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The Differences of Feed Quality and Egg Production Performance of Tegal and Magelang Ducks on Farming in Central Java

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ABSTRACT

This study was conducted to compare the environmental conditions around farms which was located in Tegal for Tegal ducks and Magelang for Magelang ducks. This study was also aimed to compare the composition of both feed nutrient content and the egg production. The research was conducted by survey method with purposive random sampling based on duck populations and age (8-15 months) provided by the farmer. Each area was provided 10 farmers for every farm and the data were collected in July-September, 2017. Environmental condition measurement were the temperature of the duck housing, and the composition and nutrient content of feed and the egg production of ducks. The results showed that all farmers' ducks on a dry system rearing (without water pool) with average temperature in Tegal area 30.53±1.38ºC and Magelang 28.32±1.00ºC. Feed compositions given for Tegal duck consist of: dried rice, rice bran, concentrate, *trash fish*, *golden snail*, *vermicelli* waste and shrimp waste. The average nutrient content was crude protein 19.25%, energy 2,913 kcal/kg, crude fiber 5.82%, crude fat 6.87%, Ca 3.06% and P 1.40%. Feed composition for Magelang ducks consisted of rice (*nasi aking*), rice bran and concentrate, with crude protein content of 17.99%, 2,801 kcal/kg, crude fiber 8.14%, crude fat 6.10%, Ca 2.29% and P 1.04%. Tegal duck egg production was lower than Magelang ducks (64.89 vs 75.44%), but the egg weight was relatively the same. It could be concluded that the temperature of Tegal duck housing in Tegal region was hotter than Magelang region. Although the food quality of Tegal ducks was better than that of Magelang ducks, Tegal duck had a lower egg production because of the high environmental temperature.

Keywords: Ducks, Egg production, Feed, Temperature

Introduction

Local ducks are one of the genetic resources in Indonesia that include Indian runner duck, the well-known egg-producer species. The order of Indian runner duck consists of several types and are given name based on the habitat such as Tegal duck, Magelang duck, Mojosari duck and Alabio duck, each with different level of productivity (Yuwanta *et al*., 1999). Most local duck farming in Indonesia are aimed to produce eggs (Ismoyowati, 2008). Ducks produce egg, meat and feather, and live and develop from plain feed available in the local environment. The development of ducks relies on the reproductive ability. Local ducks are needed to preserve the genetic resources that have undergone adaptation and serve as the source of breeding and future investigation (Lin *et al*., 2006).

Duck farming in Indonesia is a long-standing, traditional venture for centuries. The development of duck farming is rapid, marked by the increased population of farmed duck by 4.82% and the increased egg production by 5.56% in 2017 (Directorate General of Livestock and Veterinary, 2017). The majority of duck population in Indonesia are farmed in the rural area to produce egg because duck eggs, both fresh and salted, are the common food in society. The genetic factor is signified by the different egg production of several species of local duck. Egg production is strongly determined by the genetic factor and the environmental factor. Egg production of Tegal duck within four months (120 days) is 78±19 per duck on average, each egg weighs approximately 66.60±5.05 g (Ismoyowati, 2007). During the peak production, the average egg production of Magelang ducks kept in the closed cage system or ranch system was 70.4% and 69.60%, respectively (Ismoyowati and Purwantini, 2009).

Environmental factors such as feed and the surrounding temperature significantly impact egg production. High temperature of the premises may lead to stress and decrease feed consumption of the poultry (Ajakaiye *et al.,* 2011). The location or area of duck farming determines feed availability; therefore, the content and the

quality may vary from one area to another. Different quality of feed leads to the different egg production. The objective of this study was to investigate the different feed, environment temperature and egg production of Tegal and Magelang duck in the duck farmings in Tegal and Magelang.

Materials and Methods

The research was conducted in the duck farming centres in Central Java that included "Berkah Abadi" Livestock-Farming Group in Pesurungan Lor village, Margadana, Tegal (Tegal duck) and "Sido Rukun" Livestock-Farming Group in Sawangan, Magelang (Magelang duck). Research materials were two species of local ducks and the eggs obtained from the farmers. Survey was conducted to the farmers. Purposive random sampling was used to select 10 farmers from each area, along with the ducks (Sugiyono, 2010a). The respondents and ducks were selected based on duck population in the farming centres and the duck's age.

