

THE EFFECT OF CLOSED HOUSE CAGE TYPE ON BROILER REARING ON PRODUCTION PERFORMANCE OF PLASMA FARMS AT PT. MUSTIKA JAYA LESTARI MADIUN

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Abstract. This study aims to analyze the success rate of broiler rearing production performance based on the type of cage maintenance. The research material were 30 broiler farmer's plasma farms at PT Mustika Jaya Lestari in Madiun, East Java, Indonesia, consisting of 17 modern closed house cage broiler farms and 13 semi-closed house cage broiler farms. The research method was a case study. The samples of plasma farmers were chosen by purposive sampling method of farmers groups who have broiler farming businesses, modern closed house (T1) and semi-closed house cage types (T2) in partnership with PT. Mustika Jaya Lestari in Madiun. Data collection techniques in this study were: surveys, interviews and documentation. The data was analysed using unpaired t-test. The results showed that modern closed housed (T1) had better ($P < 0.01$) feed conversion (1.57 vs. 1.65), mortality rate (3.93% vs. 5.37%) and performance index (380.02 vs. 339.65) than semi-closed house cage types (T2). There is no difference ($P > 0.01$) of feed consumption and final body weight of the animals. The conclusion of the study is that the production performance of broiler of modern closed house is better than semi-closed one.

Key words: poultry; tropical climate; feed conversion, mortality

1 Introduction

Livestock is one part of the agricultural sector that needs to be developed and utilized optimally for the prosperity of the people. One of the potential livestock commodities to be developed is broilers. This is because broilers produce meat as a source of protein that is very important for humans.

In broiler agribusiness, the partnership pattern has proven to be a way out of the tempest of the economic crisis that has not subsided since mid-1997. If in 1997 the structure of poultry agribusiness actors was 30% partnerships and 70% independent businesses, then in 1999 this structure changed to 80% partnerships and 20% independent businesses [1].

The latest broiler rearing system that is widely applied in Indonesia is a closed cage system (closed house) which consists of modern closed house and semi closed house. Modern

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closed house is one of the efforts of technological innovation to deal with weather changes that are quite extreme, so that it is expected to minimize the adverse effects of environmental conditions or climate change outside the cage. Hidayat et al [2] explained that the purpose of using cages modern closed house is to create a controlled microclimate in the cage, increase productivity, land and labor efficiency and create an environmentally friendly livestock farms, but development modern closed house costs a lot of money. While semi closed house is an adoption of the principle modern closed house. The shape is like an open-air cage, the walls are made not permanent using curtains or tarpaulins, the top of the cage is made of ceiling, and uses exhaust fan which serves to attract or suck oxygen and carbon dioxide and the cost of making cages tends to be cheaper than modern closed house.

Analysis of the influence of closed house cage types is needed to determine the production performance of plasma farms and if it can provide information to farmers on the extent of the success of the business they established and as evaluation material in decision making in the future period. For farmers, evaluation is very helpful in finding existing problems that further improve them so that the livestock business can run more optimally than before.

2 Materials and Methods

The material used is broiler plasma farms, modern closed house cages, and semi-closed houses at PT Mustika Jaya Lesatri Madiun. Determination of sample size in the study was carried out using the Slovin formula. The number of modern closed house cage is 17 farms and semi-closed house cage 13 farms. The research was conducted on broiler farms in partnership with PT. Mustika Jaya Lestari Madiun. The research and data collection will be carried out from May 8th to July 7 th, 2023. The determination of the location of this research was carried out by purposive method with consideration of PT. Mustika Jaya Lestari Madiun is a company engaged in the growing poultry world that has established partnerships with broiler farms totaling 96 plasma farmers and spread across the Madiun, Magetan, Ngawi and Ponorogo areas and has never been used for research before. The method used at the time of research is a case study. Data collection techniques in this study are: surveys, interviews and documentation collection.

2.1 Variables

The variables used in the study were feed consumption, final body weight, feed conversion, mortality and Index of Production (IP).

2.2 Statistical Analysis

The data were analyzed using Independent t Test to see the effect of the know the effect of modern closed house cages and semi-closed house cages on broiler production performance.

3 Results and discussion

3.1 The Effect of Closed House Cage Type on Feed Consumption

Widodo, et al [3] explaining that feed consumption is the amount of feed consumed by poultry during the maintenance period. Feed consumption is calculated from the difference between the amount of feed given and the amount of feed residue that is not consumed or scattered. Feed consumption can be calculated daily, per week or all at once at the end of

maintenance starting from 1-35 days of age. The amount of feed consumed by broilers each week will continue to increase until the age of 5-6 weeks. Some factors that affect feed consumption are body weight, sex, livestock activity, environmental temperature, feed quality and quantity, feed form, feed energy content, livestock health, growth speed, and stress [4].

