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PENGARUH PENAMBAHAN MIKROKAPSUL DARI EKSTRAK LIMBAH IKAN PATIN TERHADAP AKTIVITAS ENZIM PENCERNAAN AYAM BROILER

The Effect of Adding Microcapsules of Catfish Waste Extract on the Digestive Enzyme Activity of Broiler Chickens

Putri Aulia Eka Rahma*, **Abun**, **Hendi Setiyatwan**
Departemen of Animal Nutrition and Feed Technology, Faculty of Animal Husbandry, Universitas Padjadjaran, Jatinangor, West Java 45363, Indonesia
**Corresponding Author*: putriauliaeka0502@gmail.com

ABSTRACT

This study aims to determine the use of the best dressing in the process of making microcapsules and the best dose used. This study was conducted experimentally using a completely randomized design (CRD) with 10 treatments and 3 replications. The treatments consisted of rations without microcapsules of fermented catfish waste extract (MELIPF) and rations with the addition of microcapsules of fermented catfish waste extract (MELIPF) with different types of dressings and doses used in each treatment. Data were analyzed using analysis of variance and continued with Duncan's multiple range analysis. The results showed that in the results of protease enzyme activity, treatment R5 with gum arabic dressing at a dose of 1% was significantly different from treatment R2 with the use of maltodextrin dressing at a dose of 1%, while in the results of lipase enzyme activity, treatment R0 without the use of MELIPF was significantly different from R5 with gum arabic dressing at a dose of 1% and treatment R6 with gum arabic dressing at a dose of 2% was significantly different from treatment R9 with the use of gelatin dressing at a dose of 2%.

Keywords: *Microcapsules of fermented catfish waste extract, Dressing, Enzyme activity*

ABSTRAK

Penelitian ini bertujuan untuk mengetahui penggunaan penyalut terbaik dalam proses pembuatan mikrokapsul dan dosis terbaik yang digunakannya. Penelitian ini dilakukan secara eksperimental menggunakan Rancangan Acak Lengkap (RAL) biasa dengan 10 perlakuan 3 kali ulangan. Perlakuan terdiri dari ransum tanpa mikrokapsul ekstrak limbah ikan patin fermentasi (MELIPF) dan ransum dengan penambahan mikrokapsul ekstrak limbah ikan patin fermentasi (MELIPF) dengan jenis penyalut dan dosis penggunaan yang berbeda – beda pada setiap perlakuannya. Data di analisis menggunakan analisis ragam dan dilanjutkan dengan analisis jarak berganda Duncan. Hasil penelitian menunjukkan bahwa pada hasil aktivitas enzim protease didapatkan perlakuan R5 dengan penyalut gum arab dengan dosis 1 % berbeda nyata terhadap perlakuan R2 dengan penggunaan penyalut maltodekstrin dengan dosis 1%, sedangkan pada hasil akitivitas enzim lipase perlakuan R0 tanpa penggunaan MELIPF berbeda nyata dengan R5 dengan penyalut gum arab dengan dosis 1% dan perlakuan R6 dengan penyalut gum arab dengan dosis 2 % berbeda nyata dengan perlakuan R9 dengan penggunaan penyalut gelatin dengan dosis 2%.

Kata kunci: Aktivitas enzim, Ekstrak limbah ikan patin, Fermentasi

INTRODUCTION

Local feed ingredients at this time are still are still widely used by many farmers to help the growth and development of livestock. Local feed ingredients are easily available and also relatively cheap. But feed ingredients are not only to make livestock meet their daily feed needs, nutritional aspects need to be considered so that the nutritional needs of the livestock's body are guaranteed so that livestock can grow well body is also guaranteed so that livestock can increase activity and productivity that comes from the livestock's body.Efforts to increase livestock productivity are by provision of good quality feed good quality feed. Local feed ingredients are easy to find but local feed ingredients also have limited availability. In terms of nutrition, local feed

ingredients are not guaranteed to meet the nutritional needs of livestock. Because usually farmers only give feed to livestock until they are full. Where as livestock cannot be said to have a healthy body healthy body with just enough feed. The aspect of This aspect of nutrition is closely related to production for livestock. When livestock are given feed that contains good nutrition will have a beneficial impact on the farmer.

