

Effect of Elevation Altitude Rearing and Population on Carcass Quality of the Broilers

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Abstract : The purpose of this study was to determine the effect of elevation altitude rearing and population on carcass quality of the broilers. The materials used are 27 farm broiler farms with populations ranging from 3000-10000 tail/farm and types of cages open house. The method used is the method of field experiment using split plot design in completely randomized design (CRD). Variables observed and measured slaughter weight, carcass weight, carcass percentage and abdominal fat percentage. Data were tabulated using Microsoft Excel program and statistically analyzed using split plot design into CRD 3x3 with 3 replications. If there is a difference between the effect of the treatment is continued Least Significant Difference Test (BNT). The results showed that the altitude rearing significant effect ($P < 0.05$) carcass weight; provides highly significant effect ($P < 0.01$) on carcass weight and influence was not significant ($P > 0.05$) on carcass and abdominal fat percentage. While the population of broiler and their interactions provide no real influence on the ($P > 0.05$) slaughter weight, carcass weight, carcass percentage and abdominal fat percentage. It was concluded that the rearing of broiler best is on highlands with a population range of 3000-10000 tail/farm because it provides slaughter weight and carcass weight of the best.

Keywords : altitude, broilers, carcass quality, population, rearing

I. Introduction

Productivity broiler can be affected by the altitude and ambient temperature maintenance. Broilers susceptible to the ambient temperature so it would be difficult to adapt to changes in environmental temperature. Daily temperature range in Indonesia is 25.2 - 27.9°C and it exceeds the average optimum temperature of growth of broilers. The optimum temperature of broiler growth ranged between 20 - 25°C with humidity ranging between 50-70% (Hillman, Scot and Tienhoven, 2000).

Increasing the height of a region from the ocean surface caused daily temperature range decreases. These conditions causes the increased broiler feed intake to meet their energy needs. Most of the feed energy is converted into heat to overcome the lower ambient temperature. At optimum ambient temperatures will occur efficiency of feed because broiler not expend energy to cope with changes of ambient temperature. In addition, the density of the cage also can cause the productivity of broiler tend to decrease the growth, feed intake and carcass quality. High-density enclosures can affect final body weight and feed efficiency (Riley and Estevez, 2000).

Broilers tend to give a good carcass quality if reared at a highlands with low ambient temperatures. Carcass percentage of broiler on research Soeharsono (1976) which is reared at ambient temperatures 19 - 26°C was 73.9% and was higher than the reared on the ambient temperature 25 - 32 °C, which is 70.5%. Puspani, Nuriyasa, and Candrawati (2011) adds, body weight and carcass weight of broiler with reared on the the altitude of 300 m asl is 1,642.07 and 1,166.37 g while rearing altitude of 50 m asl is 1,583.77 and 1,110.78 g.

Additionally, maintenance of broiler ever increasing its population in the cage may affect carcass quality. Research Bahari, Fanani, and Nugroho (2012) indicate that the maintenance of large-scale of broiler (>2,375 tail) have body weight higher than the small-scale (<2,375 tail). The increase in body weight can affect carcass quality produced.

Based on the description above then be done research on the effect of elevation altitude rearing and population on carcass quality of the broilers

II. Material And Methods

The research material used 27 of broilers breeding farm with of broilers population criteria 3000-10000 tail/farm with cage-type open house. The research method using field trials with the split plot design in completely randomized design (CRD) 3x3 with 3 replicates. As for the divisions there are two main plot (X) and the subplot (Y), as described below:

X1 : rearing in the lowlands (<400 m asl)

X2 : rearing in the middle lands (400-700 m asl)

X3 : rearing in the highlands (> 700 m asl)

Y1 : population 3,000-5,333 tail/farm
 Y2 : population 5,334-7,667 tail/farm
 Y3 : population 7,668-10,000 tail/farm

Maintenance Broiler

Each location of maintenance, DOC placed randomly in the cage. Feed start given from the first day DOC came until ages 35 days were divided into three periods with different feed each period. As for the content of nutrients feed intake in this study are presented in Table 1.

Table 1: Nutrition Composition of Broilers Feeding

Nutrition	Feeding period		
	Starter (0-7 days)	Grower (8-21 days)	Finisher (22-35 days)
Dry matter (%)	87.19	88.57	88.29
Crude protein* (%)	26.54	21.46	21.16
Crude fiber* (%)	3.29	3.20	3.69
Lipid* (%)	6.20	6.44	6.65
Ash* (%)	7.44	6.84	5.95
Energy metabolism** (Kkal/kg)	3,091.80	3,176.02	3,189.60

Description : * Based on a 100 % dry matter

** The results of calculations using formulas Balton (Siswohardjono, 1982)

$$ME = 40.81[0.87(PK+2.25LK+BETN)+2.5]$$

Research variable

Variable that observed and measured in this study is the slaughter weight (g/tail), carcass weight (g/tail), carcass percentage (%), abdominal fat percentage (%).