Table 1. Feed consumption (g/head), final body weight (g/head), feed conversion, mortality (%) and Index of Production (IP) of modern closed house (T1) and semi closed house cage type (T2).

Variable	Cage Type	
	T ₁	T ₂
Feed Consumption (g/head)	3.329 ± 0,241	3.277 ± 0,376
Final Body Weight (g/tail)	2.164 ± 0,130	2.097 ± 0,188
Feed Conversion	1,574 ± 0,037*	1,646 ± 0,036
Mortality (%)	3,927 ± 0,786*	5,369 ± 1,247
IP	380,02 ± 16,622*	339,65 ± 17,177

Information: The sign (*) indicates highly significant effect (P<0.01)
 T1 = Modern Closed House; P2 = Semi Closed House

In Table 2 it can be known the nutritional content of the feed during the study (according to the information written in the label).

Table 2. Nutritional content of feed at the time of the study

Nutritional Content	Feed period		
	Pre Starter	Starter	Finisher
ME (kcal/kg)	2900	3000	3100
Water Content (%)	14	14	14
PK (%)	21-22	20-21	19-20
SK (%)	5	5	5
LK (%)	5	5	5
Ash (%)	8	8	7
Ca (%)	0,80-1,10	0,80-1,10	0,8-1,10
P (%)	0,50	0,50	0,60

The average feed consumption of animals as seen in Table 6. indicated that although there is tendency that animal kept in semi-closed house cages consumed less feed (3,277±0.376 g/head) than modern closed house (3,329±0.241 g/head) but there is no significant difference (P>0.05) between them.

Based on the results of the data analysis conducted, it proves that the semi-closed hoause housing system in this study provides adequate comfort for livestock so that it does not affect or reduce the amount of feed consumption or has the same consumption as the consumption of animal feed kept in modern closed house enclosures. The working principle of the two types of modern closed house and semi closed house cages is basically the same, namely creating a comfortable microclimate for the poultry house, the only difference is that in modern closed house cages the arrangement is done automatically while in semi closed houses temperature and humidity settings are still done manually.

Added by Krisnawati [5] that high ambient temperature and humidity can reduce feed consumption so that it can disrupt metabolic processes and result in the deficiency of food substances needed for growth and production. Feed is one of the sources of heat generation in the body of broilers. The ability of broilers to consume feed is greatly influenced by the ambient temperature. The physiological response to cold temperatures is to increase feed consumption, while at hot ambient temperatures broilers will reduce feed consumption to reduce heat production in the body. In hot weather, chickens try to cool their bodies by breathing quickly (panting). This behavior can cause a lot of blood circulation to the respiratory organs, while blood circulation in the digestive organs has decreased so that it can interfere with digestion and metabolism. Feed consumed can not be digested properly and many nutrients in the feed are discarded in the form of feces.

3.2 The Effect of Closed House Cage Type on Body Weight

The average weight gain results Table 6, shows that broilers raised aged 34.8 days in modern closed house cages have an average body weight gain of around 62.18 g / head and semi-closed house cages with a longer maintenance life of 35.44 days with an average weight gain of around 59.16 g / head. Daily weight gain is not the same every week, depending on the age and sex of broilers. Daily weight gain of broilers will increase with age. Male broilers have a higher daily weight gain than females. This is due to higher levels of testosterone in the body of roosters.

In Table 6. shows that the average final body weight in the study in modern closed house cages was 2,164 better than the average achievement of final body weight in semi-closed house cages which was $2,097 \pm 0.188$. According to Muharliien, et al [6] explained that the final body weight produced by each livestock varies. The difference in body weight between cattle given add-libitum feed and cattle whose feed is restricted and the difference between cattle that get an optimal feed ratio and cattle that get a non-optimal feed ratio. The content of food substances that determine performance in broilers is a balanced nutritional content between protein and energy, besides that vitamin and mineral needs must also be met. Broiler feed consumption is directly proportional to the final body weight. A decrease in feed consumption will result in decreased final body weight. In addition, the height of the premises and the temperature of the keeping environment also affect the final body weight of broilers. Low ambient temperatures tend to provide a lower final body weight compared to high ambient temperatures. Low body weight due to heat stress is associated with inefficient use of feed. It was also added by Wasti, et al. [7] that low body weight is associated with low feed consumption which results in feed deficiency in chickens that experience heat stress. In addition, the decrease in production in livestock raised at high temperatures will have a direct impact on changes in their hormonal system. The final body weight of the chickens raised showed a 37-fold increase compared to the initial weight.

