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GROWTH PERFORMANCE OF 'SUPER NATIVE CHICKEN' TREATED WITH A SUPLEMENTATION OF MAGGOT FLOUR OF *DROSOPHILA MELANOGASTER* IN RATION

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Abstract

The role of insects as natural resources could be used by farmer as animal feed has been starting to get important attention in livestock sciences. This research aimed to study the growth performance of super native chickens that treated with D. melanogaster maggot flour supplementation. A total of 64 super native chickens (DOC) reared until they are eight weeks old. This study used a completely randomized design (CRD). Experimental animals were divided into four groups according to the level supplementation treatment: T0 0%; T1 0.25%; T2 0.5%; and T3 0.75%. Each group divided into four units of replication consisted of 4 chickens. The variables observed were total of feed consumption, body weight and feed conversion ratio. The results showed that the effect of treatment on feed consumption was non-significant (P>0.05) while the effect on body weight and FCR value were significant (P<0.05).

Key words*: growth performance, insect, maggot, native chickens, natural resource.*

INTRODUCTION

Insects are abundantly available in nature. Many of insects have great potential to be used as animal feed (Chia et al., 2019) and van Huis (2016) because of they contain nutrients that are important for the development and production of livestock, especially for poultry (Toar et al., 2015).

Utilization of insects as feed could reduce the use of food that is needed directly by humans globally, especially as the population continues to increase.

The potential of insects to be used in livestock improvement (Rumokoy et al., 2020; Toar et al., 2021) especially to be applied in animal feed production (Chaalala et al., 2018) is inseparable from various factors such as: socio-cultural aspects (Hartman et al., 2015), ecological sustainability (Chavez, 2021; Premalatha et al., 2011), regulations in the countries concerned, human skills, and awareness of farmers to reduce the use of human food as animal feed.

Foodstuffs are more suitable for use only for humans, especially in difficult times where the distribution of food for the world's population is experiencing obstacles both in terms of quantity and other aspects. Rumokoy et al. (2019) stated that this effort was wise in suppressing competition between humans and livestock in using food.

Various scientific reports indicated the role of insects in the development of poultry farming: Allegretti et al. (2018) reported the use of insects in the chicken farming industry, as stated by Toar et al. (2020) that during a pandemic the use of insects can act as animal feed.

The use should be aligned with efforts to consider its impact on the environment in a sustainable manner. This is in line with the various opinions expressed by Tomberlin et al. (2015), Ratnadass et al. (2012), that linked to

Yen (2009) that concerned with environmental protection when carrying out insect production activities as a source of livestock nutrients. In other side Abro et al. (2020) and Smetana et al. (2016) considered the importance connected to socio-economic and environmental impacts of the application of insects as animal feed. Beside that Rumokoy et al. (2018) reported that certain proteins from insects play a role in livestock health

In a study of bio-chemical compounds conducted by Church & Robertson (1966) showed the nutrient content of *D. melanogaster* larvae in several life cycles.

In essence, many of insect species are easy to breed and spread throughout the world.

Based on the above background, we have conducted a study concerning use of *D. melanogaster* larva flour (DMF) as feed supplement in ration on growth performance of chickens.

MATERIALS AND METHODS

This study used a total of 64 day-old-chick of 'super native chicken'. The chickens were cultivated until 8 weeks old in a battery-system cage, formed of 16 units where 4 chickens placed in each unit. The chickens were divided in four groups according to the *D. melanogaster* larva flour (DMF) treatment levels in ration: T0 0.0%; T10 0.25%; T2 0.5%; T3 0.75% which was added in a 100% of ration formed.

Insect larvae come from the eggs of wild mother insects. Larvae were cultured in transparent plastic cylindrical containers with a diameter of 8.5 cm and a height of 14 cm.

Wild adults come from the environment and are allowed to lay eggs in cylindrical containers and are equipped with food media and ovipositing. Each container was equipped with an attractant from fresh ripe papaya flesh which is left for three days and placed in a shady open space, on the fifth day the larvae begin to grow.