The selected Tegal duck farmers had a minimum 600 ducks aged 8-15 months, while Magelang duck farmers had a minimum 150 ducks aged 8-15 months. The selection was based on the prior survey which revealed that farmers in Tegal had approximately 400 mature female duck, while in Magelang was 100 ducks in production period.

The primary data were egg production, egg weight, composition or types of feed, the surrounding environment of the cage and the population of duck in the farming. The ducks aged 8-15 months (within production period). The observed environmental condition was the temperature of the premises. The observation and data collection was conducted within 3 months (July – September 2017). Feed composition was observed and sampled for proximate analysis in the laboratory.

Data of egg production and egg weight was subject to t-test analysis, while the condition of the cage premises, feed composition and feed nutrient were subject to descriptive analysis presented in the table (Sugiyono, 2010b).

Result and Discussion

The environmental condition of Tegal and Magelang duck farmings

The average temperature during the three-month observation in Tegal duck and Magelang duck farming was 30.53±1.38^{o}C and 28.32±1.00^{o}C, respectively. Both temperatures were above the thermoneutral zone, i.e. 23-25^{o}C (El-Badry *et al*., 2009). A high temperature in the premises would make the ducks release body heat by panting. Panting would increase 10 times when the temperature exceeded the thermoneutral zone (Ahmad *et al*., 2005). Heat stress would cause the ducks to drink more and eat less; consequently, the nutrient intake and egg production decreased. The control over the cage premises, particularly the temperature, humidity, ammonia level and the water level was the contributing factor to the ducks' welfare (Jones and Dawkins, 2010).

The result of observation to the duck cage showed that Tegal ducks and Magelang ducks were kept in an open, plain cage. The cage consisted of compartments for the duck to rest, take shelter and lay egg, and the earthen floor was covered with hay or rice husk as the litter. The overall cage was made of bamboo and wood with roof made of asbestos and tile. The cage was averagedly 1m^2 for 4-8 ducks in their production age (8-15 months). The poultry cage usually produced a higher ammonia when lacked of ventilation. Duck farmings are susceptible to an increased ammonia due to the excreta that contained 90% more water than that of the chicken. Siregar and Farrel (1980) reported that duck farming produced four times ammonia as high as chicken farming.

All cage samples in Tegal were a dry, closed cage that provided no pond for the duck to swim. Ranch was provided at the front yard for the ducks to feed, drink and play around. The cage density of Tegal duck farming was 4-6/m^2. The cage of Magelang duck was dry and closed with a density of 6-8/m^2 without a ranch. The ideal cage density for layer birds was 6-7/m^2 (Kang *et al*., 2016). It was in line with Jones *et al*. (2009) that despite the strong connection between duck and body of water, there was no requirement for the farmers to provide a pond for the ducks to bathe or swim. Several farmers provided a pond but majority of them only had water for drinking, cleaning the beak and moistening the feather. Suswoyo *et al*. (2014) reported that duck farming in the coastal area of Java island were mostly a closed, wet cage (pond provided) and some others were a closed, dry cage. Cage density and duck population in the wet cage system were higher than those in the dry cage system. A high cage density caused the cage to wet and damp, which may lead to the feather picking, stress and cannibalism among the ducks.

Ducks prefer an open body of water or pond to water provided in nipple for drinking. Accordingly, ducks have more space to roam and show better physical and feather condition in the wet cage system (Ruis *et al*., 2003; Knierim *et al*., 2004; Heyn *et al*., 2006). In contrast, ducks must put extra effort to drink from the nipple in the dry, closed cage (Cooper *et al*., 2002); therefore, a clean, open body of water (shallow or deep) was more preferable (Ruis *et al*., 2003). Rainwater as the alternative reservoir also increased the physical activity of ducks as observed from the ducks' similar behavior when in the rain or in the pond (Benda *et al*., 2004).

Feed of Tegal duck and Magelang duck

Result showed that Tegal duck received a more varied feed compared to Magelang duck (Table 1 and 2). Tegal duck mostly fed on marine

products such as trash fish, shrimp head, and golden snail. The additional supplement included rice bran, concentrate and dried rice. Feed offered to Magelang ducks in all respondents consisted of concentrate, rice bran, and *nasi aking*. Each farmers rationed the feed in different composition. The supplemental feed to the ducks were offered periodically, which included golden snail, golden snail and particular vegetable.