Based on the results of the t test, the ratio between modern closed house and semi-closed house cages has no significant difference ($P > 0.05$) on body weight gain. There are factors that can affect weight gain other than the same seeds, namely gender, environment, feed consumption and feed quality. This is in accordance with Nugraha, et al. [8] factors that affect weight gain, namely sex differences, feed consumption, environment, seeds and feed quality. Umam, et al [9] explained that the body weight of chickens that are not significantly different is also caused by the ability of chickens that are almost the same in metabolizing feed in the body by means of nutrients contained in feed will be converted into nutrients that can be digested and absorbed by the body and the rest that is not absorbed will be secreted into feces. If digestible energy is converted into metabolic energy that can be utilized to produce heat as well as energy for basic living and production activities, the expected growth of broilers will

increase. Body weight gain is closely related to feed, in terms of quantity related to feed consumption if feed consumption is disrupted it will interfere with growth.

3.3 The Effect of Closed House Cage Type on Feed Conversion

Feed conversion ratio (FCR) is useful for measuring livestock productivity and is defined as the ratio between feed consumption and body weight growth obtained over a certain period of time. The smaller the ration conversion value, the more efficient the livestock is in converting feed into meat.

Based on the analysis of data, it shows that the closed house cage type has a highly significant effect on feed conversion ($P < 0.01$). Table 7 showed the feed conversion of broilers raised in modern closed house cages is 1.574 ± 0.037 compared to semi closed house ranged of 1.646 ± 0.036 . The results showed that in the modern closed house cage type, the achievement of FCR 1,574 can be interpreted that to achieve a body weight of 1 kg / head requires 1,574 kg/head of feed, while in the semi-closed house cage type, the achievement of FCR 1,646 can be interpreted that to achieve a body weight of 1 kg/head requires more feed, namely 1,646 kg/head. The higher achievement of feed conversion ratio in modern closed house cages proves that it is more efficient than semi-closed house cages.

The feed used in broiler rearing, both in modern closed house and semi-closed house cages, consists of 3 phases, namely pre-starter in the form of fine crumble feed, then starter in the form of crumble feed/granules, while the last finisher in the form of pelleted feed. The pre-starter feed used is with code 610 then the starter feed used with code 611 and the finisher feed in maintenance is used with code B12MTK.

High feed conversion is produced by broilers experiencing heat stress due to high temperatures. The increasing level of density will further increase the conversion value of feed. Increased conversion at high densities leads to inefficiency of the production process because efforts to increase body weight per gram will be even greater. The high density of the coop leads to an increase in the temperature of the coop caused by the heat that chickens generate from metabolic processes. According to Lesson, et. Al [4] explained that the value of Feed Conversion Ratio (FCR) is influenced by several factors, including disease stress, ammonia levels, how and time of feeding, water, temperature, light, noise, physical form, and anti-nutritional factors. Factors that affect the value of Feed Conversion Feed (FCR) are genetic basis, type of feed used, feed additives used in feed, maintenance management, and environmental temperature. In broilers, males are more efficient in converting feed into meat and therefore have faster growth than females. The more mature the chicken, the Feed Conversion Ratio (FCR) value will be greater because the chicken will eat more to maintain body weight, so the use of protein is 80% to maintain large body weight and 20% for growth, so that feed efficiency becomes less good. According to Muharliien, et al [6] that several things that affect FCR are the quality of day old chick (DOC) seeds, nutritional quality (water, feed), quality of maintenance management, and cage quality.

3.4 The Effect of Closed House Cage Type on Mortality

Mortality is a term used to indicate the number of chickens that die during broiler rearing. In good commercial maintenance, the management is expected to be between 2-5% mortality. Some of the factors that affect the degree of depletion are environmental hygiene, sanitation of cage equipment, environmental temperature and disease.

Based on the analysis of the data it shows that the influence of cage type has highly significant effect on mortality ($P < 0.01$). The average kept in modern closed house cages has average mortality of 3.927 ± 0.786 and semi-closed houses ranged of 5.369 ± 1.247 . The mortality rate in modern closed house cages is lower and better than semi-closed house cages.

This is in accordance with the opinion Palupi [10], which states that the factors that affect mortality or death are environmental, genetic and disease. Mortality rates can also be reduced by controlling chicken health, controlling the cleanliness of feed and drinking places, separating diseased chickens from healthy chickens. Widodo, et al [3] added that it is inevitable that at the time of rearing there are only broilers that die.

