

Research

Correlation of Production (Mortality and Weight Gain) with Status and Level of Biosecurity Implemented on Layer and Broiler Farms in West Java, Bali and South Sulawesi

(Korelasi antara Produksi (Mortalitas dan Pertambahan Bobot Badan) dengan Status dan Tingkat Penerapan Biosekuriti pada Peternakan Ayam Petelur dan Pedaging di Jawa Barat, Bali dan Sulawesi Selatan)

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ABSTRACT

Biosecurity is the most effective method to prevent farms from Avian Influenza outbreak that affects most broiler and layer farms. This paper discussed the status and level of biosecurity implemented by small and big farms (broiler and layer) in the three provinces. In addition to that is to determine whether there is any correlation between mortality and weight gain to both status and level of biosecurity implemented by farmers. Results showed that small layer and broiler farms have similar biosecurity status in Java and Bali but not in South Sulawesi. Small and large layer producers on both types of farms are also have similar biosecurity status in the three provinces. With regard to the level of biosecurity implemented the three provinces have their own characteristic of implementation. Both status and level of biosecurity implemented do not correlate with mortality in both types of farms neither on broiler weight gain.

Key words: biosecurity, layer, broiler, West Java, Bali, South Sulawesi

ABSTRAK

Biosekuriti adalah cara yang paling efektif untuk mencegah peternakan dari penularan wabah avian influenza yang menyerang sebagian besar peternakan ayam pedaging dan petelur. Artikel ini mendiskusikan status dan tingkat penerapan biosekuriti pada peternakan ayam pedaging dan petelur skala kecil dan besar di tiga propinsi, serta menentukan apakah ada korelasi antara mortalitas dan pertambahan bobot badan pada status maupun tingkat penerapan biosekuriti oleh peternak-peternak tersebut. Hasil menunjukkan bahwa peternak ayam pedaging dan petelur skala kecil mempunyai status biosekuriti yang sama di Jawa Barat dan Bali tetapi tidak dengan yang di Sulawesi Selatan. Sementara itu, status biosekuriti antara peternakan ayam skala kecil dengan skala besar baik pada ayam broiler maupun ayam petelur di ketiga propinsi tidak berbeda. Tingkat penerapan biosekuriti pada kedua jenis peternakan mempunyai karakteristik penerapan tersendiri di masing-masing propinsi. Status biosekuriti maupun tingkat penerapan biosekuriti sama-sama tidak mempunyai korelasi dengan mortalitas pada kedua peternakan demikian juga dengan pertambahan bobot badan pada ayam pedaging.

Kata kunci: biosekuriti, ayam petelur, ayam pedaging, Jawa Barat, Bali, Sulawesi Selatan

INTRODUCTION

Since late 2003, bird flu outbreaks has hit several Asian countries including Indonesia. In Indonesia, 33 provinces have been infected and are identified as the

cause of death of several people. In addition to causing human fatality, the influenza epidemic in birds which is called avian influenza / AI, also caused significant losses to farmers (reduced production and income), traders (decreasing demand), consumer (protein source).

There are many ways the disease may get into the farm, to reduce the occurrence of the disease in the farm can be reduced by blocking the pathogen entrance. Lately, the term which is very popular in the response to disease outbreaks is biosecurity. The implementation in the farm includes three areas, namely at the pre entry, the point of entry and at the post entry of the farm (Jubbs & Dharma, 2009).

The implementation of biosecurity at the farm infrastructure is very difficult and requires extra funding. Especially with the farm conditions in Indonesia, that is occasionally located adjacent to the village and other village facilities. FAO (2005) categorized Indonesia's poultry industry into four sectors which include (a) poultry sector one, is commercial poultry farm which is applied very strict biosecurity, (b) poultry sector two is commercial farms that implement with moderate to high biosecurity, (c) poultry sector three is commercial poultry sector own by villagers, implement low to minimum biosecurity, (d) the village and urban backyard farm is sector four.