Statistical Analysis Data

Data were tabulated using Microsoft Excel program. Data were analyzed statistically using Split Plot design in CRD 3x3 with 3 replicates. If there is any difference effect between the treatment then continued with Least Significant Difference Test (LSD). Mathematical models split plot design with the CRD were as follows:

$$Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \delta_{ik} + \epsilon_{ijk}$$

with i : 1,2,3; j : 1,2,3; k : 1,2,3

Description :

- Y_{ijk} : observed values at level altitude factor for i, the population factor level for j and k to the group.
- μ : common middle value
- κ_k : the group's influence to k.
- α_i : the effect level to i from height factors
- β_j : the effect level to j from the population factor
- $(\alpha\beta)_{ij}$: the effect of the interaction level to i altitude factor with level to j population factor
- δ_{ik} : random effect of the main plot
- ϵ_{ijk} : random effect of the subplot

III. Result And Discussion

Carcass are pieces of broiler without feathers, blood, head, neck, feet, claws, and internal organs. Carcass weight of broiler according to Soeparno (1994) is influenced by several factors, such as gender, ages, race, number and quality of feed, the slaughter weight and feed intake. Carcass quality according to Abubakar (2003) determined the value based on conformation, fatty, the cleanliness level from fuzz, the degree of redness, tearing the skin, and free of broken bones. The research results were observed as carcass quality are presented in Table 2.

Tabel 2. Average Slaughter Weight, Carcass Weight, Carcass Percentage, and Abdominal Fat Percentage by Elevation Altitude Rearing

Variable	Treatment		
	X1	X2	X3
Slaughter Weight (g/tail)*	1,679.67 ± 78.34 ^a	1,715.47 ± 90.58 ^a	1,881.67 ± 87.37 ^b
Carcass Weight (g/tail)**	1,228.89 ± 67.23 ^a	1,270.71 ± 74.58 ^a	1,399.11 ± 64.15 ^b
Carcass Percentage (%)	73.12 ± 0.76	73.97 ± 0.66	74.36 ± 0.55
Abdominal Fat Percentage (%).	1.58 ± 0.20	1.32 ± 0.10	1.40 ± 0.09

Description : * The letters are not the same in the same column shows the real effect (P<0.05)

** The letters are not the same in the same column indicates highly significant effect (P<0.01)

Temperature: P1 28,89-32,34 °C;P2 25,80-28,37 °C;P3 23,69-25,60 °C.

Effect of Elevation Altitude Rearing on Carcass Quality of the Broilers

Slaughter Weight

Statistical analysis showed that the treatment give significant effect ($P < 0.05$) to the slaughter weight of the broilers. Maintenance of broilers in the highlands gives a higher slaughter weight. The increase in slaughter weight related to the ambient temperature is low in highlands that can increase feed intake. The increase of feed intake is made to generate heat in the body. It is as a way to strike a balance between body temperature with the outside temperature. According Amrulloh (2004) high feed intake can cause high body heat production in poultry.

Maintenance of broilers in the highlands cause an increase in feed intake so that the resulting weight cut will be high as well. This is according to research Petrawati (2003) that the maintenance of broilers at an altitude of 590 m asl has a feed intake and body weight of 2,727 and 1,766 g/tail while at a height of 85 m asl is 2,373 and 1,487 g/tail. Lu, Wen and Zhang (2007) adds broiler ages 5-8 weeks were reared at ambient temperature 21°C has feed intake and body weight of 3,567.9 and 2,618.9 g/tail while at a ambient temperature of 34°C is 1,965.6 and 1,876, 4 g/tail.

Carcass weights

Statistical analysis showed that the treatment effect significantly ($P < 0.01$) to the carcass weight. Maintenance broilers in the highlands gives broilers carcass weight higher. Based on the Indonesian National Standard (INS) (2009), carcass weight in the lowlands and middle lands included in the medium-size and in the highlands included in large-size. The size of the carcass based on INS (2009) can be divided into three, which is the small size of $< 1,000$ g, medium size ranging from 1,000-1,300 g, and the large size $> 1,300$ g.

