International Journal of Veterinary Science and Agriculture Research
Volume 4 Issue 2, March-April 2022
ISSN: 2582-4112, Available at www.ijvsar.com

Effect of the introduction of maggot meal in the diet of Malagasy chicks, in 2021

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Abstract: The productivity of local Malagasy chicks fed with maggot meal was evaluated over a period of 9 weeks. During the experiment, 9 chicks were divided into 3 treatments with 3 chicks per batch. First Treatment T_0 represented the control batch with no maggot meal added to the diet; 5% and 10% maggot meal was added to T_1 and T_2. The batch that consumed a lot of maggot meal had a rapid weight gain compared to the others. The chicks of T_2 had 3.95 g daily weight gains against 3.08g and 2.66g for T_1 and T_0 respectively. There is no significant difference on the feed consumption of the chicks because p-value is higher than 0.005. The average feed consumption of each chick varied between 14g and 15g per day. For the feed conversion ratio, the treatment with high maggot content has a low feed conversion ratio. The maggot meal is very efficient for the growth of chicks and could replace expensive fish meal.

Keywords: *Growth, husbandry, Malagasy chick, Maggot meal, Protein, Madagascar*

I. INTRODUCTION

The population growth of developing countries is galloping and contrasts with their economic development. This problem could be solved by controlling agriculture and livestock [1]. The breeding of short-cycle species is certainly one of the solutions to improve the protein coverage of populations. Among these species, poultry is the one whose breeding requires few means and can be practiced by all socio-professional categories [2], [3], [4].

In Madagascar, the local breed of chicken remains the first choice of Malagasy farmers and consumers and accepted by all for their taste. This breed has a slow growth. Traditional poultry farming is practiced by most Malagasy breeders. To have more meat production in poultry farming, it is necessary to improve the poultry feed

which is rudimentary. However, in the event of an unceasing increase in the price of poultry feed on the market, it is important to find a substitute product that is as rich in nutrients, less expensive and available locally to feed poultry [5] The maggot (housefly larva) is an abundant source of animal protein that is not well known to most farmers [6]. The maggot is very easy to raise and more profitable. The problem that arises is to know the effect of using maggot meal in the diet of the Malagasy chicken. The only way to answer this question is to follow the growth of chicks fed with feed containing maggot meal. It is in this optics that this subject will carry out.

II. Material and Methods

2.1 Experimental animals

Experiments were performed using 9 chicks. Chicks were divided into three batches of three chicks. The experiment started from the first day of age of the chicks until 9 weeks. The chicks were fed with local feeds mixed manually on the spot (Table 1). At the beginning of the experiment, the average weight of the chicks at the start was 28g.

The production of maggots is very important in this study. The larvae are used to be ground into powder which is then mixed with other raw materials to make feed for the chicks.

2.2 Maggot production

Organic wastes (manure, dung, rumen contents...) were deposited in containers and exposed to the open air to attract mosquitoes to lay eggs in them [7]. This environment must be moist enough for the fly to lay its eggs on this substrate. To ensure optimal development of the larvae, the water supply must be daily. The production of maggots was achieved by culturing housefly larvae in a medium of cattle manure. They mature in 3 days, then are harvested, dried and ground to form maggot meal [8].

Figure 1: Manure and dung substrate

Figure 2: Maggot extraction

Figure 3: Drying of maggot

2.3 Rearing of the chicks

The breeding takes place in a courtyard of 1m width and 4m length. This brooder is divided into three for each batch of chicks. Each brooder is equipped with a watering trough and a feeder of local manufacture. All chicks were marked with a numbering to differentiate them. An electronic scale is used to weigh the feed and the chicks. All the raw materials used for the production of feed were weighed and mixed manually, as well as the weighing of the feed given to the chicks and the weighing of all the chicks.

2.4 Feed distributions

The chicks receive two rations per day, the first in the morning and the second in the evening. The food ration and the drinking water were served *ad libitum* to the chicks.

2.5 Formulation of the food rations

The materials used for the composition of the feeds are maggot meal, corn grain, premix mineral and vitamin supplements (MVS), lysine, Calcined Bone Powder (CBP) and cooking salt.

Table 1: Composition of the experimental feed

Ingredients	**Ration Composition (%)**		
	T_0	**T_1**	**T_2**
Maize	96,3	91,3	86,3
Maggot meal	0	5	10
Mineral and vitamin supplements	0,2	0,2	0,2
Calcined Bone Powder	2,5	2,5	2,5
Common salt	0,5	0,5	0,5
Methionine	0,2	0,2	0,2
Lysine	0,3	0,3	0,3
Total	**100**	**100**	**100**

T_0, T_1 T_2: different treatments

2.6 Growth control of the chicks

During the experiment, the growth of the chicks is controlled by an individual weighing, every day and at the same time around 7 pm. This weighing allows determining the average daily gain the feed conversion ratio (FCR) and the feed consumption of the chicks.