Many studies have been conducted on the impact of bird flu outbreaks in sector 3 poultry farms, but none of those observed the biosecurity status and the level of biosecurity implemented by the farms in this sector. Therefore, this paper will discuss about:

1. The biosecurity status of large and small farms (layer and broiler), which is describe as the structure of the farms regarding to the source of the risk factors. The risk factors which indicate the status of the farm that will be assessed includes the distances of the sheds to disease sources such as roads, other farms, rice fields and live bird markets; house hold and farm size; sources of house hold income and; farm worker characteristics.
2. The level of biosecurity implemented by small and large broiler and layer farms. This will show what measured farmers have been doing to ensure biosecurity on their farms.
3. Correlation between production (mortality and

weight gain) with status and level of biosecurity implemented on the farms in West Java, Bali and South Sulawesi.

MATERIALS AND METHODS

Data collection

The survey was conducted in three provinces as an initial activity to identify cost-effective biosecurity measures for NICPS (Non Industrial Commercial Poultry Sector) farms in West Jaa (Bogor), Bali and South Sulawesi\}. Summarize of the number of respondents in each province was showed in Table 1.

Biosecurity risk which has been assessed regarding to the risk factors of a poultry farm biosecurity were implementation at the farm boundary, between farm boundary and shed and at the shed door as describe in Figure 5.

The status and level of biosecurity implemented by the farms can be assessed in a number of ways including before the farm entrance point, the point of entrance and the post of entrance point. This study focused on three main risk factors, as follows:

1. Level of biosecurity at farm gate; fence and lock, number of entrances, parking and vehicle washing, signs around perimeter, footbath to enter the farm, shower and change room for visitors and employees, whether using own cages when selling live chickens, whether cages and equipment returning from market cleaned and disinfected before reentering the farm.
2. Level of biosecurity between the farm gate and the shed; feed shed sealed against rodents and birds; tap overflows, split feed, chickens and ducks wandering around that shed.
3. Level of biosecurity at the shed door, shed wall materials, shed locked at all times, sign at the door, concrete footbath in front of shed entrance and disinfectant, wild birds and rodents enter the shed, and measures taken to prevent the entry of wild birds and rodents.

Table 1 The number of respondents in the three provinces

Type of farm	Province		
	West Java	Bali	South Sulawesi
Broiler	67	60	60
Layer	41	60	60
Total	108	120	120

To determine the correlation between production (mortality and weight gain) with status and level of biosecurity implement in the three provinces, data was collected on mortality of 4 month period before the survey was conducted. Each risk factor was scored based on their performance. The more closer the answer to biosecurity expectation, the higher the score achieved. The status and level of biosecurity is then divided into three categories: low, medium and high.

Data Analysis

To find out how far the relationship or differences between level of bio-security and based on the population scale, data in frequently form than analysis using Goodness Heterogeneity-Test (GH-Test) based on Chi-Square table (χ^2) in 3 x 2 contingency tables: three rows of variable levels of bio-security (Low, Medium and Large) and two variables of production scale (Small scale and Large Scale). To find out correlation between mortality and weight gain data was analysed using polynomial regression.

RESULT

Status and level of biosecurity implemented in small and large broiler and layer farms in the three provinces

The majority of the respondents from both layer and broiler farms are involved in small scale commercial production. This categorization was based on the average number of chickens managed by the farmers. Small broiler farmers manage less than 5.000 birds, while the small layer producers own less than 10.000 birds in three provinces. In term of experience on farm, on average, the layer

producers have longer year experience, for twice as long as those on broiler farms. The average year of experience on layer farms was 10.76 years, compared to 6.4 years on broiler farms (Table 2).

The biosecurity status of small and large broiler and layer farms in the three provinces is described in Table 3. In general, there are no significant differences in the three level of biosecurity status between small and large layer and broiler farms in the three provinces.

Table 4 present the level of biosecurity implemented by small and large layer and broiler farms in the three provinces. As previously mentioned this study focus on the implementation of biosecurity from the farm gate to the shed door of the farms.

