International Journal of Fauna and Biological Studies
Available online at www.faunajournal.com

IJFBS International Journal of Fauna And Biological Studies

ISSN 2347-2677
IJFBS 2020; 7(1): 25-28
Received: 07-11-2019
Accepted: 12-12-2019

I Wayan Sudarma
Bali Assesment Institut of Agricultural Technology, Indonesian Agency for Agricultural Research and Development, Ministry of Agriculture, Denpasar-Bali, Indonesia

AANB Sarmuda Dinata
Bali Assesment Institut of Agricultural Technology, Indonesian Agency for Agricultural Research and Development, Ministry of Agriculture, Denpasar-Bali, Indonesia

IGNG Bidura
Faculty of Animal Science, Udayana University, Denpasar-Bali, Indonesia

Corresponding Author:
I Wayan Sudarma
Bali Assesment Institut of Agricultural Technology, Indonesian Agency for Agricultural Research and Development, Ministry of Agriculture, Denpasar-Bali, Indonesia

Supplementation of cellulase enzymes (isolation from termites) in the ration to the productivity of native chickens

I Wayan Sudarma, AANB Sarmuda Dinata and IGNG Bidura

Abstract
The purpose of this study is to determine the level of effectiveness of cellulase enzymes isolated from Termites in feed on the productivity of intensively kept native chickens. The study used a randomized block design (CRBD) with 3 treatments and 15 groups as replications. Each group used 15 unsexed chickens aged five weeks. As for the feed treatment given as follows: P0): chickens that were given commercial feed without the addition of cellulase enzymes; P1): commercially fed chicken+cellulase enzyme as much as 12 g/kg of feed; and P2): commercially fed chicken+cellulase enzyme as much as 24 g/kg of feed, respectively. The results showed that cellulase enzyme supplementation isolated from Termin (Group P1 and P2) were significantly different ($P<0.05$) which could increase weight gain, feed consumption, and feed efficiency. It can be concluded that supplementation of cellulase enzymes (isolated from termites) into the ration can increase the productivity of native chickens in the growth phase.

Keywords: Cellulase enzyme, termites, growth, native chicken

Introduction
The development of domestic poultry farms lately is increasingly being cultivated, both in rural and urban areas. Its potential should be developed to increase the nutritional needs of the community and increase family income in rural areas. Aside from being able to be cultivated as a part-time livestock, free-range chickens are easily maintained and can be sold at any time for urgent needs (Mardiningsih *et al*., 2004) [14]. In addition, the commodity of free-range chicken also supports government programs, especially in fulfilling self-sufficiency in meat. The development of native chicken farms lately is in line with the increasing population, and also can not be separated from the public awareness of the importance of animal protein needs, especially chicken meat. The demand for poultry meat in Indonesia from year to year per capita, namely in 2016, was 0.111 kg/week per capita, while in 2017 it increased to 0.124 kg/week per capita (BPS, 2018) [4]. Nationally, the production of free-range chicken meat in Indonesia reached 11.07% or 259.9 thousand tons, while the contribution of production to poultry meat reached 16.9%.

Efforts to fulfill it have not been fulfilled, so that meat imports from outside are still being pursued. The development of native chicken farms among rural communities is generally still done traditionally so that the results obtained are still relatively low, so that in efforts to develop native chicken farms with intensive maintenance patterns have agribusiness-oriented business prospects (Dinata *et al.,* 2019; Diwyanto *et al.,* 1996) [5, 6]. Feed is the largest cost component of 60-80% of total production costs. Lately, the price of commercial feed at the market level has increased along with the increase in feed ingredients on the market, so farmers are looking for various alternative ingredients to meet their feed requirements without reducing the production yield they produce, including by utilizing feed additives in the form of cellulase enzymes from the colony *Termite*.