3.5 The Effect of Closed House Cage Type on Performance Index

Package, et al [11] stated that the production index (IP) is one of the criteria that can be used as an indicator to determine the success of broiler rearing. The greater the broiler production index (IP), the better the performance of chickens and the more efficient the use of feed. The production index (IP) can be used as a production reference because it not only considers the final body weight and feed conversion but also considers the percentage of the number of livestock that live and the length of maintenance. If the production index (IP) value is lower than the standard, it is highly recommended to evaluate the implementation of maintenance management.

Based on the analysis of data it shows that the influence of cage type has a highly significant effect ($P < 0.01$). On the Index of Production /IP. The average IP in modern closed house cages is $380.02 \pm 16,622$ compare to $339.65 \pm 17,177$ in semi-closed houses. The achievement of the Index of Production in modern closed house cages is better than semi-closed house cages. According to Widodo, et al [3] with the achievement of IP 380.02 in modern closed house cages is considered as special category, while IP in semi-closed house cages with value of 339.65 is considered in the good category. This is in the opinion of According to Widodo, et al [3] added that in broiler farming business, success can be assessed from the achievement of the production index because this indicator has included the number of chicken deaths, body weight, Feed Conversion Ratio (FCR) and harvest age.

4 Conclusion

Production performance of broiler farming business plasma cage farmers of modern closed house is better and more efficient than semi closed house in terms of feed conversion, mortality and index of production, but the feed consumption and final body weight of the two cage system are same. Mortality (5.369%) and performance index (339.65).

References

1. Suasta, I. M., Mahardika, I. G., & Sudiastara, I. W. 2019. Evaluasi Produksi Ayam Broiler Yang Dipelihara Dengan Sistem Closed House. *Majalah Ilmiah Peternakan*, **22**(1), 21-24.
2. Hidayat, A., Sarjana, T. A., & Kismiati, S. 2020. Perubahan iklimatmik Amonia pada Zona Berbeda dalam Kandang Closed House Ayam Broiler di Musim Kemarau terhadap Tampilan Karkas. *Jurnal Sain Peternakan Indonesia*, **15**(1), 60-66.
3. Widodo, E., Pradikdo, B.A., Ardilla, Y. N. N., Ramadhan, H. M. dan Purnama, N. W. 2021. Teknis, Manajemen dan Desain Penelitian Ayam Pedaging. Media Nusa Creative. Malang.
4. Lesson, S. and J. D. Summer. 2000. Production and Carcass Characteristic of The Broiler Poult. *sci*. **59**: 786-798.

5. Krisnawati, I. S., Rokana, E., & Lisnanti, E. F. 2018. The Effect of Light Dyes on Phase Layer Performance in Closed House Cage System. *Jurnal Ilmiah Fillia Cendekia*, **3**(2), 31-34.
6. Muharlien, Edhy S., Adelina H., Heni S. 2017. *Ilmu Produksi Ternak Unggas*. UB Press.
7. Wasti, S., Sah, N., & Mishra, B. 2020. Impact of Heat Stress On Poultry Health and Performances, and Potential Mitigation Strategies. *Animals*, **10**(8), 1266.
8. Nugraha, Y. A., K. Nissa, N. Nurbaeti, F. M. Amrullah, dan D. W. Harjanti. 2017. Pertambahan Bobot Badan dan Feed Conversion Rate Ayam Broiler yang Dipelihara Menggunakan Desinfektan Herbal. *J. Ilmu-Ilmu Peternakan*. **27** (2):19 – 24.
9. Umam, M. K., H. S. Prayogi dan V. M. A. Nurgiartiningsih. 2016. Penampilan Produksi Ayam Pedaging Yang Dipelihara Pada Sistem Lantai Kandang Panggung Dan Kandang Bertingkat. *Jurnal Ilmu-Ilmu Peternakan* **24**(3):79 – 87.
10. Palupi, R. 2015. Manajemen Mengatasi Heat Stress Pada Ayam Broiler Yang Dipelihara Dilahan Kering. In *Prosiding Seminar Nasional Lahan Suboptimal*, Palembang: 1-9.
11. Pakage, S., Hartono, B., Fanani, Z., and Nugroho, B. A. 2015. Analysis of technical, allocative and economic efficiency of broiler production using closed house system in Malang District of East Java Indonesia. *Livestock Research for Rural Development*, **27**(9), 1-8.