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Contents

Preface

List Paper of Oral Presentation

List of Poster

Resistance against *Salmonella pullorum* in IPB-D1 Crossbreed, Kampong and Commercial Broiler Chicken

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Abstract

The aim of this research was to study the resistance against *S. pullorum* infection on IPB-D1 crossbreed, kampong and commercial broiler chickens. Chicken IPB-D1 is derived from a cross between a male line of F1 pelungx sentul (PS crossbreed) with a female line of F1kampongx broiler parent stock, Cobb strain(KB crossbreed). A total of 31 chickens consisting of IPB-D1 (11 birds), kampong (13 birds) and commercial broiler (13 birds) were used in this research. All of chickens are collection of Division of Animal Breeding and Genetics, Department of Animal Production and Technology, Faculty of Animal Science, Bogor Agricultural University (IPB). The experiment was designed using a completely randomized design.Biological assays of resistance indicator were measured, including leukocytes profile (leucocytes concentration and its differentiation, H/L value), and clearance test using *S.pullorum*. Data from all observations were statistically analyzed using analysis of varian. The result of this research showed that the value of leukocytes profile and body resistance parameters from IPB-D1 crossbreed and kampong chicken were not significantly different, but on both these chickens, these parameters were significantly different than those in commercial broiler chickens. The conclusion is the IPB-D1 crossbreed biologically have the same resistance against *S. pullorum* infection with the kampong chicken and it higher than commercial broiler chickens.

Keywords: resistance, *S. pullorum*, crossbreed, kampong chicken, broiler chicken

1. Introduction

National meat consumption from poultry reached 66.97%. The needs of these poultry meat, still supplied by commercial chicken industry that 90% of its production components, of both breed and feed were import based. The meat consumption from the local chickens have just reached 11.10% [1]. This is due to small farming do not have a breeding program which is structured. So that the local chicken farmer is very difficult to get the selected chicken for breeding. This condition is very opposed to the potential of Indonesia is very rich in genetic resources of local chicken, and Indonesia is one of the centers of domestication of chickens in the world [9].

In 2010 [5] stated that in Indonesia there are 31 local chickens that have been identified and characterized. The existence of genetic resources from 31 local chickens is very important because it has a genetic basis information for the development of chickens in the future. The development of local chicken industry through the selection and crossbreeding between the local chicken with broiler parent stock could be an alternative choice for produce superior composite chicken based on local resources.

Chicken IPB-D1 is derived from a cross between a male line of F1 pelung x sentul (PS crossbreed) with a female line of F1 kampung x broiler parent stock, strain Cobb (KB crossbreed). The uses of these chickens are

based on the premise that the pelung chicken has the large framework, potentially resulting in a lot of meat. Sentul chicken was a kind of local chickens that has high eggs production [9], while the kampong chicken has high resistance against infection of Salmonella sp. [10, 11]. The third of local chickens that used, as Indonesian local chicken in general, have a late growth rate. The effort to increase the local chicken growth is through crossbreeding with broiler chicken. This crossing is expected to obtain the heterosis effect [6]. The presence of 25% the broiler blood in IPB-D1, is feared could reduce its body's resistance, because broiler chickens are very susceptible to diseases infections. Therefore, this study was conducted to evaluate the resistance of IPB-D1 chicken and compare it with kampong chicken and commercial broiler chicken.

2. MaterialandMethods

2.1. Animal Experiments and Rearing

The study was conducted in field laboratory of Division of Animal Genetics and Breeding, Faculty of Animal Science, IPB. It used three kinds of chicken (11 birds of IPB-D1, 13 birds of kampong chicken, and 13 birds of commercial broiler chicken). Each kind of chickens were placed in pen (1.5x1.0 m^2). Every pen was equipped with feed, water and light bulbs (18 Watt). Each of chickens were numbered.

This study used feed of broiler commercial that contain 22-23% crude protein for broiler chicken. IPB-D1 and kampong chicken were given a mix of 60% commercial broiler feed and 40% rice bran (17% crude protein). Feed and water were given *ad libitum*. Every week chicken body weight were weighed. Observation was done until IPB-D1 and kampong chicken 12-weeks aged, and the broiler chicken until 5-weeks aged. When all three types of chickens 5-weeks aged, blood samples were taken for analysis of leukocytes profile and clearance test.

2.2. Observation of Leukocytes Profile

The concentrations of leukocytes and its differentiation were assessed by the Giemsa method [8] in PhysiologyLaboratory, Faculty of Veterinary Medicine IPB, as follows: 20 µL of chicken blood was dissolved in 380 µL of Turk solution (1 mL of 1% gentian violet in water, 1 mL glacial acetic acid, and 100 mL distilled water) using a micropipette. The total number of leukocytes present was calculated by counting all viable cells present on four areas located in four corners of the room count under a light microscope (100x magnification) and then multiplying by 50 to determine the concentration of each mm^3.