Ketaren and Prasetyo (2001) reported that high energy feed offered to the ducks was dried rice and rice bran, while the protein source included concentrate, trash fish and shrimp waste. The success of duck farming was considerably affected by the quality and quantity of the feed. Feed must have a sufficient quality in terms of a balanced nutrient between crude protein, crude

Table 1. Composition of feed ingredients, nutrient content and feed consumption on Tegal ducks

Farmer	Feed (%)						
	Dried rice	Rice bran	Concentrate	Trash fish	Golden snail	Vermicelli waste	Shrimp waste
1	36.4	36.4	-	27.2	-	-	-
2	30.4	45.4	1.5	22.7	-	-	-
3	22.1	44.1	0.7	11.05	22.1	-	-
4	26.2	31.4	3.1	18.3	10.5	-	10.5
5	76.9	-	-	20.5	-	-	2.6
6	32.0	46.6	1.3	20.1	-	-	-
7	29.1	46.5	1.2	23.2	-	-	-
8	30.8	49.4	1.2	18.6	-	-	-
9	26.1	50.7	1.4	21.7	-	-	-
10	33.9	33.9	1.1	16.35	-	5.64	-
Farmer	Feed intake g/duck/day	CP *(%)	Energy *(kcal/kg)	CF (%)*	Fat (%)*	Ca (%)**	P (%)**
1	147,8	21.71	2,981.6	5.22	6.83	3.30	1.51
2	155,6	20.08	2,955.9	4.96	7.7	2.75	1.43
3	171,5	14.49	2,726.5	6.30	7.2	3.55	1.28
4	173,3	19.92	2,752.5	7.33	6.0	3.55	1.29
5	146,1	18.405	2,999.8	9.04	2.6	3.30	1.46
6	187,5	18.79	2,951.7	5.15	7.7	2.83	1.39
7	182,2	20.26	2,956.8	4.82	7.85	2.67	1.43
8	161,0	18.14	2,946.6	5.09	8.02	2.71	1.37
9	162,3	19.69	2,947.7	4.64	8.27	2.42	1.40
10	146,2	21.05	2,920.6	5.60	6.53	3.50	1.48
Mean	163.35	19.25	2,913.97	5.815	6.87	3.06	1.40

Source : *Result of proximate analysis; ** Calculation based on table of feed composition according to Hartadi (1980).

Table 2. Composition of feed ingredients, nutrient content and feed consumption on Magelang ducks

Farmer	Feed (%)		
	Concentrate	Dried rice	Rice bran
1	27.2	27.2	45.6
2	42.8	28.6	28.6
3	37.5	37.5	25
4	25	50	25
5	20	40	40
6	28.6	42.8	28.6
7	22.2	44.4	33.4
8	31.3	31.3	37.5
9	40	40	20
10	22.5	25.8	61.7

Farmer	Feed intake g/duck/day	CP *(%)	Energy * (kcal/kg)	CP (%)*	Fat (%)*	Ca (%)**	P (%)**
Farmer 1	153.06	20	2,771.2	9	5	2.48	1.02
Farmer 2	181.3	20.85	2,745.14	8.28	6	2.06	0.99
Farmer 3	152.3	19.5	2,776.75	8.62	5.5	2.66	1.02
Farmer 4	71.1#	16.5	2,839	8.75	5.25	2.66	1.07
Farmer 5	100#	15.6	2,843.2	7.6	6.8	2.47	1.07
Farmer 6	131.1#	16.75	2,821.75	7.75	6.62	2.12	1.05
Farmer 7	128.5	16	2,841.3	8.11	6.11	2.00	1.07
Farmer 8	161.6	18.25	2,790.62	7.68	6.75	2.03	1.02
Farmer 9	170.8	20	2,771.2	9	5	1.81	1.02
Farmer 10	180.5	16.45	2,814.3	6.64	8.12	2.63	1.04
Mean	146.07	17.99	2,801.4	8.143	6.1	2.29	1.04

Source : *Result of proximate analysis; ** Calculation based on table of feed composition according to Hartadi (1980).
Note: # Free-range maintenance, feed only provided in the morning.

fiber, metabolic energy, lysine, calcium and phosphor. The quantity has to meet ducks' dietary demand.

The result showed that the nutrient content of Tegal duck feed was higher than that of Magelang duck (Table 1 and 2). The difference was attributed to the different feed composition. The protein source in Tegal duck feed was trash fish, while in Magelang duck was factory-made concentrate. The nutrient demand for layer ducks in production age (>20 weeks) consisted of 17-19% crude protein, 2700 kcal/kg metabolic energy (ME), 0.37% methionine, 1.05% lysin, 2.90-3.25% calcium (Ca) and 0.6% phosphor (P) (Ketaren, 2002).