MATERIAL AND METHOD

Time and Place

The research was conducted in December 2023 till January 2024 at the Laboratory of Non Ruminant Poultry Nutrition and Animal Food Industry and Mini Feedmill, Faculty of Animal Husbandry, Padjadjaran University, Sumedang Regency, West Java Province.

Preparation for making ELIPF microcapsules, as follows:

1. Prepare the catfish waste extract and the coating material.
2. Comparison used in the preparation of microcapsules
3. Comparison for gum arabic 20: 80, gelatin 20: 80, and maltodextrin 40: 60 in the ratio of ELIPF: dressing material.
4. Microcapsules were prepared in 250 ml per dressing.
5. Prepare the pangasius waste extract and the dressing according to the calculated dosage.
6. Mix the catfish waste extract and the dressing while stirring on the stove until homogeneous.
7. The homogeneous extract of catfish waste and dressing is placed into a baking pan
8. Next, the microcapsules were put into the oven for 5 days until dry.
9. Next grind the microcapsules with a blender
10. Store the mashed microcapsules in a jar.
11. MELIPF that has been mashed is weighed according to the needs per treatment to be mixed with the feed that has been ground (Lina et al., 2019)

Protease enzyme activity was measured using spectrophotometric method using spectrophotometer based on Sigmas's Aldrich Protease Activity Assay method. The protease activity assay begins with the preparation of a standard curve of tyrosine with concentrations of tyrosine solution of 0 mg/mL, 0.005 mg/mL, 0.01 mg/mL, 0.015 mg/mL, 0.02 mg/mL, 0.025 mg/mL, 0.03 mg/mL, 0.04 mg/mL and 0.05 mg/mL, respectively. Tyrosine solution was added 2.5 mL Na_2CO_3 and 0.5 mL Folin Ciocalteu reagent. The tyrosine solution was reacted with Na_2CO_3 and Folin Ciocalteu reagent then put the tyrosine solution into a cuvette to measure its absorbance using a spectrophotometer. The absorbance results from the spectrophotometer made a standard curve of tyrosine made to complete the protease enzyme activity test data to be entered into the formula.

Protease enzyme activity test begins with pre-incubation of 1% casein larutsn as much as 0.5 ml at 37ºC for 5 minutes. Then 0.5 mL sample solution was added and vortexed and incubated at 37ºC for 10 minutes in a waterbath. After 10 minutes, 5% TCA was added as much as 5% to stop the hydrolysis reaction, then let stand.

Centrifuge the solution mixture at 10,000 rpm for 10 minutes and then take 0.5 ml The supernatant was centrifuged and reacted with Na_2CO_3 and 0.25 ml of Folin-Ciocalteau reagent and incubated for 10 min at 37ºC. This solution was measured using a spectrophotometer at a wavelength of 660 nm. The protease activity of the enzyme was calculated by the formula.

Lipase enzyme activity is measured using the titrimetric method (Pereira, 2001). The titrimetric method is done by titrating the sample and other chemicals. Titration is done until there is a color change in the sample solution to pink. Measurement of lipase enzyme activity was done in duplicate. Analysis of lipase enzyme activity was calculated based on the difference between the sample titrant volume and the

blank.

Lipase enzyme activity test begins with preparing 2 mL of olive oil and 1 mL of 0.05 M phosphate buffer pH 7 and 1 mL of enzyme incubated at 35ºC for 30 minutes. Then the enzyme substrate was activated with 1 mL of acetone: ethanol mixture (1:1) followed by titration with 0.05 N NaOH using 1% PP indicator. For the determination of the blank is done with the same composition, but when the enzyme is inserted, 1 mL of acetone: ethanol (1:1) mixture is immediately added, titrating with the same procedure as the sample analysis. Analysis of lipase enzyme activity can be calculated by the formula (Pereira, 2001).