Each group constituted with 4 chickens. The experiment was designed by using a CRD (completely randomized design). The parameters measured were total of feed consumption, final body weight, and feed conversion ratio. The ration including drink water were *ad libitum* distributed to the animals.

RESULTS AND DISCUSSIONS

The results of the study regarding the consumption of rations, as shown in Figure 1, showed that the treatment of supplementation with DMF up to 0.75% into the ration had no significant effect ($P>0.05$) on the accumulation of feed consumption of experimental chickens.

The application of supplementation to this level had no impact on the palatability of the chickens so the amount of feed consumed was not significantly different in the four experimental groups. These results are in line with various scientific reports regarding the use of insect larvae meal in diets.

This result is in line with the study consumption (Allama et al., 2012) of using insect meal of *Alphitobius diaperinus* larvae into rations up to 2% which did not have a significant effect on broiler.

Supplementation had a significant effect on body weight of experimental chickens ($P<0.05$). The test between treatments showed that the body weight of the T3 treatment group was significantly higher than that of the T0, T1 and T2 treatments.

These results indicate that the DMF supplementation level of up to 0.75% (T3) in ration increased the body weight of experimental chickens by an average of 688 g. This supplementation supports livestock health because there have not any experimental chickens were sick during the observations carried out in this study. Rumokoy et al. (2021) indicated a potential immunity of insect to animal studied.

This performance was most likely conducted by the nutrient compounds in DMF such as methionine and other specific amino acids. This is related to the report of Parkhitko et al. (2016) and Cox et al. (2017) which shows the metabolic role of various chemical compounds, including the role of nutrigenomics in the body of *D. melanogaster* (Baenas & Wagner, 2019).

The application of DMF as feed supplement in chicken ration caused a significant effect on feed conversion ratio value ($P<0.05$).

The test between treatments showed that the FCR value in the T3 (2.03) treatment group was significantly better than the other treatments in the T0 (2.23), T1 (2.24) and T2 (2.21) groups.

Bovera et al. (2015) showed a positive role in broiler FCR by using a feed additive made from several insect species. This role is related to the research results of Oonincx et al. (2015).