Termites are a nation of isopterans classified as social creatures and live in a colony in nature, where the existence of these creatures is greatly feared by humans, because it can be detrimental to human life due to damaging furniture wood, wood supporting the house, money, and other important document files. Besides that, termites are potential cellulose decomposers in the tropics. Utilization of Termites can be in the form of enzymes they contain or symbionic organisms that play a role in cellulose degradation. This ability is inseparable from

microbes in the digestive tract, especially in the back of the stomach which accumulates various symbionts of microorganisms (protozoa, bacteria, and fungi) that are useful in breaking down plant fibers (Bidura *et al.,* 2012; Adawiyah, 2000) [3, 1]. The activity of hydrolysis enzymes produced by termites, so that they can break down the feed fiber through the symbiotic mutualism that occurs in termite bodies, then this potential is good enough to be developed as a cellulase enzyme in feed in an effort to increase the digestibility value of animal feed, especially free-range chickens (Nugraha, 2006) [16].

The purpose of this study is to determine the level of effectiveness of cellulase enzymes isolated from termites in feed on the productivity of intensively kept native chickens.

Materials and Methods

Experimental design, animals, housing and diets. The study used a randomized block design (CRBD) with 3 treatments and 15 groups as replications. Each group used 15 unsexed chickens aged five weeks. Classification of chickens based on body weight placed into a stable enclosure measuring 1 x 0.5 m. Cage plots are made of bamboo slats and wire nets, and lighting lamps to warm the cages. Each enclosure is equipped with a place to feed and drink. The ration given was in the form of a mixture of feed consisting of: 40% concentrate; yellow corn 35%; and 25% rice bran. Feeding is done 3 times a day which is adjusted to the standard feed requirements in each week. As for the feed treatment given as follows: P0): chickens that were given commercial feed without the addition of cellulase enzymes; P1): commercially fed chicken+cellulase enzyme as much as 12 g/kg of feed; and P2): commercially fed chicken+cellulase enzyme as much as 24 g/kg of feed, respectively.

Live performance. Continuous lighting and access to feed and water was provided throughout the experiment. Body weight, live weight gains, feed intake and feed conversion ratio for birds were recorded separately from week 1 until week 5 (Fig.1). Feed consumption (gram per birds) was recorded weekly at each replication by weighing the remaining diet. The total feed intake for each replicate was measured during the test experiment period. The FCR was calculated as gram of feed consumed of per gram body weight gained.

Fig 1: Weighing chicken weight at the beginning of the study (left) and at the end of the study (right)

Planting Microbial Isolation Media from Termites. The making of liquid probiotics containing cellulase enzymes is obtained through the isolation of termite microbes (*Cryptotermes spp*) taken from the termite's stomach in the back (*hind gut*). The process of making liquid propbiotics was preceded by planting the media in a petridish dish containing refined seaweed, egg whites, and liquid sugar. Planting media for termite microorganism isolates using the method of nicks/scratch vertically. Termites were first cleaned with alcohol using sterile cotton, prepare a bunsen/candle flame, and needling tools such as needles, tissue and tweezers. Planting isolate into a petridish dish begins with heating the tweezers using a Bunsen flame, then termites are taken on the head with tweezers, then do the pricking in the back of the termite's stomach, until a clear liquid comes out. Furthermore, the liquid was planted in a medium cup with nicks/scratch method starting from the top to the bottom of the media. Next, the media was placed in a cooler at 25 ^{0}C for 6-7 days. After 7 days the media was removed from the cooler and ready to be bred. Breeding can be done using clean water, coconut water, rice water, molasses, eggs, and herbal plants in the form of noni fruit, *Moringa* leaves, and t*urmeric*. All these ingredients were mixed and mashed, then filtered and put in clean plastic containers, then put the termite media into it. Fermented for 7 days to obtain liquid probiotics. Liquid probiotics were developed in solids in the form of concentrates, cassava flour, rice bran, corn, and molassis. All ingredients are mixed together, then add liquid probiotics into it and stir until smooth, fermented for 3 days then dry in the sun to dry. Dry cellulase enzymes were ready for use in experiments on feed.

Statistical analysis. The data obtained were analyzed by analysis of variance and continued with the Duncan Test with an error rate of 5% (P<0.05). Data analysis process, using SPSS software for Windows-7.