Mortality on the three biosecurity status and level of biosecurity implemented in the three provinces

Mortality on the three biosecurity status of layer farms in the three provinces is presented in Table 5. Result showed that the mortality on both types of farms (broiler and layer) in South Sulawesi which have medium biosecurity status was zero. The large broiler farm of high biosecurity status in the same province showed similar results.

Figure 1 presents the correlation between mortality and farm biosecurity status of layer farm in the three provinces. It showed that mortality had very weak ($R=0,003$) correlation with biosecurity status on layer farms.

Correlation between mortality and farm biosecurity status of broiler in the three provinces was shown on Figure 2. Similar to the layer farms, correlation between mortality with the biosecurity status in broiler also is very weak ($R = 0.046$).

Table 2 Respondent characteristic in the three provinces

	West Java		Bali		South Sulawesi		Average	
	Broiler	Layer	Broiler	Layer	Broiler	Layer	Broiler	Layer
Farm Management:								
- Contract (%)	76	5	82	3	100	-	86	-
- Independent (%)	24	95	18	97	-	100	-	97.33
Number of chicken manage (birds)	8765	49203	4875	8930	5409	2673	6350	4750
Experience on farm (years)	6.62	9.71	6.37	14.37	6.2	8.2	6.4	10.76

Table 3 Biosecurity status of small and large broiler and layer farms in the three provinces

Province	Farm Type	Population Scale	Biosecurity Status			Gh-Sig
			Low	Medium	High	
West Java	Layer	Small	24	11	10	a
		Large	6	3	6	a.b
	Broiler	Small	9	9	18	a.b
		Large	6	3	15	a.b
Bali	Layer	Small	9	1	7	a.b
		Large	0	4	20	b
	Broiler	Small	4	14	17	a.b
		Large	5	9	18	a.b
South Sulawesi	Layer	Small	12	14	30	b
		Large	1	1	2	b
	Broiler	Small	26	14	10	a
		Large	5	5	0	a

Table 4 Level of biosecurity implemented in small and large broiler and layer farms in the three provinces.

Province	Farm Type	Population Scale	Level of Biosecurity Implemented			Gh-Sig
			Low	Medium	High	
West Java	Layer	Small	22	16	7	a
		Large	5	6	4	a
	Broiler	Small	4	5	27	b
		Large	1	10	13	a
Bali	Layer	Small	5	6	6	a
		Large	0	3	21	b
	Broiler	Small	2	7	26	b
		Large	4	5	23	b
South Sulawesi	Layer	Small	27	0	29	c
		Large	2	0	2	a
	Broiler	Small	38	0	12	b.c
		Large	10	0	0	a

Table 6 showed mortality on the three level of biosecurity implemented in the layer and broiler farms. Only large layer producer at the high level of biosecurity implemented had zero mortality

rate. In addition results also showed that there was no mortality on the medium level of biosecurity implementation among all farms type in the three provinces.

Table 5 Mortality on the three biosecurity status of broiler and layer farms in the three provinces

Province	Farm Type	Population Scale	Mortality		
			Low	Medium	High
West Jawa	Layer	Small	1.79 ± 2.79	1.8 ± 3.25	2.46 ± 3.37
		Large	0.35 ± 0.42	0.67 ± 0.4	1.15 ± 0.96
	Broiler	Small	3.15 ± 1.56	1.51 ± 1.1	3.22 ± 4.73
		Large	1.16 ± 0	2.23 ± 1.83	4.12 ± 4.51
Bali	Layer	Small	1.85 ± 2.11	0.68 ± 1.16	2.09 ± 2.21
		Large	0	2.47 ± 1.35	0.54 ± 0.93
	Broiler	Small	6 ± 1.41	5.19 ± 3.66	4.46 ± 3.4
		Large	3.25 ± 1.89	6.27 ± 5.47	5.14 ± 3.85
South Sulawesi	Layer	Small	0.72 ± 1.56	0	1.17 ± 1.78
		Large	0.05 ± 0.07	0	2 ± 2.83
	Broiler	Small	1.76 ± 2.45	0	1.02 ± 1.53
		Large	2.05 ± 2.09	0	0

Broiler weight gain on the three biosecurity status farms in the three provinces

Broiler weight gain on the three biosecurity status farms in the three provinces is described in Table 7. Interestingly, body weight gain of broiler on high biosecurity status is zero and the highest gain is found in low biosecurity status farms both on small and large population scale in the three provinces.