The higher a site of maintenance broilers and the lower the ambient temperature increases the carcass weight. It corresponds with the results of research Adiwianto (2005) which showed that the the carcass weight broilers aged 5 weeks were maintained at ambient temperature 20 - 24°C (1,203 g) was higher than the ambient temperature 29 - 32°C (992.01 g). Puspani et al (2011) also suggested, body weight and the carcass weight broilers with maintenance on the the altitude of 300 m asl is 1,642.07 and 1,166.37 g while the maintenance at the altitude of 50 m asl is 1,583.77, and 1,110.78 g.

Carcasses Percentage

Statistical analysis showed that the treatment effect was not significant ($P > 0.05$) on carcass percentage. The location of the higher maintenance increases the carcass percentage of broilers. The average carcass percentage ranged from 73.12 to 74.36% of the body weight and still within the normal range. Categories carcass percentage normal range is between 65-75% from body weight (Cahyono, 2004). Daud (2006) declares that the increase in carcass followed with the age and body weight in poultry. The increase in the carcass percentage would occur with an increase in body weight, genetics and growth rates in body composition include the distribution of weight, chemical composition and carcass components (Soeparno 1994).

The average carcass percentage in this study was higher than the results Adiwianto (2005) saying that the carcass percentage of the broilers aged 5 weeks were maintained at ambient temperature 20-24°C is 69.05% and the ambient temperature 29-32°C is 71.11%. Zurriyati and Dahono (2013) says, this carcass percentage of the broilers were maintained at a temperature of 20°C is 74.83%. Differences in this carcass percentage is thought to be caused by body weight and carcass weight. It corresponds with the statement of Cherry et al. (1998) that the carcass percentage affected by body weight, within the meaning the higher body weight the higher the carcass percentage.

Abdominal Fat Percentage

Statistical analysis showed that the treatment effect was not significant ($P > 0.05$) on abdominal fat percentage. The average abdominal fat percentage ranged from 1.32 to 1.58% and lower than Resnawati (2004) saying the abdominal fat percentage of the broilers age of 5 weeks ranged from 1.50 to 2.11%.

Abdominal fat be one of the factors determining the efficiency of broilers feed. Maintenance broiler in the highlands decrease the abdominal fat percentage. A low abdominal percentage fat showed good feed conversion because feed intake is used more to produce meat than fat. This is in accordance with the statement Petrawati (2003) that broilers reared at an altitude of 590 m asl has a feed conversion of 1.54 and lower than at the height of 85 m asl which is 1.60. Quinteiro-Filho, Ribeiro, Ferraz-de-Paula, Pinheiro, Sakai, Sa, Ferreira, and Palermo-Neto (2010), adding maintenance broilers ages 5-6 weeks at ambient temperature 21°C and 31 °C each have a feed conversion of 2.46 and 2.51.

According to Tillman, Hartadi, Reksahadiprodjo, Prawirokusumo, and Lebdosoekojo (1998) abdominal fat reduction would lead to an increase in broilers body weight. Fontana, Weaver, Denbaow and Watkins (1993) adds that abdominal fat will increase in broilers that feed with low protein and high-energy feed.

Excess of energy will be stored as fat such as section around the abdomen. Low abdominal fat percentage can improve the carcass quality, where in the resulting meat have the low fat content. This might give an advantage to producers and consumers broiler.

Effect of Population and Interaction on Carcass Quality of the Broilers

Carcass quality observed included slaughter weight, carcass weight, percentage carcass, and percentage abdominal fat. The average are presented in Table 3.

Tabel 3. Average Slaughter Weight, Carcass Weight, Carcass Percentage, and Abdominal Fat Percentage by Population and Their Interaction

Elevation Altitude Rearing	Population		
	Slaughter weight (g/tail)		
	Y1	Y2	Y3
X1	1,705.87± 90.44	1,622.40± 13.84	1,710.73±93.69
X2	1,721.67±104.49	1,690.20±109.93	1,734.53±90.87
X3	1,918.87± 97.39	1,914.93± 65.28	1,811.20±74.84
Average	1,782.13±118.68	1,742.51±153.12	1,752.16±52.50
	carcass weight (g/ekor)		
X1	1,278.00±78.26	1,182.67± 24.23	1,226.00± 67.33
X2	1,277.53±60.98	1,237.47± 50.80	1,297.13±114.79
X3	1,344.20±38.34	1,456.67± 56.63	1,396.47± 47.78
Average	1,299.91±38.36	1,292.27±144.99	1,306.53± 85.62
	Carcass percentage (%)		
X1	73.62±0.91	72.83±0.77	72.90±0.58
X2	73.77±0.14	73.96±0.34	74.17±1.21
X3	74.53±0.31	74.25±0.53	74.28±0.87
Average	73.97±0.49	73.68±0.75	73.79±0.77
	Abdominal Fat percentage (%)		
X1	1.49±0.26	1.69±0.13	1.56±0.20
X2	1.34±0.13	1.32±0.11	1.31±0.10
X3	1.42±0.13	1.39±0.07	1.39±0.11
Average	1.42±0.08	1.47±0.20	1.42±0.13

