The Effect of Feed Variation on *Jowo Super* Chicken *(Gallus domesticus)* Growth in the Integrated System of Crops – Livestock – Fish

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ABSTRACT
The need of people's animal protein increases every year. One of the alternative sources of animal protein that can be easily obtained is Jowo Super chicken (*Gallus domesticus)*, a hybrid resulting from Kampong chicken and laying hens. However, the high cost of the chicken food causes hardships for breeders in the process of achieving production efficiency whereas it contributes 60%-70% of the whole production cost. One of the ways that can be used and be the solution in the effort to suppress the food and production cost is by applying the Integrated System of Crops – Livestock – Fish. This research has the purpose to find the effect on the feed variation on Jowo Super chicken *(Gallus domesticus)* based on the treatments towards each food variation. This research was done in Biological Physics Laboratory of Faculty of Agricultural Technology Universitas Gadjah Mada. The livestock used in this research are 32 Jowo Super chicken (*Gallus domesticus)* aged 3 weeks at the start of the research and 8 weeks at the end of the research. The chickens were placed inside 4 cages with each containing 8 chickens as replications. This research used Completely Randomized Design (CRD) with 4 treatments and 8 replications**.** The variations of chicken foods are i) 100% commercial food, ii) 50% commercial foods, 30% BSF maggot *(Hermetia illucens)*, 20% mustard waste (*Brassica rapa L)*, iii) 50% BSF maggot *(Hermetia illucens)*, 30% commercial food, 20% mustard waste (*Brassica rapa L)*, iv) 100% BSF maggot *(Hermetia illucens)*. The result of this research is that the P2 treatment has the most optimum level of growth efficiency in chickens.

Keywords: *Jowo super* chicken, integrated agricultural system, nutrition balance, chicken food alternatives, BSF maggot *(Hermetia illucens)*

1. INTRODUCTION

The need for protein from animal in Indonesia is increasing every year. According to Indonesian Statistic Bureau (BPS), the average of protein consumed by Indonesian population is increased by 21.04% in 2019[2]. The increase of protein needs in Indonesia is caused by an increase of it population and income levels and also increased public awareness of the fulfillment of balanced nutrition. One source of animal protein that is easily obtained is chicken meat which can comes from *Jowo Super* chicken *(Gallus domesticus)*.

Jowo Super chicken has great potential to be developed because it benefits. The maintenance of domestic chicken especially *Jowo Super* is relatively easier than broilers . *Jowo Super* chicken does not require a large management area. In the other hand, *Jowo Super* chicken tend to be more resistant to environmental conditions with poor management and has a relatively stable and relatively higher price compared to broilers chicken[8] The ease of care and management of domestic chicken causes the increasing domestic chicken meat production. According to Ministry of Agriculture (Kementan)[6] Meat production from domestic chicken has increased in the 2018-2020 period. In 2018, domestic chicken meat production was 287.2 tons, while in 2020 it's predicted to be 293.1 tons or increased by 2.05%.

The increasing of domestic chicken meat production must be balanced with improved facilities, good management, good maintenance, and improved feed

quality. Feed is one of the most important factors in optimizing chicken productivity. Feed should be sustainable. Chicken feed that is often used by farmers is commercial feed. Commercial feed is feed that is prepared based on the nutritional needs of livestock so that is can produce optimal development and health of livestock. Commercial chicken feed should contain the nutrients that needed by chickens such as protein, carbohydrates, fat, vitamins and minerals and can supply nutritional need in a balanced way[12]. However, there are problems faced by farmers that is the high cost incurred to obtain commercial feed.

Feed is one of the cost components that has the largest percentage in livestock business. Feed has contribution of 60%-70% of the total production cost in chicken farming business[11]. The big number of percentage is due to the imported raw materials used and also influenced by the increasing corn prices in the international market. As a result, overall production costs is increased by 18-20% and created an imbalance between operating costs and selling prices[13]. One of the solution that can be applied in reducing feed costs and production costs is to apply an integrated farming system. According to Handiani[4] integrated farming system can reduce production costs by 10-20%. Integrated farming system can also ensure the availability of animal feed by utilizing crop waste and other wastes generated in it system[5]. In other words, integrated farming system can increase the efficiency of each farm. This is because integrated farming utilizes inputs from within the system (internal inputs) so as to reduce dependence on inputs from outside the systems (external inputs). The concept that used in integrated system is to link two or more separate farming sub-systems. Each of these sub-systems will produce output in the form of waste which will then become input material for other sub-systems[10] .

