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RESEARCH ARTICLE

STUDY ON DUCK (*Anas Plathyrhinchos*) WELFARE UNDER EXTENSIVE AND INTENSIVE SYSTEMS OF PRODUCTION

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ABSTRACT

Shifting duck production systems from extensive traditional to more intensive could have significant effect on egg production and welfare. This research aimed to study the duck welfare under extensive and intensive systems of production. Fourty duck farmers have been involved as respondents comprised 20 farmers using extensive system while the rest was intensive duck farmers. From each farmer 10 samples of duck blood have been taken for hematological analyses. The sample ducks were also used for crop contents analysis. Direct observations were conducted to study the daily management. Sampling was done using cluster sampling method based on location and production systems. The cluster was two locations namely Purbalingga Regency as high altitude area, and Cilacap Regency as low altitude area. Whereas the sub-cluster was production systems i.e. extensive and intensive systems. Farmer respondents were randomly selected from each cluster for both systems. Parameters observed were egg production and blood status. The results showed that average egg production was 64.50 % and 30.56 % in intensive and extensive systems of production respectively. Values of H/L ratio of ducks in Purbalingga were 1.69±1.06; and 2. 29±0.84 for extensive and intensive systems; while those in Cilacap were 2.25±1.22; and 2.94±2.23. It was concluded that local ducks kept at different environmental condition would have different resistance, however areas and production systems did not bring about different stress condition.

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INTRODUCTION

Ducks has an important role as an egg producing poultry in Indonesia, about 19.35% of 793,800 tons egg comes from the bird. Whereas as meat producer the role was not as high as an egg producer, only 0.5% from total 3 million tons (Directorate General of Livestock Services, 2019). Productivity of local ducks was relatively low but it has high potency to be increased. Extensive traditional system has been claimed as the main reason for the low productivity. The system refers to scavenging system in which the ducks were herded following rice harvesting to seek their natural feed such as snails, insects, fallen ruce grains, etc. This flock movement caused stress which lead to low productivity. Nowadays, introduced intensive system has been adopted by farmers in many areas. In intensive system, ducks were confined in specific piece of fenced land, so the bird had no access to the outside areas. It was well understood that production systems had effect on duck welfare.

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Shifting from extensive to intensive systems seemed to be relevant since the extensive system had many obstacles, such as more intensive pesticide used in rice fields and low availability of natural feeds. Contradictory, under intensive system duck feeds could be provided inline with its requirement to support optimal productivity. Stress susceptibility in farm animals is a major problem in the modern intensified industry, and many managerial practices subject animals to stress. Animals' inability to adapt to those stressors results in changes of behavioral and physiological homeostasis that cause a greater effect on animals' emotional and physiological well-being, such as susceptibility to disease and increase in frequency of abnormal behavior (Cheng, 2003). Elimination of stress was the main factor to protect duck from stress (Prayitno, 2004). The current trend in animal agriculture is towards sustainable production systems in which animal welfare is considered to be an integrative part of an ideal sustainable system (Estevez, 2003). Poultry welfare could be assessed by calculating heterophyl/lymphocyte ratio (H/L ratio) (Huff *et al.*, 2005). Gross and Siegel (1983) stated that H/L ratio could be used as hematological indicator of stress in chickens.

Campo *et al.* (2000) indicated that optimum ratio between heterophyl and lymphocyte would improve welfare which lead to reduce stress. Ethologists agreed that animal welfare should be taken into account at any production systems. Under welfare condition, ducks would produce optimally and induced healthy condition of farms and its products. In Indonesia, low attention has been paid to duck welfare; thus this study aimed to compare duck welfare under extensive and intensive systems of production.