Results and Discussion

The results of the study as presented in Table 1, showed that feed consumption, live weight gains, and feed efficiency showed significant differences (P<0.05) between treatment groups. Feed consumption increased significantly (P<0.05) in chickens received rations fed cellulase enzyme supplementation (Groups P1 and P2) compared to controls (P0). Feed consumption at the beginning of maintenance looks constant, but entering the 3rd week to the 5th week of maintenance of native chicken feed consumption were increases, this indicates that the longer the maintenance period, the value of feed consumption will increase. This is logical, because chicken growth was getting faster, so the need for more nutrients (Bidura *et al.,* 2019) [2]. This indicates that the longer the maintenance period, the efficiency of the use of feed will decrease. Edjeng and Kartasudjana (2006) [7] state that the feed conversion ratio is defined as the amount of ration spent to produce every kilogram of weight gain. A small FCR means that the amount of rations used to produce one kilogram of meat increases.

The average live weight gain of chicken groups P1 and P2, were: 18.04% and 17.60% significantly (P<0.05) higher than controls (P0). The average FCR value during the study in the control chicken group was 1.90/birds (Table 1). The mean FCR in chicken groups P1 and P2, were: 5.26% and 5.79% significantly (P<0.05) lower than control chickens (P0).

Some factors that influence the level of feed consumption in poultry include: individual livestock, animal health, growth period, environmental temperature, housing system, and drinking water (Suprijatna *et al.,* 2005) [20]. In this study also observed the FCR to determine the level of efficiency of feed use. Feed Conversion Ratio is one of the indications that gives

an overview of the efficiency of feed use, where the lower FCR value means the higher the efficiency of feed use (Laksmiwati, 2007) [13]. Low consumption rates indicate the level of consumption of feed use will get better, if consumption rates get bigger then the use of feed will be less good (Hardjosworo and Rukmiasih, 2000) [11]. This is in line with the level of body weight that is increasing with the supplementation of cellulase enzymes in the ration. This shows the activity of cellulase enzymes produced by Termite symbionts in the form of protozoa capable of hydrolyzing feed cellulose fibers in the ration, so that the absorption of nutrients in the intestinal villi area becomes wider and optimal which results in increased body weight of chickens to be more optimal, and optimal use efficiency. feed that has an impact on increasing body weight (Ketaren *et al*., 2008) [12]. In several previous studies, the use of probiotics and enzymes has increasingly seen its effects in line with the rate of body weight gain and the production of chicken eggs produced (Guntoro *et al*., 2000) [9].

Table 1: Effect of cellulase enzyme supplementation (isolation from Termit) in the ration on the performance of native chickens

Treat-ments[1)]	Feed consumption (g/bird/day)	Live weight gains (g/birds/day)	FCR (feed consumption: body weight gains)
P0	60.29[a2)]	31.71[a]	1.90[a]
P1	67.26[c]	37.43[b]	1.80[c]
P2	66.86[b]	37.29[b]	1.79[b]

Note:

1. P0): chickens that were given commercial feed without the addition of cellulase enzymes; P1): commercially fed chicken+cellulase enzyme as much as 12 g/kg of feed; and P2): commercially fed chicken+cellulase enzyme as much as 24 g/kg of feed, respectively.
2. Means within colums with different superscripts are significantly different (P<0.05)

The results of the study such as Figure 2, shows the growth of free-range chickens in the early weeks, body weight gain is still seen constant, as well as in the middle of the second week (2), where the level of weight gain between treatments does not seem to have a significant effect (P>0.05), but stepping on the end of the second week (2) in the treatment of P1 and P2 it appears that the growth has increased higher compared to P0 (control). This occurs as a result of the activity of cellulase enzymes in the ration has begun to appear visible, where the activity of cellulase enzymes in hydrolyzing fiber in feed acts as a bio catalyst, its activity begins to appear that affects the palatability of livestock. Because of the increased palatability of livestock to feed, the role of cellulase enzymes that have specific activities on the enzyme endo-β-D-1,4-glucanase as a source of protein in the degradation of feed cellulose fibers appears to start working, although its work is not so optimal when compared with the treatment of P0 given rations without cellulase enzymes (Watanabe et al.,1997; Purwadaria *et al.*, 2003) [21, 17].