Amylase enzyme activity was measured using spectrophotometric method using spectrophotometer with DNS reagent referring to Wahjuni et al. (2017). The amylase activity test using the DNS method makes a glucose standard curve with the concentration of glucose solution. 10 mg/mL, 20 mg/mL, 30 mg/mL, 40 mg/mL, and 50 mg/mL respectively and 1.5 mL DNS reagent. Glucose solution was reacted with DNS reagent then put the glucose solution into a cuvette to measure its absorbance using a spectrophotometer. The absorbance results from the spectrophotometer made a glucose standard curve made to complete the amylase enzyme activity test data to be entered into the formula.

The amylase enzyme activity test begins with preparing 1 mL of sample with 1 mL of 0.2 M phosphate buffer pH 7 and vortexed to homogenize the solution. Then the solution was incubated for 20 minutes at 35oC, then added 1 mL of DNS reagent, vortexed again and measured the absorbance at a maximum wave of 515.6 nm. The data obtained is entered into the formula (Wahjuni et al., 2017).

RESULTS AND DISCUSSION

Effect of Giving Microcapsules of Patin Fish Waste on Protease Enzyme Activity

The results of the study on the effect of patin fish waste microcapsules on protease enzyme activity in the duodenum of broiler chickens are presented in Table 1.

Table 1. Protease enzyme activity of each treatment

Repetition	R0	R1	R2	R3	R4	R5	R6	R7	R8	R9
1	0,790	0,068	0,061	0,045	0,108	0,073	0,087	0,073	0,070	0,058
2	0,072	0,051	0,066	0,071	0,118	0,105	0,087	0,053	0,054	0,072
3	0,044	0,071	0,045	0,070	0,055	0,110	0,075	0,089	0,069	0,111
Average	0,302	0,063	0,057	0,062	0,094	0,096	0,083	0,072	0,064	0,081

Table 2. Duncan test results of the effect of treatment on protease enzyme activity

Treatment	Mean Activity (U/mL)	Significance
R0	650.00	ab
R1	633.33	ab
R2	573.00	b
R3	622.33	ab
R4	936.67	ab
R5	962.67	a
R6	829.33	ab
R7	716.00	ab
R8	642.00	ab
R9	805.67	ab

Based on the table, the results of protease enzyme activity from the effect of the treatment of microcapsules of fermented catfish waste extract, the highest results were obtained from treatment R5, which was given gum arabic dressing with a dose of 1% in the ration with the obtained value of 0.096 U/ml and for the lowest protease enzyme activity results from all treatments, namely treatment R2 with maltodextrin as a dressing with a dose of 1% maltodextrin with the obtained value of 0.057 U/ml. In this enzyme activity test, livestock are given feed supplements or microcapsules with various dressings. It can be seen in the table that has been presented that The result of enzyme activity value is obtained from the lowest to the highest. In the results of enzyme activity testing to get the best seen from the highest results obtained. The results obtained are in accordance with the dosage of the dressing used in the manufacture of the microcapsules. In the results of protease enzyme activity, the highest results were obtained by microcapsules with gum arabic dressing. Gum arabic, as a coating, has better emulsifying properties than maltodextrin (Hasrini et al., 2017). To choose the right and effective dressing material. Gum Arabic in essential oil encapsulation research using the complex coacervation technique, gelatin and maltodextrin were used as binders. Gelatin and maltodextrin are suitable dressings used for essential oil encapsulation (Indah, 2016). Based on the physical and chemical properties, stability, density, and solubility of gum arabic, it is considered as a reliable dressing material. The best encapsulant, therefore, affects the results of enzyme activity testing.

Effect of Giving Microcapsules of Patin Fish Waste on Lipase Enzyme Activity

The results of research on the effect of patin fish waste microcapsules on lipase enzyme activity in the duodenum of broiler chickens are presented in the table below.

