* in the ration on internal quality of the broiler. The experiment used 125 broiler day old chicken with a Completely Randomized Design. The ration treatments were R_0 (control), R_1 (99% R_0 + 1% supplement Zn and Cu proteinat), R_2 (98% R_0 + 2% supplement Zn and Cu proteinat), R_3 (97% R_0 + 3% supplement Zn and Cu proteinat) and R_4 (96% R_0 + 4% supplement Zn and Cu proteinat) where each treatment was repeated five times and each replication consisted of five broiler chicks. Variable analysis were body cut weight, carcass percentage, liver relative weight, and the content of cholesterol broiler meat. Conclusion of the research showed that by using 3% of Zn and Cu proteinat supplement substrat in the ration gave the best internal quality of broiler, increased body cut weight, carcass percentage, otherwise liver relative weight and the content of cholesterol broiler meat were normal.

Keywords : Zn and Cu proteinat supplement, rations ,broiler internal quality

INTRODUCTION

Nutrient necessity of broiler ration has been recommended among each of feed-mill, but the validity is still asked a question. This case stigma can be suggest by giving supplement, either amino acids, vitamins, or mineral of any animal product. By adding of an organic mineral straight apprehensive, it will be tied to fatty acid be a phytate complex which is very difficult to absorb and makes mineral and another nutrient deficiency. Mineral supplementation are given in organic matter, where the organic minerals could be done by bioprocess using one of the specific microorganism pass through *Saccharomyces cerevisiae* yeast fermentation.

Saccharomyces cerevisiae is an unicellular fungi and called yeast, oval round shape, have a 5 – 12 μ measurement and after adult will be broken to be mother cell (Frazier *et.al*., 1993). The active yeast can produce amylase, lipase, protease, and other enzymes which can change complex molecule to be a simple molecule and could be serve digest of nutrient in digestible organs (Tjitjah, 2005). As long as Zn and Cu minerals and its substrat mixture are metabolized by yeast, both of those minerals composed the linkage of protein and carbohydrate cluster. The mineral bound can be a simple organic and then be absorbed by intestine (Shin, 1996; Pilliang, 2000).

The readiness of Zn and Cu micro minerals must be takes a special attention, because those minerals have catabolism functions in biology process (Georgievskii, 1982; Murray, 1997; Pilliang, 2000). The Zn mineral is a cofactor that can be met in thirty enzymes, while Cu is important in haemoglobine biosynthesis and the rupture of errythrocytes, and as a seruloplasmine component, dismutase of superoxide, and cytochrome oxydase (Kidd *et al.*,1996; Tanuwiria, 2004). Zn and Cu minerals have a high biological readiness in organic matter, and looks-like proteinate of Zn and Cu which makes from corn-meal and soy- bean meal substrat compound as much as 20 percent via *Saccharomyces cerevisiae* yeast as an fermented inoculum. The product of fermentation, could be an additive nutrient, and in the ration makes as feed supplementary (amino acids, fatty acids, vitamins, and minerals), especially for broiler chicks. The essential of amino acid content in *Saccharomyces cerevisiae* is very well, it contains lysine 7.8 percent and tryptophan 1.3 percent (Dhalika *et al.,* 2004). The amino acid synthesis, later could be decarbonization and become pyrophosphate isopenthenyl, and then lanosterol, and at the end makes cholesterol (Paik *et al*., 1999). The cholesterol biosynthesis is not directly arranged by the decreasing of glutathione (GSH) and Oxyde-glutathione (GSSG) (Kim *et al.*,1992; Bakali and Pesti, 1994). The decrease of GSH related to liver cell protection from free radical poisonous at high Cu, until Cu be made complex by GSH, and then is transfered to metallothionein form, for example: Cu storage. The increasing of GSSG concentration caused the activity of 3-hidroxy-3-3-methylglutaryleo-enzyme-A (HMG-CoA reductase) decreased until the flow of carbon via mevalonat track also decreased and finally cholesterol synthesis become lower (Feedman *et al.,*1998).

Supplement nutrient product of Zn and Cu analysis : water 10.67 percent, crude protein 21.35 percent, crude fat 4.04 percent, crude fiber 4.42 percent, Zn 2400 mg/kg and Cu 400 mg/kg. The research with phytase and Zn (132.70 ppm) and $CuSO_4$ (286.16 ppm) in the ration raised body weight effectively and decreased feed conversion on broiler chicks (Setyawan *et al*., 2007). A treatment with $CuSO_4$-250, Cu-Methyonine-125, and Cu-Methyonine-125 and Cu-Methyonine-250 caused Cu concentration in the liver significantly decreased total cholesterol plasma (Paik *et al.,* 1999).