2.7 Statistical analysis

At the beginning of the experiment, individual body weight of each bird chicks was recorded and every week thereafter, then the feed intake was re-recorded every week. The weight gain and feed conversion ratio of the bird chicks were recalculated every week.

The data collected were entered using Excel software. The statistical analysis was done with XLSTAT 2014 software. The comparison of the observed means between the different food treatments was carried out by the Levene test, comparison of variance K samples. Statistical significance is expressed at probability $p < 0.05$ [9].

III. Results

The evolution of the weight of the chicks is controlled by a daily weighing but the calculation of the average weight is done weekly. The initial average weight of the chicks is 33g for T_0, 29g and 25.6g for T_1 and T_2. At the end of the experiment, this average weight is reversed, the batch with a high maggot rate gained more weight.

This table shows the average weekly weight of chicks in each treatment.

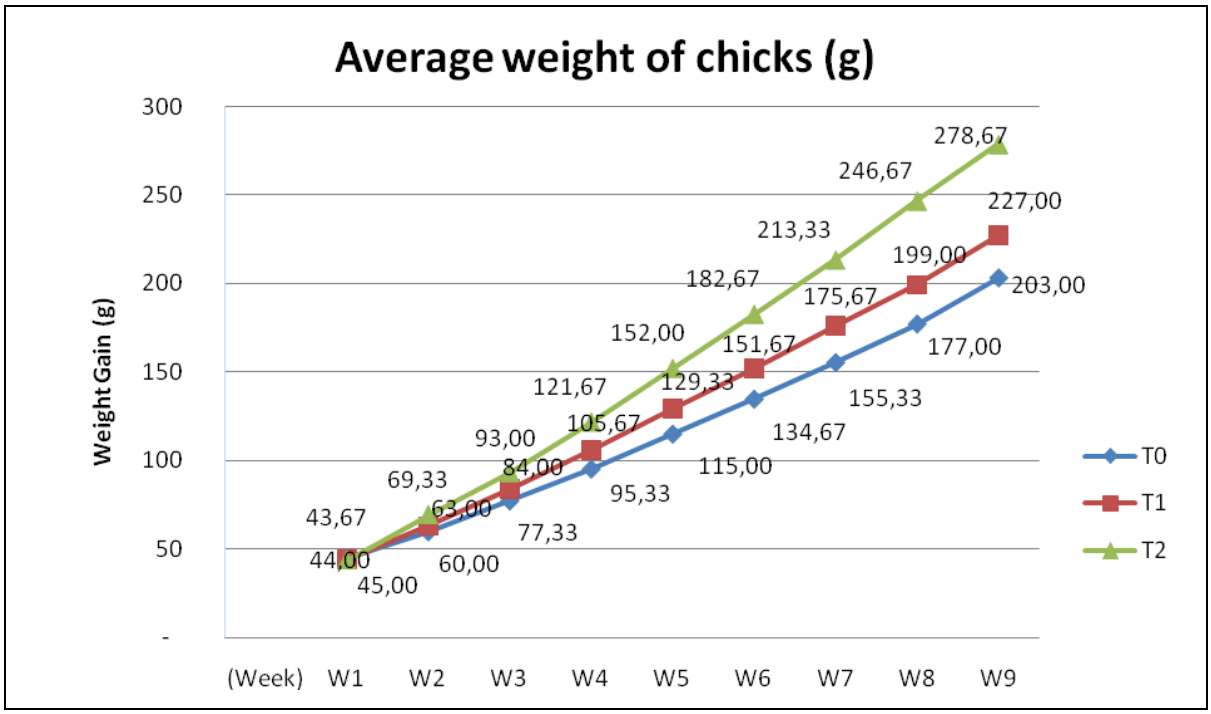

Figure 4: Average weekly weight gain of chicks subjected to different treatments

W: week, T_0, T_1 T_2: different treatments

During the test, sex differentiation is not considered. According to this table, chicks that consumed more high maggot rate gained more weight. The average weight of chicks was significantly different ($p<0.0001$).

It was found that the chicks that consumed more maggots had a rapid growth compared to the other batches with a final average weight of 203g±12.165, 227g±7.54 and 278.66±28.30 concerning the 3 treatments of T_0, T_1 and T_2.