The current study examines the growth of domestic chickens by providing different input variations in chicken farm. Input comes from maggot *(Hermetia illucens)* output and mustard *(Brassica rapa L.)* farming output. This research has the purpose to find the effect on the feed variation on Jowo Super chicken *(Gallus domesticus)* based on the treatments towards each food variation.

2. METHODS

2.1 Materials

The chickens used in this study were 32 *Jowo Super* chicken *(Gallus domesticus)* aged 3 weeks at the beginning of the study. The study used 4 cages according to treatment with a size of 1.5 m x 0.75 m which was equipped with a place to feed and drink. Each cage contains 8 chickens.

2.2 Husbandry

The research was carried out in the biological physics laboratory, Faculty of Agricultural Technology, Universitas Gadjah Mada. Room temperature and humidity in the range of 28^{o}C with 81% humidity. Each chicken is given a colored bracelet that shows and indicates the chicken number. In this study, chickens were not sexed. The prevention of disease in chickens is done by giving the Gumboro B vaccine when the chicken is 30 days old.

2.3 Feeding and Drinking

Feed is given as much as 52 grams/chicken/day at the age of 3 weeks and increases every week. (table 1). Feeding is given twice a day in the morning and evening. The treatments are described below :

A. Treatment I (P1) the feed was 100% commercial feed BR I crumble from Comfeed.
B. Treatment II (P2) was a mixture of 50% commercial feed, 30% BSF maggot, and 20% mustard greens.
C. Treatment III (P3) was a mixture of 50% BSF maggot, 30% commercial feed, and 20% mustard greens.
D. Treatment IV (P4) is 100% BSF maggot.

Drinking is given *ad libitum* with a drinking container

Table 1. Chicken feed needs every week

Age	Feed requirement
4-5 week	52 gram chicken^{-1} day $^{-1}$
5-6 week	64,5 gram chicken^{-1} day $^{-1}$
6-7 week	73 gram chicken^{-1} day $^{-1}$
7-8 week	80,5 gram chicken^{1} day $^{-1}$

Table 2. Chicken feed requirements for each treatment (grams chicken^{-1}day^{-1})

Age (Week)	P1			P2			P3			P4		
	Commercial	Maggot	Mustard	Commercial	Maggot	Mustard	Commercial	Maggot	Mustard	Commercial	Maggot	Mustard
4-5	52	0	0	26	15.6	10.4	15.6	26	10.4	0	52	0
5-6	64.5	0	0	32.25	19.35	12.9	19.35	32.25	12.9	0	64.5	0
6-7	73	0	0	36.5	21.9	14.6	21.9	36.5	14.6	0	73	0
7-8	80.5	0	0	40.25	24.15	16.1	24.15	40.25	16.1	0	80.5	0

2.4 Data Analysis

2.4.1 Daily Weight Gain (DWG)

The growth of chicken body weight was measured every week from 3 weeks to 8 weeks (35 days). The growth performance of chicken body weight can be measured using the following equation

$$DWG = \frac{Chicken\ weight\ (T1-T0)}{T} \quad (1)$$

Description :
DWG = Daily Weight Gain
T = Research time (days)

2.4.2 Feed Conversion Ratio (FCR) and Feed Efficiency

FCR is the ratio between the amount of ration consumed and the increase in body weight of chickens. Edjeng and Kartasudjana[3] defines FCR as follows.

$$FCR = \frac{Feed\ consumption\ (gram/chicken)}{Weight\ result\ (gram)} \quad (2)$$

While feed efficiency is a large percentage of the ability of feed that can be digested by chickens to increase its weight. The value of feed efficiency can be calculated by the following formula.

$$Efficiency = \frac{DWG}{Average\ feed\ consumption} x100\% \quad (3)$$

3. RESULT AND DISCUSSION

3.1 Feed Consumption

The feed consumption of each treatment was calculated every day by weighing the amount of feed to be given and weighing the remaining feed if any. The water is provided *ad libitum* and changed every day. The total feeding of each treatment during the study was 1890 grams/chicken with an average feed consumption of 54 grams/chicken with the assumption that the remaining feed in each treatment is the same.