Slaughter Weight

Statistical analysis showed that the population of broilers in one farm and their interaction give effect that was not significant ($P>0.05$) to the slaughter weight. Total population of broilers that has increased produce weight slaughter that no different. This shows that broiler can be maintained at population range 3,000-10,000 tail/farm.

Increasing population of broilers that is offset wide cage in accordance with its capacity to create a comfortable environment conditions for animals so do not affect the productivity. Broilers were reared in large-scale ($>2,375$ tail) produce a higher slaughter weight than small-scale ($<2,375$ tail) (Bahari, Fanani, and Nugroho, 2012). Different from the research Dahlan (2010) saying that the increase in population in a cage decrease the slaughter weight of broilers. Broilers population 3,000 and 5,000 tail have the each weight slauhger 1,912 and 1,830 g/tail.

Carcass weights

Statistical analysis showed that the population of broilers in one farm and their interaction the influence was not significant ($P>0.05$) on carcass weight. Increasing of population in the cage gives almost the same carcass weight. This shows that the broilers can be reared at population range 3,000-10,000 tail in one farm.

Treatment carcass weight Y2 including medium-size while the treatment Y1 and Y3 including large sizes. While the interaction showed that treatment carcass weight X1Y1, X3Y1, X3Y2, and X3Y3 including large size while the other treatments including a medium size. The size of the carcass was based on ISN (2009) range from 1,000-1,300 g, while the large size $> 1,300$ g.

Interaction on X3Y2 treatment had a higher carcass weight than the other treatments interaction. Achievement of carcass weight related to the result of slaughter weight. Interaction X3Y2 treatment had a higher slaughter weight compared to the other treatment interaction.

Carcasses percentage

Statistical analysis showed that treatment give effect that was not significant ($P> 0.05$) on the carcass percentage of broiler based on broilers population in one farm and their interactions. Table 3 shows that increase on broilers population in one farm increasing the carcass percentage. This value is different with result of body weight and carcass weight. This is contrast to the opinion of Daud (2006) saying that the increase in carcass followed by the increasing age and body weight.

Cherry et al. (1998) adds the higher the broilers body weight will increase the carcass percentage. In the interaction X1Y2 have a low carcass percentage because it has slaughter weight and carcass weight were lower than other treatments. The highest carcass percentage is on the interaction with X3Y1 and higher slaughter weight than other treatments.

The average carcass percentage on population and interactions each one is 73.68 to 73.97% and 72.83 to 74.53% from slaughter weight. The range of carcass percentage is still within the normal range. According Cahyono (2004) category of the normal carcass percentage range is between 65-75% from body weight. The average carcass percentage of in this research was higher than the results Adiwinto (2005) saying that the carcass percentage of broiler aged 5 weeks were maintained at ambient temperature 20 – 24°C is 69.05% and the ambient temperature 29 - 32°C is 71.11%.

Abdominal Fat Percentage

Statistical analysis showed that the population of the broilers in one farm and their interaction give effect that was not significant ($P>0.05$) on abdominal fat percentage. The average of abdominal fat percentage on populations and their interactions are of each 1.42 to 1.47% and 1.31 to 1.69%. This average lower than Resnawati (2004) that states if abdominal fat percentage of broilers age of 5 weeks ranged from 1.50 to 2.11%.

Table 3 showed that the lower of broilers population tend to have higher abdominal fat percentage than the high broilers population. High of abdominal fat percentage showed poor feed conversion value because the feed intake is used more to produce fat than meat. Low percentage of abdominal fat can improve carcass quality and meat that is produced has a low fat content. Lower abdominal fat can increase body weight of broiler (Tillman et al, 1998).

IV. Conclusion

Based on the results of this study concluded that

1. Rearing of broilers in the highlands provides the best carcass quality, seen by of higher slaughter weight, carcass weight and carcass percentage and the low abdominal fat percentage.
2. Broilers population in a farm on rearing in the lowlands, middle lands and highlands provide the same carcass quality.
3. Interaction between the rearing of broilers in the highlands with a population of 3000-10000 tail/farm provides the best carcass quality, views of the high slaughter weight, carcass weight and carcass percentage and low abdominal fat percentage.

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