The weight gain of the chicks is increased until the end of the experiment. The average weight gain for each batch was 170g for T_0, 197g for T_1 and 253g for T_2. Comparison of the mean between these three batches showed that the average daily gain was significantly different ($p<0.001$). The best weekly gains were observed in T_2 with 10% maggots in the ration (33.33±6.42).

The average daily gain obtained during the 62 days of experimentation was 3.4g for T_0; 4.02g for T_1; and 5.16g for T_2.

Table 2: Average gain (g/week)

Average gain (g/week)			
Period (week)	**T_0**	**T_1**	**T_2**
W0	12.00 ± 1.73	14.00 ± 0.00	18.00 ± 1.00
W1	15.00 ± 1.73	19.00 ± 2.64	25.66 ± 3.51
W2	17.33 ± 2.51	21.00 ± 1.00	23.66 ± 2.08
W3	18.33 ± 3.05	21.66 ± 1.52	28.66 ± 4.04
W4	19.33 ± 1.15	23.66 ± 0.57	30.33 ± 5.13
W5	19.66 ± 4.04	22.33 ± 2.51	30.64 ± 2.08
W6	20.66 ± 2.08	24.00 ± 1.00	30.66 ± 4.93
W7	21.66 ± 5.50	23.33 ± 0.57	33.33 ± 6.42
W8	26.00 ± 4.35	28.00 ± 1.00	32.00 ± 4.58

W: week, T_0, T_1, T_2: different treatments

IV. Discussion

From the first day to the end of the experiment, the chicks keep increasing in weight. The compositions of the feed given to the chicks are identical except for the maggot content. The batch (T_2) that received the feed with high maggot content showed a good weight evolution (25 to 278g). T_1 with 5% of maggot increased from 30 to 227g and for the T_0 with 0% of maggot evolved from 33 to 203g. This result can be explained by the fact that, maggot meal is an alternative source of protein that can be used to substitute other valuable limited protein sources of animal origin in poultry feed. This is in accordance with the work of Bouafou et al. [10, 11].

Product of analysis showed that maggot meal had no significant effect (P> .005) on the consumption of chicken ration [12]. Several parameters give differences factors essential to the growth of the chicken. The maggot has a better nutritional source, especially a high protein rate with a rate of 59.65% [13].

During the experiment, the food consumption of the chicks evolves according to their age. The individual food consumption of the chicks is between 8 and 37g per day. There was no difference in feed consumption because the calculated p-value was above the 0.05 significance level ($p>0.05$). The average feed consumption of chicks in each batch ranged from 14g to 15g per day. On the food consumption, the first week of age the chicks consume little but without waste. But when the chicks grow up, there is a sudden increase of food consumption and a waste of food (scattering of food on the litter).

During the first week, it was about 8 to 37g/chick/week and increased gradually to reach 253g, 197g and 170g respectively in the chicks fed with T_2, T_1 and T_0 diets at the end of the starting period. The chicks in T_2 performed better. At the end of the experiment, the average daily gain of the chicks of each batch was significantly different ($p<0.05$). The weight gain increased with the maggot content of the feed [14].

The first week of age, the chicks consume little and without loss. But when the chicks grow up, there is a sudden increase of food consumption and also a waste of food. The numbers of chicks are still the cause of this superiority in feed consumption. Twice daily feeding is also one of the major factors that increase this feed consumption of chicks. According to this change of feed, the temperature is influenced this food consumption because if the season is cold the chicks consume a lot. While, this study was conducted during the cold season.

Several reasons can determine the causes of the differences in average daily gain, which are the quality of the feed (granulometry); the rate of maggots in the ration and different rearing environments and the breed of chicks used.

The FCR value of malagasy chicks fed T0, T1 and T2 were 5.45, 4.71, and 3.66, respectively. These results showed a similar pattern as previous studies of Hwangbo J., et al [15], which showed a significant differences ($P<0.05$) regarding to the suplementation of maggot meal on the ratio of feed conversion of chicks.

V. Conclusion

Beard & Sands (1973) [16] and Hussein et al. (2017) [17] pointed out that *M. domestica* is one of the most active flies in the decomposition of animal dung and more specifically in the aerobic degradation of poultry faeces. According to Beard & Sands (1973), poultry droppings provide adequate protein sources for maturation of the fly's eggs but also for larval development.

The effect of incorporating maggot meal in chicken feed is effective on chick growth because chicks that receive the ration plus maggot meal grow rapidly compared to batches that do not have maggot meal in their feed.

Several optimizations on the use of the maggot, could be necessary to have a good result. However, maggot meal should be used as only as a supplementary food as a replacement for highly priced ingredient as fishmeal in chicken feed formulation because they are rich in protein. Maggot supplementation could reduce commercial ration fed to chickens.

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