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The influence of transportation distance during the dry season on broiler chickens' carcass traits

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Abstract. This research aims at investigating the influence of transportation distance on broiler chickens' carcass traits. Two hundred and fifty two broiler chickens were divided into 3 treatment groups (within a transportation distance of 60 km; 120 km; and 180 km). The observed parameters were the broiler chickens' live weight, carcass weight, carcass percentage, and non carcass components including visceral weight, giblet weight, abdominal fat level, carcass value and chemical-containing meat. The research results showed that the broiler chickens' live weight, carcass weight, carcass percentage, visceral weight and carcass economical value significantly decreased within a transportation distance of 180 km. Meanwhile, the giblet weight and meat fat level started significantly decreased within a transportation distance of 120 km. However, the transportation distance does not influence the abdominal fat level of broiler chickens' carcass, protein percentage and water content. This research concluded that the farther the transportation distance, the more the broiler chickens' carcass traits and values may decrease.

1. Introduction

Stress during the transporting process may be caused by the distance, duration, transportation facilities and environmental conditions. The ambient temperature changes may influence the balance of body biochemical reactions [1] and subsequently followed by the reducing weight and mortality. The another research shows that the broiler chickens' weight and mortality rate respectively decrease by 1.27% and 0.24% during the transporting process for less than 3.5 hours and respectively by 2.09% and 0.45% for more than 5 hours [2]. Thus, the farther the transportation distance to the slaughtering house, it may significantly influence the poultry's mortality rate [3]. The broiler chickens' mortality rate transported within the distance of 50 km is 0.1465% and within the distance of 300 km is 0.862% indicating that the mortality rate increases due to the increasing transportation distance [4].

In Indonesia, broiler chickens are usually transported using open trucks without covers or fans. The transporting time is usually made during the day or night depending on the slaughtering house operating hours. The transportation made during the day takes longer time than that made during the night due to the different traffic density that results in more extremely negative impact on the broiler chickens. Some research reported that broiler chickens' mortality rate is related to the transporting process either made in the afternoon or in the evening [5]. Indonesia only has rainy and dry season. In dry season, the ambient temperature and humidity are considered high with low rainfall level. In May 2017, the rainfall in Semarang was classified into low category by only 50 – 100 mm with the average



ambient temperature of 33.22°C. Meanwhile, the dry season may negatively influence the transported broiler chickens.

Carcass is the broiler chicken's major part with the highest economic value when compared to the others. Transportation may reduce the broiler chickens muscles to provide energy for the required thermoregulation process due to the unavailability of feed. Some research reported that during the transporting process for 2 hours, the female broiler chickens with the live weight of 2000 g may decrease in percentage [6].

Although non carcass parts do not have higher economic values, some researchers have reported that the liver part and visceral weight decrease due to the different transporting durations. Longer transportation distance may degrade the fatty liver level to meet the required energy for thermoregulation and the other required maintenance. Another research reported that longer transportation and fasting time may reduce the liver glycogen level [7]. In hot and stressful condition, the liver and gall bladder weight may be significantly reduced [8]. Longer feed withdrawal time may significantly reduce the digestive channel weight [9].

The transporting process may reduce the broiler chickens' meat quality due to the stressful conditions during the transporting process. The research has reported that transportation may influence the broiler chickens' meat color but not the water drip percentage [10].

This research aims at evaluating the influence of transportation distance on broiler chickens' carcass traits. The research hypothesis is the longer the transportation distance, the more the broiler chickens' carcass traits may decrease trait.

2. Material and method

The research samples are two hundred and fifty two broiler chickens with the weight rate of 1.93 ± 0.08 kg. This research employs a completely randomized design (CRD) consisting of 3 treatment groups with 7 replications (within a transportation distance T1:60 km, T2:120 km, and T3:180 km). The transportation distance, transportation instrument and the crates were adapted and arranged based on the poultry company processing unit's standard of operating procedures in Central Java (PT. Charoen Pokpand Indonesia). The broiler chickens were transported with the same starting points and time that the farthest distance will spend longer time. After the transporting process of forty two broiler chickens with the same average weights from each group were taken for the determined carcass and non carcass traits as well as the chemical-containing chicken chest meat. The observed carcass traits include the live weight, carcass weight, carcass percentage, and carcass value while the non carcass components include the visceral weight and percentage, giblet weight and percentage, abdominal fat weight and percentage, as well as the chemical-containing meat.