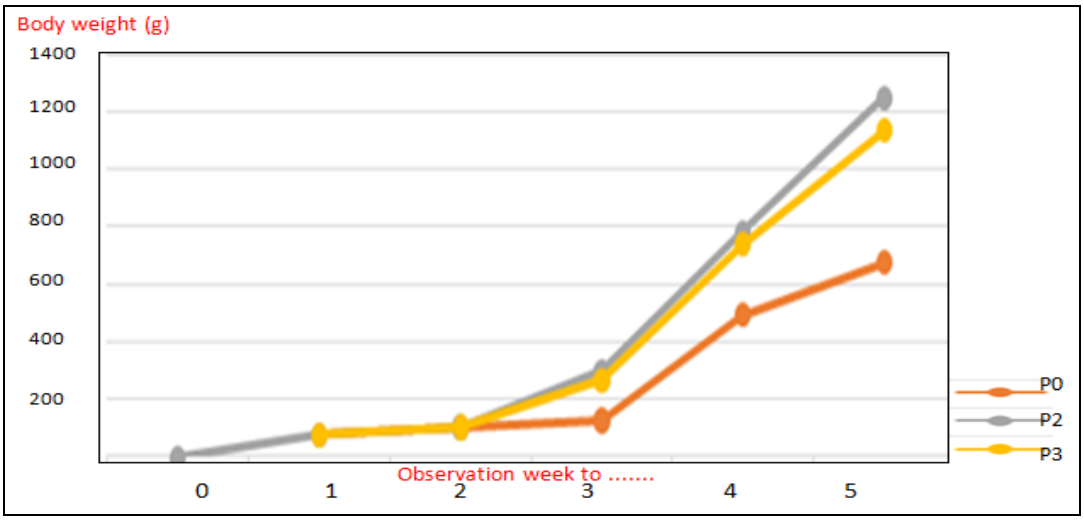

Fig 2: Growth chart of native chicken fed with additional cellulase enzymes (isolation from termites)

Cellulase enzyme activity is strongly influenced by several factors, namely: temperature, pH, substrate concentration, enzyme concentration, and the presence of inhibitors (Hames and Hooper, 2005) [10]. Cellulase enzyme activity is highly dependent on temperature and pH factors (Sari, 2008) [19]. Cellulase enzyme activity from termites is able to work optimally at temperatures of 40-45 ^{0}C and at pH 6.0 (Ramin *et al*., 2008) [18]. According to Gauthier (2007) [8], the pH range of chicken digestive tract, especially in the small intestine is in the pH range between 5-7. This pH range condition is sufficient to support the work activity of cellulase enzymes isolated from termites in all treatments. The higher use of cellulase enzymes given turned out to cause cellulase enzyme activity to decrease. This is due to the higher digestive mucus produced, causing the activity of cellulase enzymes associated with the active side of the absorption of feed nutrients will be smaller (Masfufatun, 2011) [15].

Conclusion

It can be concluded that supplementation of cellulase enzymes (isolated from termites) into the ration can increase the productivity of native chickens in the growth phase.

Acknowledgements

The author would like to thank the Head of Bali Assesment Institut of Agricultural Technology, Indonesian Agency for Agricultural Research and Development, Ministry of Agriculture, Denpasar-Bali, Indonesia for their permission

and support during the study. Acknowledgments To Analytical Laboratory staff for their assistance in sample analysis.