Table 3. Lipase enzyme activity of each treatment

Repetition	R0	R1	R2	R3	R4	R5	R6	R7	R8	R9
1	11,667	5,000	5,833	8,333	6,667	9,167	10,000	5,833	6,833	7,000
2	3,333	5,833	5,833	6,667	7,500	13,333	10,833	8,333	7,500	3,333
3	1,667	8,333	9,167	8,833	6,667	8,833	8,333	7,500	6,667	5,000
Average	5,556	6,389	6,944	7,944	6,944	10,444	9,722	7,222	7,000	5,111

Based on the table the results of lipase enzyme activity from the effect of the treatment of microcapsules of fermented catfish waste extract, the highest results were obtained from treatment R5, which was given gum arabic dressing with the value obtained of 10.444 U/ml and for the lowest enzyme activity results from all treatments, namely treatment R9 with gelatin as a dressing with the value obtained of 5.111 U/ml. In the test results of lipase enzyme activity, the highest results were also obtained by using gum arabic as the encapsulant material. The purpose of using a comparison of dressing materials on microcapsules is to find out how each type of dressing material impacts the quality characteristics of the microcapsules produced (Sulistiyani, 2022). Gum Arabic has the advantage of being easily soluble in water and having a high solubility, this makes it a perfect choice to be used as an encapsulation material. Based on the physical and chemical properties, stability, density, and solubility of gum arabic, it is believed to be the best encapsulant material, hence affecting the results of enzyme activity testing.

Table 4. Duncan test results of the effect of treatment on lipase enzyme activity

Treatment	Mean Activity (U/mL)	Significance
R0	55 555.67	bc
R1	63 888.67	abc
R2	69 444.33	abc
R3	79 444.33	abc
R4	69 444.67	abc
R5	104 444.33	a
R6	97 222.00	ab
R7	72 222.00	abc
R8	70 000.00	abc
R9	51 111.00	c

R0 = 100% basal ration without the use of dressing
R1 = Ration containing 0.5% maltodextrin
R2 = Ration contains 1% maltodextrin
R3 = Ration contains 2% maltodextrin
R4 = Ration containing 0.5% gum Arabic
R5 = Ration containing 1% gum arabic
R6 = Ration contains 2% gum arabic
R7 = Ration contains 0.5% gelatin
R8 = Ration contains 1% gelatin
R9 = Ration contains 2% gelatin

Effect of Giving Microcapsules of Catfish Waste on Amylase Enzyme Activity

The results of research on the effect of patin fish waste microcapsules on amylase enzyme activity in the duodenum of broiler chickens are presented in the table below.

Based on the table the results of amylase enzyme activity from the effect of the treatment of microcapsules of fermented catfish waste extract, the highest results were obtained from the R2 treatment, which was given gum arabic dressing with the value obtained of 0.0312 U/ml and for the lowest enzyme activity results from all treatments, namely the R0 treatment with no added dressing with the value obtained of 0.0267 U/ml. In the test results of amylase enzyme activity, the use of gum arabic as a dressing also obtained the highest value. Giving feed supplement can affect the duodenal enzyme activity of broiler chickens. Feed supplement contains some elements of food substances and medicines, the elements of food substances that are usually contained in it are vitamins, amino acids, and minerals.

Table 5. Amylase enzyme activity of each treatment

Repetition	R0	R1	R2	R3	R4	R5	R6	R7	R8	R9
1	0,030	0,031	0,030	0,027	0,031	0,027	0,027	0,031	0,028	0,029
2	0,018	0,030	0,031	0,027	0,027	0,029	0,028	0,029	0,026	0,028
3	0,030	0,031	0,031	0,030	0,029	0,028	0,029	0,029	0,030	0,029
Average	0,026	0,031	0,031	0,028	0,029	0,028	0,028	0,030	0,028	0,029

Table 6. Duncan test results of the effect of treatment on amylase enzyme activity