The linkage of Zn and Cu product of bioprocess by *Saccharomyces cereviciae*, Zn and Cu organic matter are an active nutrient for metabolism and digestible system. By using Zn and Cu proteinate in the ration, is expected the respons not only on the performance, but also in the organ development on broiler meat cholesterol. The objective of the research was to find out the effect and optimal percentage of adding Zn and Cu proteinat supplement fermentation by *Saccharomyces cereviciae* in ration on internal quality of the broiler.

MATERIALS AND METHODS

The research used 125 DOC of broiler Cobb Strain, with the average of body weight was 43.26 gram and 6.56 percent of variable coefficient. The birds kept in cage system, as much as 25 cages, and each cage consisted of 5 chickens. Every cage is equiped by round feeder and round waterer, 40 watts of bulb lamp as heater hanging in the middle of each cage, where a 10 watt of tube lamp as a house light.

The ration was made by corn-meal, fish meal, rice bran, coconut meal, soy-bean meal, and bone meal ingredients. The diet formula have 20 percent of protein and 3000 kcal/kg of metabolizable energy. The Zn and Cu proteinat supplement were made in The Poultry Nutrition, Non-Rumminant,and Industrial Laboratory, Faculty of Animal Husbandry, Padjadjaran University.

The formula rations were :

R_0= Control ration without Zn and Cu proteinat content

R_1= 99 percent Control ration + 1 percent of Zn and Cu proteinat

R_2= 98 percent Control ration + 2 percent of Zn and Cu proteinat

R_3= 97 percent Control ration + 3 percent of Zn and Cu proteinat

R_4= 96 percent Control ration + 4 percents of Zn and Cu proteinat

Completely Randomized Design was used in this experiment with 5 treatments, and each treatment was repeated 5 times. Then the data was analyzed by random simple test, and among treatments with Duncan's Multiple Range Test. Variable analysis were body cut weight, carcass percentage, liver relative weight, and the content of cholesterol broiler meat.

The basal diet composition is showed in Table 1. The nutrient content of five experimental ration for 0–5 weeks of broiler age is presented in Table 2.

Table 1. Ration Treatment Formula (R_0)

Ingredient	Control Ration (%)
Yellow Corn- meal	62
Rice bran	3
Soy-bean meal	19
Coconut meal	5
Fish meal	8
Bone meal	1
Coconut oil	1.5
Premix additive	0.5
Total	100

RESULTS AND DISCUSSION

The body cut weight, carcass percentage, liver relative weight, and the content of cholesterol of broiler meat is showed in Table 3.

Body Cut Weight

By treatment of 97 percent control ration

Table 2. The Nutrient Content of Experimental Rations *)

The Nutrient	R_0	R_1	R_2	R_3	R_4
	....	....	(%)	....	....
Crude protein	19.99	20	20.02	20.03	20.04
Crude fat	6.41	6.39	6.36	6.34	6.31
Crude fiber	3.81	3.81	3.82	3.82	3.83
Calcium	1.18	1.18	1.17	1.17	1.16
Phosphor	0.45	0.45	0.44	0.44	0.44
Lysine	1.13	1.13	1.13	1.13	1.13
Methionine	0.4	0.4	0.4	0.4	0.4
Zn (mg/kg)	33.25	45.47	57.69	69.92	82.15
Cu (mg/kg)	7.24	8.84	10.39	11.95	13.51
Metabolizable energy(kcal/kg)	3011	3010	3010	3009	3008

*) Analysis of Poultry, Non-rumminant and Food Industrial Nutrition Laboratory, The Faculty of Animal Husbandry, University of Padjadjaran (2008).

with 3 percent of Cu and Zn proteinat gave the best result of broiler body cut weight, and significantly different ($P<0.05$) from other treatments. If connected to feed consumption which was not significant, then the existence of Zn and Cu proteinat supplement in the ration via *Saccharomyces cereviciae* bioprocess made the ration easier to digest.

The same as digestibility observation, the addition of 3 percent Zn and Cu proteinat supplement in the ration gave 80.92 percent dry matter, 81.18 percent organic matter, and 80.92 percent digestible value (Tjitjah *et al*., 2006). The higher protein digestible, the higher meat productivity. By adding 3 percent Zn and Cu proteinat supplement in the ration (R_3) gave Zn and Cu absorption 46.85 mg/kg and 8 mg/kg, while at R_1 and R_2 still below or not enough, because minimal requirement of Zn and Cu 40 mg/kg and 8 mg/kg (NRC, 1994).