MATERIALS AND METHODS

This study involved 40 duck farmers as respondents comprised 20 farmers using extensive system and 20 were intensive duck farmers. From each farmer 10 samples of duck blood have been taken for laboratory analyses. Laboratory analyses done was hematological analyses to assess condition of the ducks. The sample ducks were also used for crop contents analysis. At the same time, direct observations were also conducted to study the daily management. Sampling was done with cluster sampling method based on location and production systems. The cluster were two locations namely Purbalingga Regency as high altitude area, and Cilacap Regency as low altitude area. Study site in Purbalingga Regency was located at 700 m above sea level, while in Cilacap it was 8 m. The average daily ambient temperature were 28.30±0,65°C and 28.85±0,71°C with relative humidity of 85% and 82% in Purbalingga and Cilacap respectively.

The sub-cluster was production systems i.e. extensive and intensive systems. Farmer respondents were randomly selected from each cluster for both systems. Parameters observed were egg production and blood status i.e. numbers of leucocytes, differential leucocytes (neutrophil, eosinophil, basophil, (lymphocyte dan monocyte), and heterophyl/ lymphocyte ratio. Three milliliters blood was taken from each sample duck through *axillary vein*. Hematological analyses was done according to Pierson (2000). Crop content analysis was conducted to estimate the feedstuffs consumed by extensive ducks during herding. Data obtained were analysed using variance analyses of nested classification continued with Honestly Significant Difference Test.

RESULTS AND DISCUSSION

Farm condition: Under intensive system duck house was established around farmers' house with bamboo fence of 2m height. Teh roof mainly from tile with free range access in front of the house. Some of them had swimming access whereas the other just provided access for drinking water. In extensive system, there was no special duck house. The farmers provided roof to protect the birds from uncomfortable environmental condition, as well as for laying nest. The house could be in the middle of rice field or in the house nearby herding areas. Flock size varied with an average of 193 ducks per herder in extensive system and 228 ducks per farmer in intensive system. Intensive duck feed in Purbalingga was composed from rice bran, dried rice, and commercial concentrate at 22.89 %, 50.80 %, and 10.26 respectively. With this composition the duck ration had 17.47 % crude protein, and 3,032kcal/kg metabolize energy. Ration of intensive ducks in Cilacap was a mix of 40.70 % prawn waste, 54.2 % dried cassava, and 5.1 % rice grain. The mix had crude protein content of 20.0 % and 1,723 kcal/kg metabolize energy. This nutrient content was relatively lower to that suggested by Prasetyo (2006) who recommended the protein content of 20 % and the energy content of 3,000 kcal/kg for local ducks during laying period. During herding at post harvest rice fields in Purbalingga, based on crop contents analysis, the ducks consumed rice grain 55.8%, snails 17.0%, grasses and other leaf materials 10.0%, insects 6.5%, young frogs 3.7%, and gravel 7.0%. This sample had protein content of 16.8, percent, and 2,800 kcal/kg metabolize energy. Similar condition was found in Cilacap in which extensive ducks consumed rice grains 56.6%, snails 18.5%, grasses and other leaf materials 8.1%, insects 7,2%, young frogs 2.8%, and gravel 7.2%. This contents had 15.0 percent protein, and 2,780 kcal/kg metabolize. These data indicated that extensive ducks were under malnutrition which affected egg production.

Egg production: During this study, average egg production was 64.50 % and 30.56 % in intensive and extensive systems of production respectively.

Tabel 1. Average numbers of leucocytes, leucocytes differensial, and heterophyl-limphocytes ratio in ducks under extensive and intensive systems of production

Area	Purbalingga		Cilacap	
Production system	Extensive	Intensive	Extensive	Intensive
Leucocytes (,000/µL)	14997.62± 5195.51[b]	11766.67± 2814.99[a]	20503.85± 8637.48[c]	14336.36± 7409.66[b]
Heterophyl (%)	39.86±9.68[a]	52.4±8.13[b]	42.15±10.52[a]	49.18±15.34[b]
Eosinophyl (%)	24.57±11.70[b]	16.93±6.41[a]	29.15±8.12[b]	21.55±10.45[a]
Lymphocyte (%)	29.43±11.22	25.20±7.73	22.62±9.61	22.00±10.45
Monocyte (%)	6.62±2.54	5.47±3.18	8.38±4.48	7.27±3.82
H/L ratio	1.69±1.06	2.29±0.84	2.25±1.22	2.94±2.23