2.3. Observation of Body Resistance

Body resistance was detected in blood samples using the clearance test [3] in Bacteriology Laboratory,Faculty of Veterinary Medicine IPB. This method was used to look at normal bacterial (*S. pullorum*) population growth compared that of populations weregiven specific treatment. The treatment impact on bacterial growth was measured after incubating for 24-48 hours at 35±1^{o}C. Preparation of bacteria culture begins with the rejuvenation of culture in nutrient medium at a temperature of 36±1^{o}C for 18-24 hours and a sub-culture on Brain Heart Broth medium at a temperature of 36±1^{o}C for 18-24 hours.

2.4. Statistical Analysis

This study used a completely randomized design. The kind of chicken as a treatment (IPB-D1 crossbreed, kampong, and commercial broiler chicken). The following model wasused :$Yij = \mu + Ti + \varepsilon ij$ (Yij is the result observation, µ is the overall mean, Ti is the effect of the kind of chickens, and εij is the random residual effect). Data were analyzed using the GLM procedure of SAS 9.1.3 software (SAS Institute, Cary, NC, USA).

Table 1. Body Weight of IPB-D1, Kampong and Broiler Chicken

Kind of chicken (n)	Age (week)	Body weight (g/bird)
IPB-D1 (11)	12	1 514.57±57.42
Kampong (13)	12	921.67±61.23
Commercial broiler (13)	5	1 550.26±30.71

Table 2. Leukocytes Profile in IPB-D1, Kampong and Commercial Broiler Chicken

Leukocytes profile	IPB-D1 (n=11)	Kampong (n=13)	Commercial broiler(n=13)
Leukocytes concentration ($x10^3/mm^3$)	23.16±3.10a	22.23±2.17a	29.91±2.73b
Heterophiles (%)	43.22±3.25a	41.37±2.81a	70.83 ±3.41b
Monocytes (%)	5.07±0.73a	5.17±0.97a	5.20±1.11b
Lymphocytes (%)	50.16±4.02a	51.69±3.13a	22.42±0.61b
H/L ratio	0.86±0.29a	0.80±0.14a	3.16±0.25b

Different letters in the same row means different significantly (P<0.05)

Table 3. The Result of ClearanceTest in IPB-D1, Kampong and CommercialBroilerChicken

Kind of chicken (n)	The ability to kill *S.pullorum* (%)
IPB-D1 (11)	99.21±0.83A
Kampong (13)	99.38±0.48A
Commercial broiler (13)	36.67±0.66B

Different letters in the same column means significantly different (P<0.01)

3. Result andDiscussion

3.1. Body Weight

Body weight of IPB-D1 and kampong chicken at 12-weeks aged, and broiler commercial chicken body's weight at 5-weeks aged were presented in Table 1. The IPB-D1 crossbreed that was reared until 12 weeks produced body weight that almost the same with broiler commercial chicken at 5-weeks aged. The kampong chicken that was given the same feed with IPB-D1 only produced the body weight less than 1 kg/bird. The chicken body weight at 12-weeks aged according [9] almost reached 1 kg/bird (pelung chicken), and about 714 g/bird for sentul chicken. This research result showed the presence of heterosis effect on growth character in IPB-D1, which is derived from crossing between pelung, sentul, kampong, and broiler chicken.

3.2. Leukocytes Profile

The leukocytes profile observation included leukocytes concentration, differentiation of leukocytes (heterophiles, monocytes, and lymphocytes), and H/Lvalue (Table 2). This result shows that leukocytes profile between IPB-D1 and kampong chicken were not significantly different, but both of this chickens were different significant (P<0.05) than those at commercial broiler chicken. Data leukocytesprofile (except H/L value) werein the normal range for chicken [4]. It means that all chickens were used in this study no interference physiologically.

IPB-D1 and kampong chicken have higher lymphocytes percentage than its heterophiles percentage. It means that the IPB-D1 and kampong chicken have higher ability to produce the specific immune response with forming antibody specific. Meanwhile the broiler chickenwhich the higher heterophiles percentage was potentially overcome the disease with non specific immune responsethrough phagocytosis [12].

H/L value shows the ability to overcome heat stress. The higher of H/L value means the chickens will experience

higher stress at high environment temperature.As such IPB-D1 can adapt well to the tropical environment such as kampong chicken,and on the contrary with the broiler chicken.

3.3. Body Resistance

Body resistance in this study was detected based on the ability to eliminate *S. pullorum* bacteria when in their blood samples were challenged with this bacteria through clearance test(in-vitro). The result of it was presented in Table 3.

This result showed that after 30 minutes blood were challenged with *S. pullorum* ($6.8x10^{10}$cfu/ml), blood from IPB-D1 and kampong chicken could eliminate this bacteria untill more than 99%, and highly significant different ($P<0.01$) than commercial broiler chicken (36.67%). IPB-D1 and kampong chicken can more kill *S. pullorum* because their blood contain high lymphocytes percentage. It can produce antibody specific [2] to against *S. pullorum*. In addition, they also can eliminate these bacteria through phagocytosis by heterophiles.

Conclusion

Based on this study, it could be conluded that: 1). IPB-D1 and kampong chicken have body resistance against *S. pullorum*higher significant different than broiler commercial chicken, 2). At 12-weeks aged, IPB-D1 produce higher body weight than kampong chicken, and almost the same with body weight of commercial broiler chicken at 5-weeks aged, 3). IPB-D1 can be developed as a composite chicken as meat producer.

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