Treatment	Mean Activity (U/mL)	Significance
R0	267.0000	b
R1	284.3333	b
R2	285.3333	b
R3	285.3333	b
R4	286.6667	b
R5	293.0000	b
R6	294.6667	b
R7	300.6667	b
R8	310.3333	b
R9	312.0000	b

R0 = 100% basal ration without the use of dressing
R1 = Ration containing 0.5% maltodextrin
R2 = Ration contains 1% maltodextrin
R3 = Ration contains 2% maltodextrin
R4 = Ration contains 0.5% gum arabic
R5 = Ration contains 1% gum arabic
R6 = Ration contains 2% gum arabic
R7 = Ration contains 0.5% gelatin
R8 = Ration contains 1% gelatin
R9 = Ration contains 2% gelatin

Giving feed supplements that contain vitamins, amino acids, and minerals that are important for broiler health can help increase duodenal enzyme activity. Gum arabic has advantages and disadvantages, the advantages of gum arabic to be an encapsulant material because it is more easily soluble in water and High solubility and the disadvantage of gum arabic is its softness.

CONCLUSION

The effect of giving microcapsules of fermented catfish waste extract (MELIPF) is able to increase the activity of protease, lipase and amylase enzymes in the duodenum of broiler chickens and from the results of the enzyme activity obtained, it can be known that the best dressing and dose for making microcapsules of fermented catfish waste extract (MELIPF).

The dressing material used in the manufacture of microcapsules of fermented catfish waste extract (MELIPF) in this study is gum arabic with a usage dose of 1% is the best dressing material and can be used as the best alternative as an encapsulant material.

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REFERENCES

Abraham, A. A., Pangestuti, H. T., & Sinlae, M. (2021). Penambahan larutan daun binahong dalam air minum terhadap kualitas fisik daging ayam broiler fase finisher [Unpublished bachelor's thesis, Universitas Nusa Cendana, Kupang].

Bidura, I. G. N. G. (2016). Bahan makanan ternak [Unpublished undergraduate

report, Program Studi Peternakan, Universitas Udayana, Denpasar].
Djafar, F., & Supardan, D. M. (2019). Pengaruh penyalut maltodekstrin terhadap produk mikrokapsul minyak jahe dengan teknik spray drying [Unpublished bachelor's thesis, Jurusan Teknik Kimia, Universitas Syiah Kuala, Aceh].
Fanni. (2015). Pengaruh rasio kombinasi bahan penyalut (maltodekstrin dan gum arab) terhadap kualitas mikrokapsul crude minyak ikan lemuru (Sardinella longiceps) dengan metode freeze drying [Unpublished bachelor's thesis, Universitas Brawijaya, Malang].
Istia'nah, D., Utami, U., & Barizi, A. (2020). Karakterisasi enzim amilase dari bakteri Bacillus megaterium pada variasi suhu, pH, dan konsentrasi substrat [Unpublished bachelor's thesis, Universitas Islam Negeri Maulana Malik Ibrahim, Malang].
Lani, R. K., Kasmiyati, S., & Suksmana, A. (2019). Seleksi dan karakterisasi enzim protease dari getah tumbuhan Ficus spp. pada variasi suhu dan pH [Unpublished bachelor's thesis, Universitas Kristen Satya Wacana, Semarang].
Malvin, T. (2019). Perbandingan pemberian beberapa level mikrokapsul minyak ikan dalam ransum terhadap performa broiler [Unpublished bachelor's thesis, Universitas Papua, Manokwari].
Marpaung, E., Prasetia, A. L. R., Fitry, Rahmayani, & Irma. (2016). Pengaruh perbandingan maltodekstrin dan gum arab pada mikroenkapsulasi ekstrak daun duku kumpeh (Lansium domesticum corr.) [Unpublished bachelor's thesis, Universitas Jambi, Jambi].
Nopiani, Y., Yandri, A. S., & Hadi, S. (2016). Peningkatan kestabilan enzim lipase dari Pseudomonas aeruginosa ATCC 27853 dengan amobilisasi menggunakan bentonit [Unpublished bachelor's thesis, Universitas Lampung, Bandar Lampung].
Noviyani, T., Wartini, N. M., & Harsojuwono, B. A. (2022). Pengaruh perbandingan maltodekstrin dan gum arab terhadap karakteristik enkapsulat ekstrak pewarna daun singkong [Unpublished bachelor's thesis, Universitas Udayana, Denpasar].
Pakage, S., Hartono, B., Fanani, Z., Nugroho, B. A., Iyai, D. A., Palulungan, J. A., Ollong, A. R., & Nurhayati, D. (2020). Pengukuran performa produksi ayam pedaging pada closed house system dan open house system di Kabupaten Malang, Jawa Timur, Indonesia [Unpublished bachelor's thesis, Universitas Papua & Universitas Brawijaya].
Pratantie, E. M., Bintoro, V. P., & Dwiloka, B. (2021). Isolasi enzim amilase dari kecambah kacang tunggak (Vigna unguiculata) [Unpublished bachelor's thesis, Universitas Diponegoro, Semarang].
Salvia, Ramaiyulis, Dewi, M., & Sari, D. M. (2022). Teknologi pengolahan pakan [Unpublished diploma thesis, Politeknik Negeri Payakumbuh, Payakumbuh].
Saputri, N. E., & Ngatirah, N. (2019). Mikroenkapsulasi minyak sawit merah dengan variasi suhu pengeringan dan jenis bahan penyalut dengan metode foam-mat drying [Unpublished bachelor's thesis, Universitas Tanjungpura, Pontianak].
Sari, K. L., Bekti, K. E., & Sani, Y. E. (2019). Jenis bahan penstabil terhadap sifat fisikokimia organoleptik pada leather labu

