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# Sustainable brooder for supporting local chicken in North Sumatera Province, Indonesia

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**Abstract.** Demand for local chicken has lasted for ages in Sumatera Utara Province, Indonesia. Demand is higher than supply because local chicken has low productivity which caused by several factors, for example heater or brooder for day old chicken (DOC). People who live in villages where mostly local chicken are raised have difficulty in serving brooder as electricity is expensive. In Biological Laboratory, Animal Production Programme Study, University of Sumatera Utara, a study has been conducted from August until November 2016. The objective of this study is to investigate sustainable brooder for local chicken. A study of 300 local DOC with designs: T1) local DOC + electric lamp brooder, T2) local DOC + biogas lamp brooder, T3) local DOC + propane lamp brooder has conducted. The key parameters measured were temperature stability, DOC spread, body weight gain, and mortality. Designs T1, T2 and T3 were almost equal in temperature stability, DOC spread, body weight gain and mortality while T2 was superior as it was environmentally friendly. A recommendation for local people to use biogas brooder instead of electric or LPG brooder.

## 1. Introduction

Local chickens are native chickens of Indonesia that have long been nurtured and developed by the community, especially rural communities who maintain them as a source of family food for eggs, meat, and as savings that at any time can help finance Suprijatno and Atmomarsono [1]. Brooding time was an important moment in nurturing local chicken so handling intensively should be taken at this period. Failure in this period will minimize the achievement. In the brooding period, the temperature needs to be well noticed, especially the heating process.

Local chicken breeders who have not developed well, still use oil lamps, LPG gas and in small amounts using an incandescent lamp as a source of energy for the brooder. Although the breeders complained about brooder operational cost, they kept using them like no other option. Electricity consumption was growing along with the increase of population while raw materials to produce electricity such as fossil fuel was limited and LPG gas was expensive.

On the other hand, fossil fuel emits green house gases, and Indonesia committed to reducing its greenhouse gas (GHG) by 26% in 2020 one way by promoting clean energy use for example biogas. Ginting [2] found biogas gave more benefits in the agricultural areas such as energy which was environmentally friendly energy, slurry which was organic fertilizer and clean environment as agricultural waste which usually discharged into the environment become biogas input. Ginting [3] mentioned that biogas support farmers in the rural area when farmers use biogas instead of firewood in



the process of coffee bean roasting. Biogas was capable of producing good energy; the flames are blue, odorless and smokeless. Therefore it was expected that biogas could be used during brooding as source of heat. Balde [4] found that biogas produced renewable electricity and heat. According to Rajakovic [5] in comparison, 1 m<sup>3</sup> biogas was equivalent to 0.48 kg LPG, 0.42 l solar, 0.8 l gasoline, 0.62 l kerosene, 0.6 crude oil, 1.4 kg coal, 4.7 kWh electricity and 3.5 kg firewood.

## 2. Method

Research material was chicks cage, 40% formalin for cage fumigation, 300 (DOC), feed, vaccine. The tool was used brooder for chicken, i.e., incandescent lamp 60 Watt, LPG lamp, biogas lamp, thermometer, digital scales for weighing chickens. The design used in this study is Completely Randomized Design (RAL) with three treatments, namely: P1 = electric brooder, P2 = biogas brooder, P3 = LPG brooder.

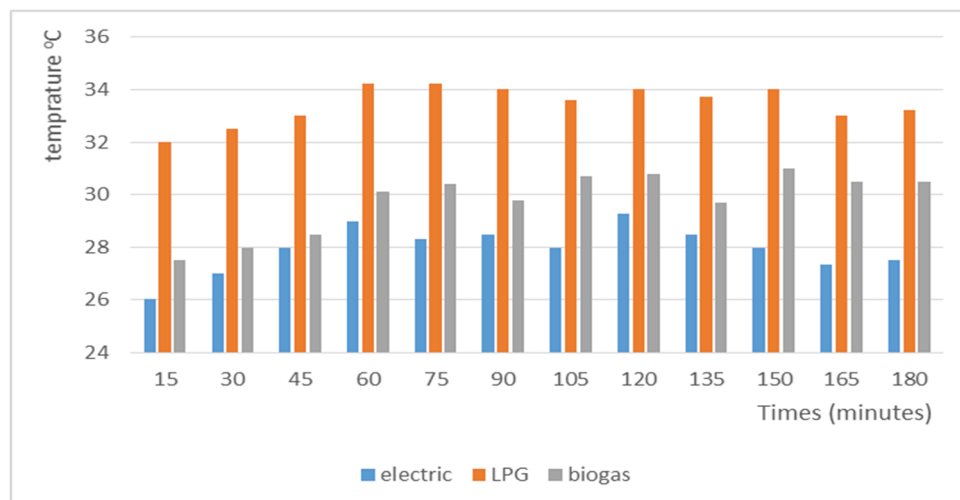
Parameter of Research was as follows: Temperature Stability, DOC spread, body weight gain

## 3. Results and Discussions

The results will be discussed in 4 subsections, they are temperature stability, spreading of DOC, body weight gain and mortality.