Table 1. Macroclimate during transportation

Parameter	T1			T2			T3		
	Beginning	Middle	End	Beginning	Middle	End	Beginning	Middle	End
Ambient temperature (°C)	28.0	30.4	32.4	28.0	33.3	36.2	28.0	36.9	35.1
Humidity (%)	77.6	61.8	51.7	77.6	54.5	49.4	77.6	53.2	51.0
Sun radiation (W/m ²)	424.29			482.73			446.99		
Heat Stress Index	150.16			151.00			152.59		

*The sun radiation measurement was only performed in the middle of the transporting process.

*The increasing temperature was recorded during the transporting process due to the different measuring time. The broiler chickens transported to farther destination were then lately measured.

During the research was conducted, the carcass value is calculated based on the carcass weight and price. The chemical analysis on the chickens' chest meat was conducted using AOAC method with a

proximate analysis. Crude protein was determined by multiplying the crude nitrogen of 6.25. Ambient temperature and humidity during the transporting process were recorded at beginning, middle, and end of the transporting process (table 1). Sun radiation value is calculated with the formula developed by Stefan Boltzman with $R = \delta T^4$. The data were analyzed using ANOVA and then the data with significant results were then examined using Duncan's Multiple Distance Test.

3. Result and discussion

Table 2 shows the results of statistical analysis on the data collected that 180 km transportation distance significantly reduced the live weight, carcass weight, carcass percentage and visceral weight, while 120 km transportation distance significantly reduced the giblet weight, yet not the abdominal fat weight and percentage.

Table 2. Carcass and non carcass traits influenced by the transportation distance

Parameter	Treatment			P	Se
	T1	T2	T3		
Live weight (g)	1929.70 ^a	1817.30 ^{ab}	1632.60 ^b	0.03	73.22
Carcass weight (g)	1468.71 ^a	1342.00 ^{ab}	1181.14 ^b	0.01	58.72
Carcass percentage (%)	76.08 ^a	73.86 ^{ab}	72.26 ^b	0.01	0.85
Visceral weight(g)	117.86 ^a	93.86 ^{ab}	88.86 ^b	0.02	0.03
Visceral percentage (%)	6.10	5.19	5.49	0.27	0.08
Giblet weight(g)	81.43 ^a	65.00 ^b	63.29 ^b	0.00	0.02
Giblet percentage (%)	4.24	3.59	3.89	0.06	0.04
Abdominal fat percentage (%)	1.49	1.54	1.73	0.28	0.03
Abdominal fat weight (g)	28.43	28.00	27.86	0.91	0.02
Carcass value (IDR)	44061.40 ^a	40260.00 ^{ab}	35434.20 ^b	0.00	1761.58

Table 2 shows that 180 km transportation distance significantly reduced the live weight, carcass weight and carcass percentage. In this research, carcass percentage is still classified into the standard category. Carcass percentage of male broiler chickens with the body weight less than 2.2 kg transported for 2 hour is 71.7% [6]. Carcass weight loss during the transporting process may increase the financial loss. The transporting process from 60 km – 180 km may reduce the carcass value up to IDR 8,627.14 or 19.58% for each chicken due to the carcass weight loss. The chicken broilers' live weight loss and carcass production during the transporting process may reduce the economical value [11].

Transporting process for broiler chickens may cause both live weight and carcass weight loss. Live weight loss during the transporting process is caused by the stressful conditions influenced by the ambient temperature and shocks during the transporting process. Shocks during the transporting process may cause the broiler chickens got so stressful [6] as well as the worsening dry season which significantly influences the broiler chickens' conditions. In this research, the Heat Stress Index (HSI) calculation is presented in table 1 and is not classified into the comfort level, as direct sun exposure during transporting process has a bigger impact on their stress. The continuously increasing body temperature during the transporting process may show the stressful condition experienced by the broiler chickens. Some research have reported that the transportation distance changes from 60 km to 120 km significantly increases the broiler chickens' body temperature by 1.27% from 41.87°C to 42.4°C [12]. The feed withdrawal duration and water access may influence the broiler chicken body's thermoregulation and catabolic process using the existing substituting energy in the broiler chickens' body.