3.2 Daily Weight Gain (DWG)

The average weight gain of chicken during the study (35 days) for each treatment can be seen in table 3.

Table 3. Data Observation on DWG of chickens

Treatment	Observation time (days)						DWG (grams/day)
	0	7	14	21	28	35	
P1	305.63	389.63	502.25	599.75	705.13	813.00	14.50
P2	339.50	405.38	511.88	617.75	745.88	849.88	14.58
P3	327.25	370.25	449.50	552.75	627.13	725.13	11.37
P4	309.88	306.38	343.88	399.75	479.75	534.75	6.43

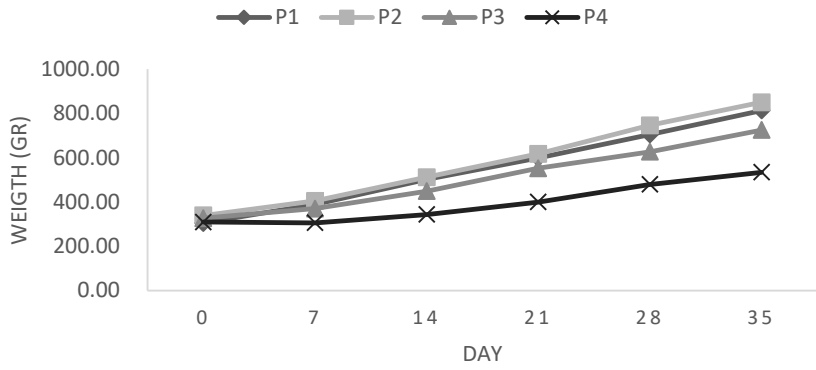

Figure 1. Graph of DWG of Chickens

The expected result of giving a variety of feeds for the growth of chickens is to find the right variety of feed so that it can benefit the breeder and the farm.

The growth rate of chickens for each treatment can be seen in Fig 2. to Fig 5. Based on the each figure, it can be seen that the growth rate of each treatment is shown by the equation y=ax+b. The growth rate of P1 is y = 14.616x. The growth rate of P2 is y=15.017x. The growth rate of P3 is y=11.687x. While the growth rate of P4 is y=6.9043x.

The weight gain of chickens can be calculated by knowing the weight of the chickens at the beginning of research until the end of research so that the value of weight gain is obtained every day (DWG).

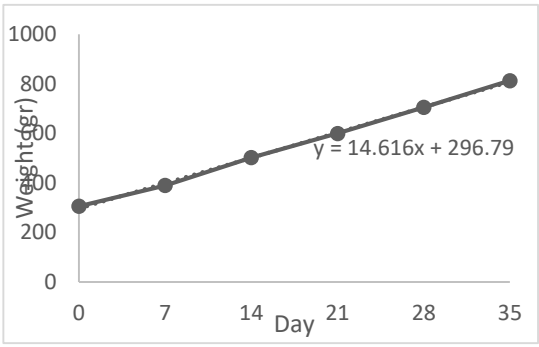

Figure 2. Growth rate of chicken (P1)