The addition of 3 percent Zn and Cu proteinat supplement made balance the action of bacterial in small intestine, and broiler body weight was higher. In R_1 ration the Zn and Cu absorbed were 30.16 mg/kg and 6.18 mg/kg, while in R_2 were 37.98 mg/kg and 7.48 mg/kg. Therefore, broilers body weight treated R_1 and R_2 rations were lower than those treated R_3 ration. Different from R_3 , the Zn and Cu absorbed in R_4 were 53.61 mg/kg and 10.06 mg/kg. It was the highest and made the work of liver more extra. The highest Zn made inflamation of liver. That is why the body weight of broiler which were gave R_0 and R_4 ration were same. Pilliang (2000) and Kim and Patterson (2004) recommended, if the content of mineral in ration too much, it will cause poisoning and decrease broiler body weight.

Table 3. Average of Body Cut Weight, Carcass Persentage, Liver Relative Weight, and Content Cholesterol of Broiler Meat

Variable	R_0	R_1	R_2	R_3	R_4
Body cut weight (g)	1204.50^{a}	1204.00^{a}	1235.20^{a}	1393.60^{b}	1200.80^{a}
Carcass (%)	67.20^{a}	67.99^{a}	68.70^{a}	70.36^{b}	67.71^{a}
Liver relative weight (%)	1.78^{a}	1.89^{a}	1.92^{a}	2.00^{a}	2.23^{b}
Cholesterol (mg/100 g)	75.143	70.095	69.883	68.077	71.134

Note: a,b Row means with different superscript were significantly different ($P<0.05$)

Carcass Percentage

The percentage of carcass weight was the empty carcass divided by slaughter weight and multiplied by one hundred percent. In Table 3 can be seen that the highest of carcass percentage was broiler chick which receiving 3 percent Zn and Cu proteinat additive in the ration R_3 (70.36%), and the lowest was R_0 (67.20%). The result of this experiment showed that by using 3 percent of Zn and Cu proteinat additive in the ration gave the optimal of broiler carcass weight, because by giving 4 percent of those, the carcass weight become decreased. Morran and Orr (1997) have stated that in fact the carcass weight percentage positive correlated with broiler slaughter weight.

Liver Relative Weight

Liver relative weight was calculated liver weight divided by slaughter weight and multiplied by one hundred percent. The liver relative weight of each treatment is showed in Table 3. The average of liver relative weight was 1.78-2.23 percent, showing increase to ration with giving more Zn and Cu proteinat of feed additive. This experiment looks like the same as Santosa's experiment,(2001) which found the liver weight was 1.7-2.3 percent.

By giving 4 percent Zn and Cu proteinat supplement in the ration (R_4), broiler received 53.61 mg/kg and 10,06 mg/kg Cu much more for Zn and Cu of standard need. Because of Zn and Cu were higher than standard, so the liver had extra work and then caused inflamation. Wahyu (1992) stated that if Cu in a ration was high, so Cu in the liver would high too, and Zn could be used to eliminate the poison of Cu. Giving Zn too high in ration makes liver inflammation. The liver color would change when getting poison and inflammation (Ressang, 1994).

Meat Cholesterol Content

The average of meat cholesterol content is showed in Table 3. The meat cholesterol levels in R_3 was the lowest (68.078 mg/100 g) and those in R_0 was the highest (75.134 mg/100g). By adding 3 percent Zn and Cu proteinat feed additive in the ration, there was a tendency that the level of meat cholesterol content going to decrease. The range of cholesterol content in blood of 21-42 days old broiler was 133.06-154.39 mg/100g (Bakali and Pesti, 1994). Researchers reported that the range of cholesterol content in broiler meat was 90 mg/100 g (Chan *et al*., 1995). Comparing to researchs, the level of broiler meat cholesterol in this research still in the normal range.

Cu mineral content in the liver controlled cholesterol biosynthesis and caused glutation hepatic goes down. Glutation active in biosynthesis of cholesterol pass-through coenzyme 3-hydroxy-3-methylglutary (HMG-CoA) stimulation (Paik *et al.,* 1999). The percent of Cu mineral into liver cell caused a complex condition by glutathione immediately, and later was transferred to be metallothionein. The increasing of glutathione concentration caused HMG-CoA activity going-down until caused the decreasing of cholesterol synthesis (Kim *et.al.*, 1992; Bakali and Pesti, 1994).

By addition 4 percent Zn and Cu proteinat supplement in the ration, the role of Cu did not give effect on broiler meat chlolesterol level. This matter because of cholesterol amount in broiler body depend on the situation of animal development period. Cholesterol in animal development period need more for steroid hormone, bile salts, and vitamin D_3 formation (Muchtadi *et al*., 1995). The research object of broiler chicks still on development periode, so by the addition of 1-4 percent of Zn and Cu proteinat supplement in the ration gave a non-significant effect on broiler meat cholesterol. Anggorodi (1995) has told that cholesterol content in the animal body organ depend on the age .

CONCLUSION

By adding 3 percent of Zn and Cu proteinat supplement in the ration gave the best result on broiler internal quality, such as: body cut weight and carcass percentage had increased, while relative liver weight and the content of cholesterol broiler meat still normal.

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