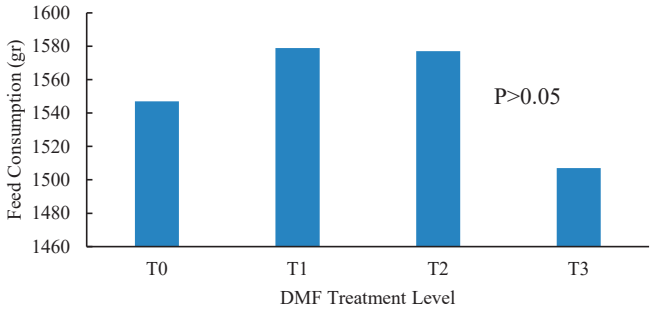

Figure 1. Accumulative of feed consumption of chickens

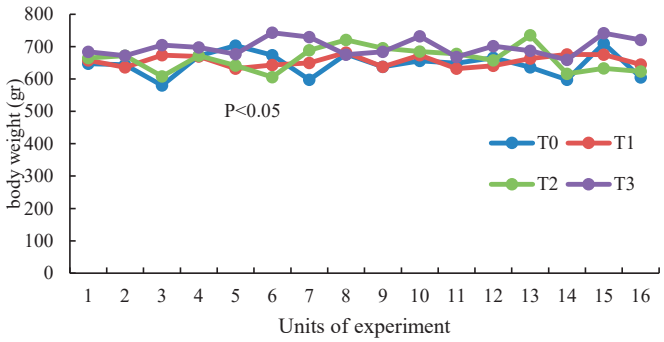

Figure 2. Body weight of experiment chickens

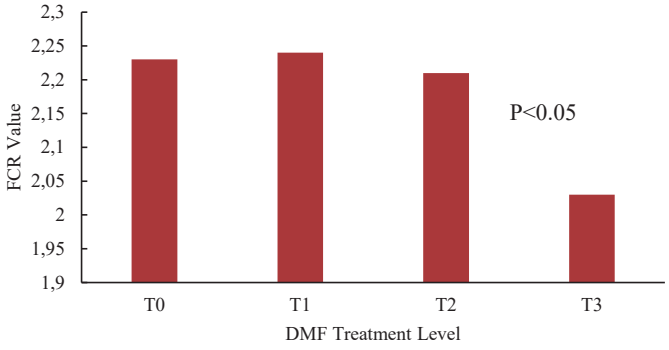

Figure 3. Feed Conversion Ration value of experiment chickens

CONCLUSIONS

Insects as natural resources can play an important role in the development of livestock production, especially poultry. The distribution of insects that are spread in a cosmopolitan manner that is able to adapt to various environmental conditions that make it easy for insects to be cultivated, especially *Drosophila melanogaster* insects.

RECOMMENDATIONS

The results of this basic research support efforts to utilize natural resources from insect organisms, but in practice it must always be aligned with attention to maintaining environmental sustainability. The next step of this research could be to explore the important and essential chemical components of D. melanogaster larvae that affect the growth performance of chickens.

REFERENCES

Abro, Z., Kassie, M., Tanga, C., Beesigamukama, D., & Diiro, G. (2020). Socio-economic and environmental implications of replacing conventional poultry feed with insect-based feed in Kenya. *Journal of Cleaner Production*, *265*, 121871.

Allama, H., Sjofjan, O., Widodo, E., & Prayogi, H. S. (2012). Pengaruh penggunaan tepung ulat kandang (Alphitobius diaperinus) dalam pakan terhadap penampilan produksi ayam pedaging. *Jurnal Ilmu-Ilmu Peternakan (Indonesian Journal of Animal Science)*, *22*(3), 1-8.

Allegretti, G., Talamini, E., Schmidt, V., Bogorni, P. C., & Ortega, E. (2018). Insect as feed: An emergy assessment of insect meal as a sustainable protein source for the Brazilian poultry industry. *Journal of Cleaner Production*, *171*, 403-412.

Baenas, N., & Wagner, A. E. (2019). Drosophila melanogaster as an alternative model organism in nutrigenomics. *Genes & nutrition*, *14*(1), 1-11.

Bovera, F., Piccolo, G., Gasco, L., Maron o, S., Loponte, R., Vassalotti, G., ... & Nizza, A. (2015). Yellow mealworm larvae (*Tenebrio molitor*, L.) as a possible alternative to soybean meal in broiler diets. *British poultry science*, *56*(5), 569-575.

Chaalala, S., Leplat, A., & Makkar, H. (2018). Importance of insects for use as animal feed in low-income countries. In *Edible insects in sustainable food systems* (pp. 303-319). Springer, Cham.

Chavez, M. (2021). The sustainability of industrial insect mass rearing for food and feed production: zero waste goals through by-product utilization. *Current Opinion in Insect Science*, *48*, 44-49.

Chia, S. Y., Tanga, C. M., van Loon, J. J., & Dicke, M. (2019). Insects for sustainable animal feed: Inclusive business models involving smallholder farmers. *Current Opinion in Environmental Sustainability*, *41*, 23-30.

Church, R. B., & Robertson, F. W. (1966). A biochemical study of the growth of Drosophila melanogaster. *Journal of Experimental Zoology*, *162*(3), 337-351.

Cox, J. E., Thummel, C. S., & Tennessen, J. M. (2017). Metabolomic studies in Drosophila. *Genetics*, *206*(3), 1169-1185.