### 3.1 Temperature Stability

The temperature stability was to evaluate the temperature change of each brooder. The results showed that the average temperature stability on the starter phase of brooder was 30.42 °C for 14 days while the average stability of chicken brooder temperature should be about 30-32 °C. The highest temperature stability on the LPG brooder was 33.45 °C, followed by biogas brooder which was 29.97 °C and the lowest on electric brooder which was 27.84 °C. Ideal temperature caused activity of DOC grow normally and they spread evenly throughout the cage. According to Hajar Fawaz et al. [6] using the solar cell as a source of energy for brooder caused stability of DOC brooder.



**Figure 1.** Temperature Stability of Electric, Biogas and LPG Brooder

### 3.2 Spreading of DOC

Spreading of DOC were depend on brooder temperature. LPG brooder caused DOC spread out, they left the brooder because it was too hot which triggered DOC consumed the feed less and they more drank water. Electric brooder brought about DOC cuddled together for seeking heat. Only biogas brooder effect normal activity of DOC. R. Denny [7] mentioned that feed efficiency was influenced

by DOC activity; DOC should consume more feed than drink. Normal activity caused better DOC growth.

According to Zhenghou Jiang et al. [8] biogas brooder on young chicks significantly reduce LPG cost. The use of biogas for brooding young chicks on a poultry farm can significantly reduce the natural gas or propane fuel cost. Jiang also mentioned that biogas brooder was an alternative for electric brooder. However, people in the rural area were not familiar with biogas technology.

### 3.3 Body Weight gain

A calculation on body weight gain was held on a weekly basis based on the difference between the final body weight weighing and the weight of the initial weight divided by the length of the study in g/head/day. From Table 1 it can be seen that the analysis of the diversity of gain of chicken body weight during the study gave no significant effect ( $P > 0.05$ ). The absence of this difference was due to almost stable cage temperature and ration was given which was equal in nutrition content. This was by the statement of Jull [9] which stated that the percentage increase in body weight gain from week to week following period was not the same and in this research, body weight gain tends to increase on the sixth week and by P2 which was biogas brooder treatment.

**Table 1.** DOC Body Weight Gain (g).

Treatment	Replication						Total	Mean $\pm$ sd
	1	2	3	4	5	6		
P1	59.14	57.19	52.43	50.95	59.57	60.81	340.10	56.68 $\pm$ 4.07
P2	59.91	65.81	57.52	61.14	57.14	65.05	366.57	61.10 $\pm$ 3.68
P3	57.24	63.62	62.29	57.76	54.33	68.00	363.23	60.54 $\pm$ 5.01
Total	176.29	186.62	172.24	169.86	171.05	193.86	1069.91	
Mean	58.76	62.21	57.41	56.62	57.02	64.62		59.44

### 3.4 Mortality

From table 2 it can see that the highest mortality was in P1(electric brooder) that were 13,3%, whereas in P2 (biogas brooder) and P3 (LPG gas brooder) there was no mortality. Mortality was occurred due to the temperature of P1 which was not hot enough for DOC while the temperature of P2 and P3 were stable. Usually, people in a rural area who raise local chicken use 60 Watt lamp for DOC brooder. This was the reason why in this research at P1 used 60 Watt lamp. This experiment proved what the caused of DOC mortality in a rural area which was electric brooder not hot enough for DOC. The people in the rural area did not want to use 100 Watt lamp, because it was too expensive.

Overall mortality rate should be less than 5%. The first week of death rate during the gain period should be no more than 1%, deaths in the following week should be relatively low until the end of the week and continue in a constant state until the end of the gain period.

**Table 2.** Percentage of DOC Mortality

Treatment	Replication						Total	Mean $\pm$ sd
	1	2	3	4	5	6		
P1	3.3	0	10	0	0	0	13.3	2.21 $\pm$ 0
P2	0	0	0	0	0	0	0	0 $\pm$ 0
P3	0	0	0	0	0	0	0	0 $\pm$ 0
Total	3.3	0	10	0	0	0	13.3	
Mean	1.1	0	3.3	0	0	0		2.21

Factors that affect the percentage of death include brooder temperature, body weight, strains, types of chickens, climate, environmental hygiene and diseases Wiedosari, E and Wahyuwardan, S [10]. Also they mention the death of DOC were largely determined by the density of DOC in the cage, the air circulation in the cage which caused the incoming O<sub>2</sub> was less while CO<sub>2</sub> was produced more from DOC respiration.

#### 4. Conclusions

Based on the research, biogas and LPG brooder were better than electric brooder as they had better on temperature stability, chicken spreading, body weight gain, and mortality. Biogas brooder was better than LPG as it was environmentally friendly.

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