References

1. Adawiyah. Kinerja Mikroba Simbion Rayap dalam Proses Degradasi Beberapa Jenis Limbah Pertanian. Thesis Untuk Magister Sains Pada Program Pasca Sarjana - Institut Pertanian Bogor (IPB), Bogor, 2000.
2. Bidura IGNG, Siti NW, Partama IBG. Effect of probiotics, *Saccharomyces* spp. Kb-5 and Kb-8, in diets on growth performance and cholesterol levels in ducks. South African Journal of Animal Science. 2019; 49(2):219-226
3. Bidura IGNG, Suyadnya IP, Mahardika IG, Partama IBG, Oka IGL and Aryani IGAI. The implementation of *Saccharomyces spp.n-2* isolate culture (isolation from traditional yeast culture) for improving feed quality and performance of male Bali duckling. Agricultural Science Research Journal. 2012; 2(9):486-492
4. BPS. Rata-Rata Konsumsi per Kapita Seminggu Beberapa Macam Bahan Makanan Penting. 2017-2018. 2018.
5. Dinata AANBS, Bidura IGNG, Rusdianta IMG, Sukasana IW, Suprio Guntoro. Productivity of Arabian chicken given probiotic Lactobacillus sp. isolated from the digestive tract of broiler chickens and laying hens. International Journal of Fauna and Biological Studies 2019; 6(6):05-09 (http://www.faunajournal.com/archives/2019/vol6issue6/PartA/6-5-8-242.pdf)
6. Diwyanto K, dan Cholil. Model Pengembangan Peternakan Rakyat Terpadu Berorientasi Agribisnis : Komoditas Ternak Ayam Buras. Direktorat Jendral Peternakan bekerja sama dengan Balai Penelitian ternak, Ciawi -bogor), 1996.
7. Edjeng S, dan R, Kartasudjana. Manajemen Ternak Unggas. Penebar Swadaya, Jakarta, 2006.
8. Gauthier R. The Use of Protected Organic Acids (galliacid™) and a Protease Enzyme (Poultry Grow 250™) in Poultry. Jefo Nutrition Inc. St-Hyacinthe, Qc, Canada, 2007.
9. Guntoro S, Rai Yasa MD, dan Suyasa N. Laporan Hasil Penggunaan Enzim Phylazim Pada ayam Petelur. Kerjasama BPTP Bali dengan BAPPEDA Provinsi Bali Tahun 2000.
10. Hames D, Hooper N. Biochemestry. Ed ke-4. New York: Taylor and Francis Group, 2005.
11. Hardjosworo dan Rukmiasih. Meningkatkan Produksi Daging Unggas. Penebar Swadaya, Jakarta, 2000.
12. Ketaren PP, Sinurat AP, Purwadaria T, Kompiang IP, dan M Amir. Penggunaan Rayap (*Glyptotermes Montanus*) Sebagai bahan Pakan Ayam. J Ilmu Ternak dan Veteriner. 2008; 6(2):100-106.
13. Laksmiwati NM. Pengaruh Pemberian Starbio dan Effective Microorganism- 4 (EM-4) Sebagai Probiotik Terhadap Penampilan Itik Jantan Umur 0-8 Minggu. Jurusan Produksi Ternak, Fakultas Peternakan, Universitas Udayana. Denpasar, 2007.
14. Mardiningsih D, Rahayuning TM, Roesali W, dan DJ Sriyanto. Tingkat Produktivitas dan faktor-faktor yang Mempengaruhi Tenaga Kerja Wanita Pada Peternakan Ayam Lokal Intensif di Kecamatan Ampal Gading, Kabupaten Pemalang Jawa Tengah. hlm. 548-554. Prosiding Seminar Nasional Teknologi Peternakan dan Veteriner 2004. Buku II. Bogor, 4-5 Agustus 2004. Pusat Penelitian dan Pengembangan Peternakan Bogor, 2004.
15. Masfufatum. Isolasi dan Karakterisasi Enzim Selulase, Journal. Surabaya: Universitas Wijaya Kusuma Surabaya, 2011.
16. Nugraha R. Produksi Enzim Selulase oleh *Penicellium Nalgiovence* SS240 pada Subtrat Tandan Sawit. Skripsi. Bogor: Institut Pertanian Bogor, 2006.
17. Purwadaria T, Marbun PA, Sinurat dan AP, Ketaren PP. Perbandingan Aktivitas Enzim Selulase dari Bakteri dan Kapang Hasil Isolasi Dari Rayap. JITV 2003; 6:213-219.
18. Ramin M, Alimon AR, Abdullah N. Identification of Cellulolitic Bakteria Isolated from the Termite *Coptotermes curvignathus* (Holmgren). Journal of Rapid Methods and Automation in Microbiology. 2008; 17:103-116
19. Sari WW. Karakterisasi Selulase Bakteri Asal Tanah Pertanian Jawa Tengah dan Jawa Barat. Fakultas Matematika dan Ilmu Pengetahuan Alam, Institut Pertanian Bogor, 2008.
20. Suprijatna EU, Atmomarsono R, Kartasudjana. Ilmu Dasar Ternak Unggas. Penebar Swadaya, Jakarta, 2005.
21. Watanabe H, Nakamura M, Tokuda G, Yamaoka I, Scrivener AM, Noda H. Site of secretion and properties of endogenous endo-beta-1-4-glucanase components from Reticulitermes speratus (Kolbe), a Japanese subterranean termite. Insect Biochem. Molecular Bio. 1997; 27(4):305-313.