Correlation between weight gain and biosecurity status of the farm is described on Figure 3, this figure showed that there is no correlation between body weight gain with farm biosecurity status (R=0.0022).

Table 8 shows weight gain on the three level of biosecurity implemented in the three provinces. Only in two provinces body weight gain was different between small and big producers in the farm with high biosecurity implementation. These provinces are West Java and Bali. The small producers in this farm get 6 grams more compare to big producers, however, again correlation analysis resulted in low R = 0.0041 which was mean no correlation between weight gain with the level of biosecurity implemented.

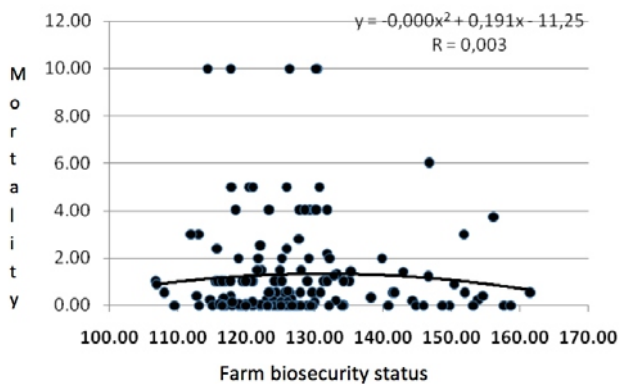


Figure 1 Correlation between mortality and farm biosecurity status of layer in the three provinces.

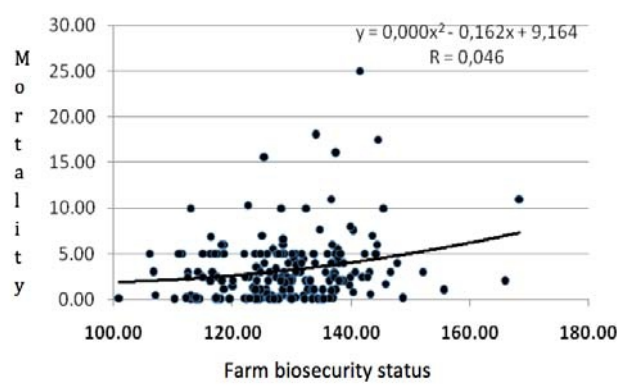


Figure 2 Correlation between mortality and farm biosecurity status of Broiler in the three provinces.

Table 6 Mortality on the three level of biosecurity implemented in the layer and broiler farms in the three provinces

Province	Farm Type	Population Scale	Mortality		
			Low	Medium	High
West Jawa	Layer	Small	1.36 ± 2.22	0	2.46 ± 3.37
		Large	0.63 ± 0.71	0	1.15 ± 0.96
	Broiler	Small	2.12 ± 1.59	0	3.96 ± 3.81
		Large	1.89 ± 1.63	0	4.74 ± 4.78
Bali	Layer	Small	1.4 ± 1.75	0	3.22 ± 4.73
		Large	1.5 ± 1.91	0	4.12 ± 4.51
	Broiler	Small	4.63 ± 3.11	0	4.34 ± 2.46
		Large	3.47 ± 1.86	0	5.52 ± 3.46
South Sulawesi	Layer	Small	0.72 ± 1.56	0	2.09 ± 2.21
		Large	0.05 ± 0.07	0	0.54 ± 0.93
	Broiler	Small	1.45 ± 0.38	0	1.24 ± 1.73
		Large	1.33 ± 0.32	0	0