Different superscript on the same line indicates significant difference (P<0.05)

This results were in accordance to Suswoyo and Ismoyowati (2010) reported that egg production in intensive system was between 43.46 to 68.40%. While for egg production under extensive system Ketaren (2007) reported it was between 27.78 to 41.67 %. These data implied that egg production in extensive system was lower than that in intensive system. Malnutrition was most probably one of reasons for this low egg production of extensive ducks. Moreover stressful condition could be the other reason for such low production. Under extensive system ducks were herded following rice harvesting, moved from a rice field to the others along the year (Ismoyowati *et al.,* 2005). In intensive and extensive systems of production the body weight of the ducks were 1,290 g and 1,153 g respectively. Different production systems which affected nutrition and stressful condition brought about the data of body weight.

Duck welfare: Calculating leucocytes was important part in studying duck welfare. In this research it was found that total leucocytes was between 11,766.67 to 20,503.85 /µl. Variance analyses showed that area had significant effect (P<0.05) on leucocytes number, in which ducks kept in Cilacap had higher leucocytes number than those kept in Purbalingga. This was due to more microorganism or pathogenic agents resulted improvement of body resistance by increasing leucocytes

quantity. Extensive ducks in Cilacap frequently found feedstuffs with pathogenic microorganisms or prawn waste resulted high leucocytes number. Levengood *et al.* (2000) indicated that duck with Zn contaminated feed would have higher leucocytes number than control. The number was also affected by environmental condition since high ambient temperature increased leucocytes number (Olayemi and Arowolo, 2009). Leucocytes differentials in this research was found normal. Production systems significantly ($P<0.01$) affected heterophyl and eosinophils. Different environmental condition could be an important factor for this reason, especially ambient temperature. This finding was in accordance to that of Olayemi and Arowolo (2009) who found that during dry season the number of heterophyl and eosinophils were lower than in rainy season. The average heterophyl were 31.88% and 63.5% during dry and rainy seasons respectively. The number of those leucocytes differentials in this study was higher compared to those of Nigerian ducks which had 13.67% heterophyl and 6.25% eosinophyl (Okeudo *et al.*, 2003). Again, environment condition of the farm might have important role in this situation. During this study, areas and systems of production had non-significant ($P>0.05$) effect on percentages of basophyl, lymphocytes, and monocytes. Animal welfare measurement could be done by calculating heterophyl/ lymphocyte ratio (H/L ratio) (Huff *et al.,* 2005). Gross and Siegel (1983) stated that H/L ratio was used as hematological stress indicator in chickens. Campo *et al.* (2000) said that optimum ratio between heterophyl and lymphocyte would provide welfare condition which leaded to prevent poultry of stress. Heterophyl and lymphocyte were fractions of leucocytes as indicated in Table 1. H/L ratios in this study were higher to those of Ismoyowati *et al.* (2006) reported values of H/L ratio in intensive Tegal duck was between 0.42 to 0.60. Thus, indicated that ducks in this study, under both production systems, suffered from stress. Pierson (2000) stated that healthy poultry which did not suffer from stress would have lower heterophyl compared to its lymphocytes, so the value of H/L ration would be less than one. Statistical analysis showed that H/L ratio had no significant effect ($P>0.05$) on egg production in both systems. Further analysis indicated that correlation number between H/L ratio and egg production in extensive system was $y=45.988-0.842x$ with values of $r=0.489$ and $r^2=0.239$, while in intensive system it was $y=51.245-0.976x$ with $r=0.352$ and $r^2=0.124$.

Conclusion

Local ducks kept at different environmental condition would have different resistance, however areas and production systems did not bring about different stress condition. It was required further study to find out better system to reduce stressing condition.

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