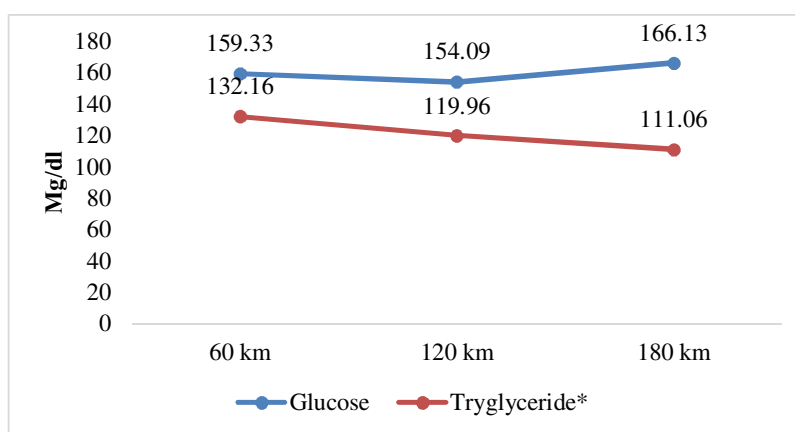
A stressful condition may accelerate the breakdown of broiler chickens' carbohydrates, fats and proteins [13]. During the transporting process to maintain the required energy, the glucose level will be supplied from triglycerides. Triglycerides used as the energy sources, will be broken down if the glucose as energy source starts to become lower [14]. In similar research published by [15] (figure 1)

shows that triglycerides within the blood were significantly decreased in 60 and 180 km transportation distance with the broiler chicken's triglyceride level respectively by 132.16 and 111.06 (mg/dl) and then followed by no the non significant changes in glucose level. Triglyceride synthesis may influence the carcass' fat level and carcass weight. The decreasing major components during the transporting process are muscles as the carcass main component, while the others, such as non carcass parts are not influenced by the transportation distance.

Table 3. Chemical-containing Meat of the Transported Broiler Chickens

Parameter	Treatment			P	Se
	T1	T2	T3		
Water Content (%)	73.44	73.78	72.96	0.82	0.96
Crude Protein (%)	20.76	21.11	21.61	0.30	0.37
Crude Fat(%)	2.22 ^a	1.36 ^b	1.73 ^b	0.00	0.05

Table 3 shows that the crude fat percentage significantly decreases in the transportation distance of 120 km without influencing the water content and crude protein percentage. The decreasing crude fat percentage is influenced by the decreasing triglyceride level which influences the carcass fat level. Triglyceride synthetic changes in liver may influence the carcass fat level [16]. Thus, it is assumed that the decreasing fat percentage is influenced by the increasing feed withdrawal duration during transporting process. During the transporting process, the preserved fat in muscle is broken down to maintain the glucose level. Low levels of plasma glucose will activate pancreatic secretion of glucagon to mobilized liver glycogen [17]. In long term feed withdrawal in transportation will do lipolysis on body fat to recover glucose level and least protein will breakdown if still needed to maintain glucose level [10,18]. Transportation distance does not influence the chest meat protein and water content since it is not longer necessarily to use protein as an energy source as long as well fulfilled by the other resources (fat). However, in the some research there is a reduction in meat pH and lightness in farther transportation distance, which indicates that there is a sign of tissue damage due to the oxidative stress during the transporting process [19].



*Tryglyceride level significantly decreases in the transportation distance of 180 km.

Figure 1. Tryglyceride and glucose level on transported broiler chicken

In this research, the decreasing giblet weight is due to the decreasing liver weight as one giblet component. The decreasing liver weight is presumably due to the hepatocyte cell damage and shrinking liver components. The decreasing liver weight is in accordance with the research conducted by [20]; [9] that the withdrawal time may influence the decreasing liver weight. The decreasing liver

weight is presumably due to the shrinking liver components, such as liver fat. The research conducted by [20] shows that the liver's fat levels in 6 hours of fasting indicating a decrease. In the transporting process, liver's fat is more advantageous to provide more energy when compared to the abdominal fat that the abdominal fat weight does not significantly decrease.

Figure 1. Triglyceride and Glucose Level on the Transported Broiler Chickens from the Similar Research [15]

This research shows that transportation distance may reduce the visceral weight due to a longer feed withdrawal time at a farther distance. The feed withdrawal time may influence the viscera, that is the digestive tract which becomes emptier. According [21] during the withdrawal period, the crop and gastrointestinal condition will be empty. The research showed that the after-16 hour withdrawal time may reduce the visceral weight up to 6.6% [9]. In the transporting process, the decreasing viscera weight is highly influenced by the transporting process extreme conditions.

4. Conclusion

It is concluded that the farther the transportation distance the more the broiler chickens' carcass traits and values may decrease.

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