Table 7 Broiler body weight gain (gram/day) on the three Biosecurity Status farms in the three provinces

Province	Population Scale	Body weight gain		
		Low	Medium	High
West Jawa	Small	45.55 ± 9.5	44.85 ± 13.2	50.64 ± 6.69
	Large	49.3 ± 28.7	48.2 ± 8.51	43.6 ± 10.9
Bali	Small	50.12 ± 21.24	48 ± 11.6	48.9 ± 13.4
	Large	45.86 ± 11	40.7 ± 5.01	43.5 ± 10.3
South Sulawesi	Small	47.44 ± 9.84	44.1 ± 4.67	47.12 ± 7.1
	Large	51.5 ± 2.89	44.2 ± 9.03	0

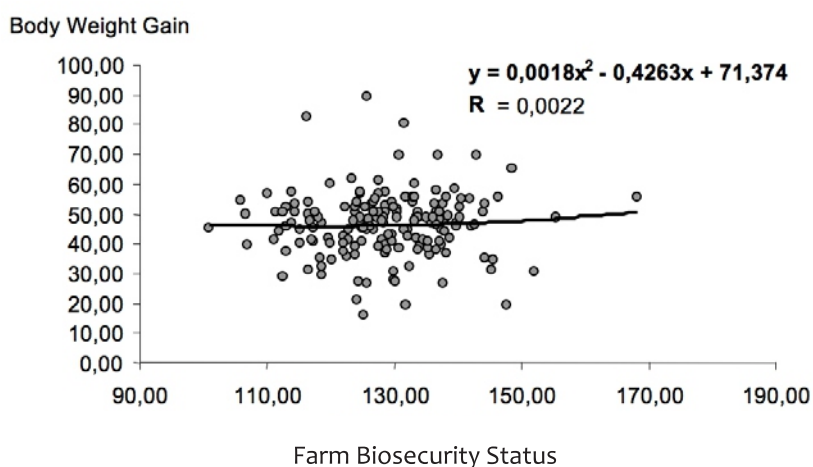


Figure 3 Correlation between weight gain and farm biosecurity status in the three provinces

Table 8 Weight gain (gram/day) on the level biosecurity implemented in the three provinces

Province	Population Scale	Level Biosecurity implemented		
		Low	Medium	High
West Jawa	Small	45.04 ± 10.9	0	50.9 ± 6.94
	Large	45.7 ± 18.5	0	44.9 ± 11.01
Bali	Small	46.7 ± 14.2	0	49.8 ± 12.6
	Large	42.2 ± 9.4	0	43.4 ± 9.16
South Sulawesi	Small	46.7 ± 8.93	0	45.4 ± 4.87
	Large	47.9 ± 7.4	0	0

DISCUSSION

People, animal, things inorganic and organic matters are risk factors to the poultry farms, so biosecurity measures implemented should be able to reduce those risks entering the farms. Figure 5 describe a model of poultry farm biosecurity, showing nine areas where biosecurity may be assessed (Patrick & Jubb, 2010).

Biosecurity status in small and large broiler and layer farms in the three provinces

There are marked differences in chicken management between broiler and layer farms in the three provinces. It can be seen on Table 1 that most broiler farms are managed under a contract, while the layer farms were generally independently owned and managed. A contract usually under companies control in producing broiler, farmers are guaranteed a certain price for broilers produced under conditions agreed to in the contract. On the