air (Lagenaria siceraria) [Unpublished bachelor's thesis, Universitas Semarang, Semarang].

Sari, Y. S. I., Suthama, N., & Sukamto, B. (2019). Perkembangan duodenum dan pertambahan bobot badan pada ayam broiler yang diberi ransum dengan protein mikropartikel ditambah probiotik Lactobacillus sp. [Unpublished bachelor's thesis, Universitas Diponegoro, Semarang].

Sarungallo, Z. L., Santoso, B., Murtiningrum, M., Roreng, M. K., & Murni, V. (2019). Karakteristik mutu mikroenkapsulat minyak buah merah (Pandanus conoideus) dengan perbandingan konsentrasi bahan pengemulsi dan bahan pelapis [Unpublished bachelor's thesis, Universitas Papua, Manokwari].

Setiyaningsih, L., & Widanarni, W. (2017). Pengaruh pemberian mikrokapsul probiotik Bacillus cereus P22 dan Staphylococcus lentus L1k pada pakan terhadap kinerja pertumbuhan, respons imun, dan resistensi ikan lele Clarias gariepinus Burchell 1822 yang diinfeksi Aeromonas hydrophila [Unpublished master's thesis, Institut Pertanian Bogor, Bogor].

Sumardi, Agustrina, R., Irawan, B., & Rodiah, S. (2020). Pengaruh pemaparan medan magnet 0,2 mT pada media yang mengandung logam (Al, Pb, Cd, dan Cu) terhadap Bacillus sp. dalam menghasilkan lipase [Unpublished bachelor's thesis, Universitas Lampung, Bandar Lampung].

Wulandari, E. C., Nurdianto, M., & Purwadi. (2022). Performans ayam broiler fase finisher yang diberi berbagai level maggot (black soldier fly) pada fase starter [Unpublished bachelor's thesis, Universitas Boyolali, Boyolali].

Zen, M. B., Putra, G. G. P., & Suhendra, L. (2021). Karakteristik enkapsulat ekstrak kulit buah kakao (Theobroma cacao L.) pada perlakuan variasi jenis dan konsentrasi bahan penyalut [Unpublished bachelor's thesis, Universitas Udayana, Bali].