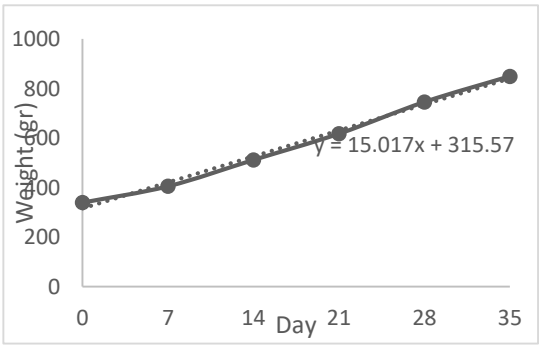

Figure 3. Growth rate of chicken P2

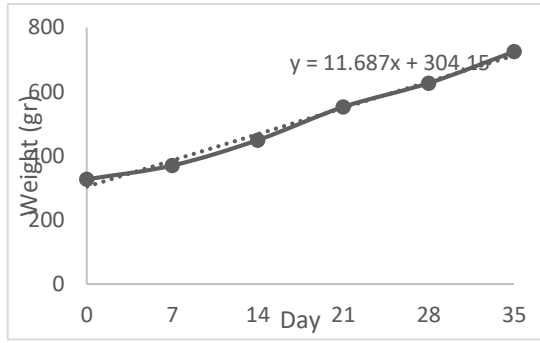

Figure 4. Growth rate of chicken P3

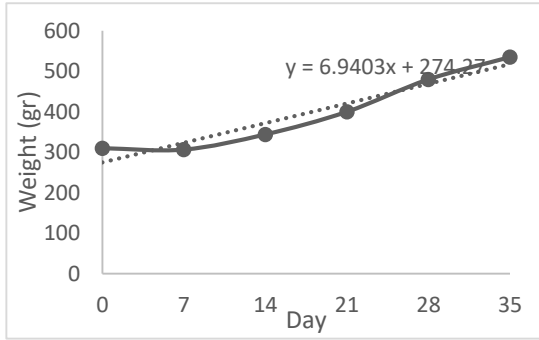

Figure 5. Growth rate of chicken P4

The value of DWG for studied chickens can be seen in table 3. The calculation of the DWG value is calculated by subtracting the average weight of the chickens at the end of the observation by the average weight of the chicken at the beginning and divided by the number of days of observation (35 days). The average DWG value for P1 is 15.40 grams. The average value of DWG for P2 is 14.58 grams. The average value of DWG P3 is 11.37 grams and the average value of DWG P4 is 6.43 grams. The differences in DWG value in each treatment can be caused by the differences in nutrient content in feed ingredients. It can be seen that the average value of DWG p4 has the lowest value compared to the value of DWG for other treatments. This can be due to the nutrients that contained in P4 are not sufficient for chicken so that even though feed consumption are

same as the other treatments, the DWG value for P4 is still low. Another thing that can cause P4 to have a low DWG value is because the nutrients contained in maggot can only meet one of the nutritional needs of chicken and cannot meet other nutritional needs.

In general, it appears that the DWG value for P2 is greater than the other treatments. This can be caused by the content of P2 feed which has better nutrition that other feed content and can also meet the nutritional needs for chicken growth. Thus, it can be concluded that by giving a feed mixture of 50% commercial feed, 30% maggot, 20% mustard greens, it can provide maximum chicken growth result.

3.3 Feed Convert Ratio (FCR) and Feed Efficiency

FCR is the ratio of the amount of feed consumed with body weight gain in a certain period of time[7]. FCR can be used to measure livestock productivity. The smaller FCR value indicates the less amount of feed used to produce one kilogram of meat. Meanwhile, the higher the FCR value, the more wasteful the feed used[3]. According to Nururrozi et al[9] FCR values for domestic chickens reared for 60 days is ranged from 4-6. Based on the table 5, the average values of P1,P2,P3 and P4 are 3.84; 3.78; 4.81; 8.54. The results showed that P2 had the lowest average FCR value compared to another treatments. Thus, the variation of P2 feed was able to improve the consumption of chicken feed and improve the FCR values.Although the value of P2 tends not to be too much different from the value of P1.

FCR value affects the level of feed efficiency. Based on table 5, it can be seen that P2 has a feed efficiency of 27% and is the highest level of efficiency compared to other treatments. This is in accordance with the statement submitted by Allama et al [1] who stated that the smaller the FCR value, more better the efficiency of using feed. This is because the chickens are more efficient in consuming feed to produce meat.

Table 5. Average DWG value, average feed consumption, FCR and feed efficiency

Treatments	DWG (grams)	Average Consumption	FCR Average	Feed Efficiency
P1	14.50	54.00	3.84	26.85
P2	14.58	54.00	3.78	27.00
P3	11.37	54.00	4.81	21.05
P4	6.43	54.00	8.54	11.90

4. CONCLUSION

The variation of P2 feed (50% commercial feed, 30% BSF maggot, 20% mustard greens) has a DWG value of 14.58 grams, with a feed efficiency level of 27%. This value is higher than the other treatments. The P2 treatment resulted in a smaller FCR value compared to other FCR value of other feed variation treatments. Thus the treatment of P2 feed variations is the best and most efficient treatment to be used as an alternative to chicken feed.

AUTHOR'S CONTRIBUTION

1. Leonardus Dwi K.B.P : Collected the data, performed the analysis, wrote the paper.
2. Umi Hapsari : Conceived and designed the analysis, supervisor.
3. Yudha Dwi Prasetyatama : Conceived and designed the analysis.
4. Lilik Soetiarso : Conceived and designed the analysis.

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