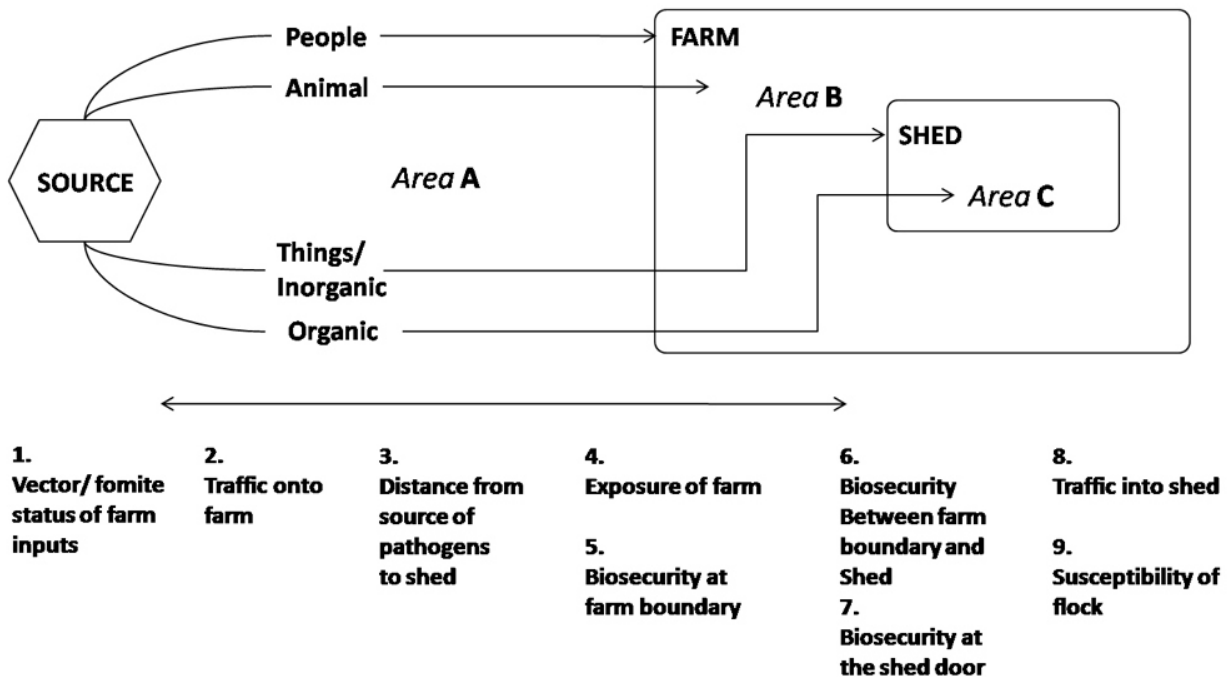


Figure 5 A model of poultry farm biosecurity showing nine areas where biosecurity may be assessed (Patrick & Jubb, 2010).

other hand the majority of layer farms (more than 95%) are independent, as such they decide all the decisions made for their business.

Biosecurity status describes the structure of the farm regarding to the sources of the risk factors. Table 2 indicated that biosecurity status of both layer and broiler farms in each province have no significant differences, except in South Sulawesi. In this province, biosecurity status of layer farms is significantly different to broiler farms. It seems that layer farms put more attention on sources of contamination compared to broilers in this province. While, there were no significant differences on the biosecurity status between small and large farms in both layer and broiler producers in the three provinces. This implies that their economic circumstances was not affected by their understanding on the biosecurity status (Susilowati et al., 2009).

The level of Biosecurity implemented in small and large broiler farms in the three provinces

It can be seen that each province have their own characteristics on the level of biosecurity implemented. In West Java although small layer farms tend to implement low level of biosecurity, there is no statistical difference to the large layer farms which is spread equally on the low, medium and high level. Layer farms in South Sulawesi and Bali, on the other hand, demonstrated that small producers implement significantly different level of biosecurity compared to large producers. Interestingly, in Bali large producers implement high level biosecurity, while in South Sulawesi small producers undertake high level of biosecurity measures.

Meanwhile broiler producers, in Bali both small and large farms implemented similar biosecurity measures. As contract farms, they may have received assistant and biosecurity advise from the contractor companies. In West Java and South Sulawesi, however, the level of biosecurity implemented was different significantly. In West Java broiler smallholders implement better biosecurity measures compared to largeholders, while in South Sulawesi both producers implement low level of biosecurity. This finding is also interesting since all broiler producers in this study were contract farms, further study needs to be conducted to find out what assistance the farmer need, what are farmers on the high level biosecurity doing and what factor encourage them to do so. The result of the study will encourage farmers to implement better biosecurity measures.