Trash fish are small fish (maximum 10 cm) that are caught along with the big catches in fishing. It includes *peperek* fish, anchovy, *selar, kurisi, tembang, cucut, pari* and *kuniran*. Trash fish has a little amount of flesh, so it is utilized by the society as cattle feed. Trash fish contains 44% crude protein (Subagyo *et al*., 2003).

The source of energy for Tegal duck and Magelang duck was *nasi aking* (dried rice). The price of corn and grains for poultry feed is increasing, particularly during the non-harvest season. The by-product of agroindustry such as broken rice (the waste from rice mill) or dried rice (leftover rice) are the alternative for corn because of the cheap price, high availability and the relatively equal content of protein and metabolic energy (Daghir, 2009). Broken rice can be used to substitute corn as much as 5% of the feed for quail in production age (Swain *et al*., 2006). Broken rice is an alternative to corn for chicken breeding due to the similar content of energy, protein, lysine, methionine, calcium, phosphor, vitamin and mineral (Rama Rao *et al*., 2000). Alternative feed was offered to the ducks due to high availability and relatively cheap price.

Egg production

Duck breed which are commercially farmed to produce egg are Mallard ducks under a tight selection for a higher egg production. Breed such as Khaki Campbell, Indian Runner or Tsaiya currently produce up to 230 eggs per year (Dean and Sandhu, 2006). One of the specifically-developed breeds for commercial eggs in the US is Golden 300 Hybrid that produces 290 eggs per year (Anonymous, 2008), twice as much as the local breed (Gunawan, 1990). In Indonesia, several local ducks (*Anas plathyrhinchos*) which produce eggs include Tegal duck, Magelang duck, Mojosai duck, Alabio duck and Bali duck. The ducks share qualitative and quantitative characteristics (Ismoyowati and Purwantini, 2010; 2011).

The result showed that egg production of Tegal duck was lower than that of Magelang duck (Table 3). It indicated that protein feed in Tegal duck was higher than that of Magelang duck, i.e. 19.25% and 17.99%, respectively. However, it did not increase egg production which was relatively similar between the two breeds. The high protein feed that failed to increase egg production may due to the increased body heat that was caused by the intensified heat increment in protein digestion. Accordingly, protein synthesis for egg production declined. A half of the protein was turned into energy to remove body heat, thereby increasing nitrogen excretion. The utilization of high protein feed in a hot environment would decrease protein synthesis and increased nitrogen excretion in the excreta (Temim *et al*., 2000; Lin *et al*., 2006).

Egg production is protein deposition in body. Protein feed significantly determined the sufficiency of protein intake. Feed intake is affected by the environmental temperature and energy content in feed. Energy content during production period was deemed sufficient at 2,800 kcal/kg, while protein content met the protein demand. Protein and amino acid were excluded from the environmental temperature; therefore, heat stress did not affect the duck performance as long as the protein demand was met. However, heat stress decreased feed intake and protein and amino acid content. Temperature above 30^0C caused heat stress that directly impact production; therefore, increasing protein content in feed did not significantly affect the process (Suprijatna *et al*., 2009). During heat stress, the level of energy and amino acid was accountable. When energy was increased, the other nutrition should be proportionally increased. When the excess of amino acid was reduced, feed intake would naturally increase. During heat stress, feed with low protein and amino acid content (particularly methionine and lysine) resulted in better performance compared to high protein feed (Daghir, 2009). Temperature and humidity significantly affected egg production. Increasing temperature and humidity index from 25 to 29 resulted in heat stress and a decreased egg production by 25% (Kilic and Simsek, 2013).

Table 3. The average population and egg production of Tegal and Magelang ducks

	Duck population (hen)		Egg production (%)		Egg weight (g)	
	Tegal	Magelang	Tegal	Magelang	Tegal	Magelang
Mean	623.50	152.70	64.89^b	75.44^a	66.84^a	66.15^a
Standard deviation	253.00	31.62	5.30	10.21	6.91	6.97

Note: Values bearing different superscript within column show significant difference ($p<0,05$) based on t- test.

Conclusions

Environmental condition in Tegal has a higher temperature compared to Magelang. The quality of feed for Tegal duck is better than that for Magelang duck. However, the egg production of Tegal duck was lower due to the higher environmental temperature.

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