Hartmann, C., Shi, J., Giusto, A., & Siegrist, M. (2015). The psychology of eating insects: A cross-cultural comparison between Germany and China. *Food quality and preference*, *44*, 148-156.

Oonincx, D. G., Van Broekhoven, S., Van Huis, A., & van Loon, J. J. (2015). Feed conversion, survival and development, and composition of four insect species on diets composed of food by-products. *PloS one*, *10*(12), e0144601.

Parkhitko, A. A., Binari, R., Zhang, N., Asara, J. M., Demontis, F., & Perrimon, N. (2016). Tissue-specific down-regulation of S-adenosyl-homocysteine via suppression of dAhcyL1/dAhcyL2 extends health span and life span in Drosophila. *Genes & development*, *30*(12), 1409-1422.

Premalatha, M., Abbasi, T., Abbasi, T., & Abbasi, S. A. (2011). Energy-efficient food production to reduce global warming and ecodegradation: The use of edible insects. *Renewable and sustainable energy reviews*, *15*(9), 4357-4360.

Ratnadass, A., Fernandes, P., Avelino, J., & Habib, R. (2012). Plant species diversity for sustainable management of crop pests and diseases in agroecosystems: a review. *Agronomy for sustainable development*, *32*(1), 273-303.

Rumokoy, L., Posangi, J., Toar, W. L., & Lopez-Aban, J. (2018). An expectation of bio-resource function against parasite infection on animal health. *Scientific Papers. Series D. Animal Science*, *61*(1), 216-219.

Rumokoy, L., Adiani, S., Kaunang, C., Kiroh, H., Untu, I., & Toar, W. L. (2019). The wisdom of using insects as animal feed on decreasing competition with human food. *Scientific Papers: Series D, Animal Science-The International Session of Scientific Communications of the Faculty of Animal Science*, *62*(1).

Rumokoy, L., Assa, G., Moningkey, S., Manangkot, H., Sumolang, C., & Toar, W. L. (2020, May). Thoraxial Antigen-G of House Fly *Musca domestica* (Muscidae: Diptera) on Serum Immunoglobulin Level of Goats. In *International Conference and the 10th Congress of the Entomological Society of Indonesia (ICCESI 2019)* (pp. 165-168). Atlantis Press.

Smetana, S., Palanisamy, M., Mathys, A., & Heinz, V. (2016). Sustainability of insect use for feed and food: Life Cycle Assessment perspective. *Journal of cleaner production*, *137*, 741-751.

Toar, W. L., Rumambi, A., Waani, M. R., & Rumooy, L. (2021). Accumulation of ITP-Hi and growth performance of *Hermetia illucens* prepupae reared in

two different media. *Scientific Papers: Series D, Animal Science-The International Session of Scientific Communications of the Faculty of Animal Science*, *64*(2).

Toar, W. L., Pudjihastuti, E., Rahasia, C. A., Kaunang, C., & Rumokoy, L. (2020). Development of Small-Scale Farming in North Sulawesi in Pandemic Covid-19 Situation. *Scientific Papers. Series D. Animal Science*, *63*(1).

Toar, Wisje Lusia, Jootje Warouw, Max Tulung, Marie Najoan, and Laurentius Rumokoy. "The Landing periodicity of *Stomoxys calcitrans* in rations, supplemented with citronella and papain on broiler health." *Scientif Papers Animal Science*, 59 (8), 322-325.

Tomberlin, J. K., Van Huis, A., Benbow, M. E., Jordan, H., Astuti, D. A., Azzollini, D., ... & Zheng, L. (2015). Protecting the environment through insect farming as a means to produce protein for use as livestock, poultry, and aquaculture feed. *Journal of Insects as Food and Feed*, *1*(4), 307-309.

van Huis, A. (2016). Edible insects are the future? *Proceedings of the Nutrition Society*, *75*(3), 294-305.

Yen, A. L. (2009). Edible insects: Traditional knowledge or western phobia? *Entomological research*, *39*(5), 289-298.