Correlation of mortality with biosecurity status and level of biosecurity implemented in the three provinces

Mortality is an important factor where farmer should pay more attention to in their poultry business, because mortality rate is one factor that influenced their income. With regard to mortality, Table 5 showed that mortality rate was higher on the farms which have medium to higher biosecurity status among all farm types in the three provinces. This occurred because the mortality of the chickens on that period was caused by factors other than diseases such as over eating for broiler and prolapsed uterus for layer. Fadilah et al. (2006) considered many factors affecting mortality of the chicken, including the quality of DOC, feed, weather condition etc. In addition, correlation analysis of the mortality resulted in very small correlation coefficient $R=0.003$ for layer farms and $R=0.046$ for broilers (Figure 1 & 2 respectively) meaning that there was no correlation between mortality with biosecurity status in both farms.

Result showed that at the medium level of biosecurity implementation in all provinces among all types of farms, the mortality rate was zero and in addition to that large broiler producers in South Sulawesi also had zero mortality (Table 6). It seems that farmers who implemented medium level of biosecurity have more intention on biosecurity than farmers who are implemented low and high level of biosecurity. Further study needs to be conducted on this, to find out what biosecurity measures are mostly implemented in this level. Meanwhile, the highest mortality found in this study is in the large broiler farm in Bali, again this is probably due to over eating which is often occur in broiler farms.

Correlation of Broiler weight gain and biosecurity status in the three provinces

Another performance on production is weight gain. Broiler Body weight rose in the three provinces at all status of biosecurity vary from 2-7 gram/day (Table 7). The highest weight gain achieved was 50.64 gram per day in smallholders which has high status biosecurity in West Java and the lowest is 40.66 gram in large producers in medium biosecurity status Farm in Bali.

In all provinces, most of the highest weight gain was found in both small and large producers which have low biosecurity status. Although the highest weight gain achieved was in the low biosecurity

status but the level of biosecurity implemented by this type of farms was high except in South Sulawesi (Table 8). Hence, correlation analysis resulted in $R = 0.0022$ (Figure 3) indicated that there was no correlation between weight gain and biosecurity status of the farm.

Another interesting result found that there is no weight gain on the medium level biosecurity implemented among all types of farm in the three provinces. Farms in both types which have medium level of biosecurity implemented also have zero mortality, although there was no correlation between production (mortality and weight gain) maybe is worth having further study on other production performances on the the level of biosecurity implemented such as FCR (Feed Conversion Ratio) or IP-score of the farm the result of this study will be important and can encourage farmer to implement biosecurity measured. The bonus given by the contract company to the farmer is based on the FCR or IP-score achieved by farms.

In conclusion, layer and broiler producers have similar biosecurity status in the three provinces except South Sulawesi. In term of production capacity, small and large producers in both type of farms are also have similar biosecurity status in the three provinces. The level of biosecurity measures implemented is different in each provinces on both Layer and broiler producers. Layer large producers in West Java similar to South Sulawesi in implementing biosecurity measures, while small layer producers in West Java similar to small layer in Bali. Small broiler producer, on the other hand, have similar level biosecurity in the three provinces. Meanwhile, large layer farmers in Bali differ significantly in the level biosecurity implement with big layer farms in both West Java and South Sulawesi. In the three provinces, the medium level of biosecurity implementation resulting in zero mortality for both farms.

For a better information and analisis of mortality and weight gain relationship with level of biosecurity and status implemented, this study recommended to conducted futher study in the future. In addition to that to encourage farmers to implement biosecurity measures study on production such as FCR or IP-score of the farm is important to be conducted since the bonus which contract company give to the farm is based on those indicators. More over further study needs to find out what assistance the farmers need, what do farmers at the high level biosecurity doing and what factor encourage them to do so.

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