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Effect of Lysine Supplementation in Commercial Feed on Energy Retention and Feed Conversion Ratio of Carp (*Osphronemus gouramy*)

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ABSTRACT

The long period of raising carp *(Osphronemus gouramy)* causes the need for excessive feed. One way that can accelerate the growth of this fish in order to shorten the maintenance period is by the addition of essential amino acids, such as lysine. However, this certainly gives its own influence on energy retention. Therefore, the aim of this study was to determine the influences of addition of lysine in feed on energy retention and feed conversion ratio of carp. The research method used an experimental method with a completely randomized design consisting of five treatments and four replications. The treatments used were the addition of Lysine 0%, 1%, 1.5%, 2%, and 2.5% to the feed. The present experiment was conducted for a year. The results showed that the addition of lysine as much as 2% in commercial feed can increase the energy retention of carp *(Osphronemus gouramy).* Moreover, the addition of lysine by giving up to 2.5% cannot reduce the feed conversion ratio in carp *(Osphronemus gourami)* rearing. It can be concluded that the use of lysine has different effects related to the increase in retention and decrease conversion ratio in carp.

Keywords: Carp, Conversion ratio, Energy retention, Lysine

INTRODUCTION

Carp (*Osphronemus gouramy*) in Indonesia experiences an increase in production every year. As in 2011, the market demand for carp was 9,322 tons and in 2012 the demand increased to 10,303 tons (Zakaria, 2008).

The growth of carp is slow to reach an average weight of 250 grams/head in male species and 200 grams/head in female takes 10-12 months (Handajani, 2007). The long period of raising carp causes the need for feed consumption (Muzdalipah and Yulianto, 2018). One way that can accelerate the growth of this fish in order to shorten the maintenance period is by the addition of essential amino acids, such as lysine (Simanjuntak et al., 2016; Nguyen et al., 2019). Essential amino acids are amino acids that cannot be synthesized by animals or plants and they trigger growth rate (Lovell, 1998). The requirement of lysine for carp is greater than that of other essential amino acids which is 5.7% (Viola et al., 1992). Lysine may improve the balance of utilization of amino acids so that it can increase the growth rate (Alam et al., 2005).

Amino acids in proteins are used as forming new proteins during growth and reproduction or replacing damaged proteins during the maintenance and growth period (Hidayat, 2016). The lysine supplementation as an essential amino acid made up of protein is expected to increase the energy retention of carp (Güroy et al., 2017; Nguyen et al., 2019).

On the other hand, the benefits of lysine as a supplemented ingredient to accelerate the growth of carp can be observed from the value of the FCR (Gan et al., 2013). FCR is the ratio between the dry weights of feed consumed and fish weight gain (Afrianto and Liviawaty, 1992). The addition of lysine is expected to reduce the Food Conversion Ratio (FCR), so that it can accelerate the growth of carp and shorten the maintenance time (rearing period) to the commercial size of consumption. For this reason, the present study was conducted with the aim of analyzing the addition of lysine in commercial feed to energy retention and conversion ratio of carp feed.

MATERIALS AND METHODS

This research was conducted from April 2016 to May 2016 in the Laboratory of the Faculty of Fisheries and Maritime Affairs, Universitas Airlangga. Proximate analysis of carp feed and the meat was conducted at the Feed Laboratory of Universitas Airlangga. Through this, several tools were used, namely 40x25 × 25 cm3 aquariums of 20 pieces, small aerators, aerated hoses, aeration stones, *seser* (fishes trap), plastic bags, pH meters, thermometers, DO meters, refractometers, analytical scales, *sipon* (suction device).

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The animals used for testing in this study were carp (*Osphronemus gouramy*). The carps used are 8-10 cm in size and each aquarium contains 10 fishes. Five treatments and four replications were arranged, with 20 aquariums and 200 fishes. The maintenance media used in this study are fresh water with a volume of 15 liters per aquarium. The diet was included commercial feed in the form of pellets and lysine (CAS Number 56-87-1, L-Lysine ≥98% (TLC), Sigma-Aldrich).

Along with conducting the research, carps were selected before being stocked in an aquarium. In this case, the selection is based on uniformity in size and completeness of the body's organs so that it can be ascertained that the carp is healthy and homogeneous. Before stocking, carps are acclimatized for 30 minutes. Stocking of carp was done in the morning or evening to avoid stress.

The study compared the effect between commercial feed which was not given lysine and commercial feed including lysine at different doses in each treatment (P_0, P_1, P_2, P_3, P_4) on energy retention and FCR in carp (*Osphronemus gouramy*). Analyses of variance were performed using the GLM procedure of SAS Institute Inc. (2005) as a completely randomized design consisting of five treatments with four replications.

Water Quality

Water quality can be defined as the suitability of water for fish survival and growth which is generally determined by several water quality parameters (Mahasri et al., 2009). The range of water quality during this study has a dissolved oxygen content of 4 mg/ l. The content of dissolved oxygen in this study was in the physiological range. The temperature of maintenance media during the study was between 28^{o}C - 31^{o}C (Indonesia, 2000). The pH value during the study ranged from 7.5 to 8.0. This is according to the optimal water pH ranges from 7.5 to 8.5 (Mahasri et al., 2009). The optimal ammonia concentration in aquaculture, in this case, is not more than 1 ppm (Indonesia, 2000). Ammonia concentration was not more than 1 ppm. Ammonia concentration values range from 0 to 0.09 (mg/l). Nevertheless, the water quality for 34 days of carp maintenance based on the data above shows that the optimal gourami breeding media and does not cause toxic results in death, this is evidenced by the survival rate of carp as many as 100% (Mahasri et al., 2009).

RESULT AND DISCUSSION

Energy Retention

The results showed the energy retention value of carp ranged from 23.36 to 37.42%. Data on average energy retention can be seen in Table 1.

The results of statistical analysis according to table 1 showed findings that were not significantly different on carp's energy retention. There was a significant difference between treatments, the highest energy retention was P_3 (37.42%) and the lowest energy retention was P_0 (23.36%). P_3 is not significantly different from P_4 but significantly different from P_2, P_1, and P_0. Furthermore, it is known that energy is obtained from an overhaul of chemical bonds through the process of oxidation reactions to feed components namely proteins, fats, and carbohydrates into simpler compounds (amino acids, fatty acids, and glucose) in order to be absorbed and to be used or stored by the body (Afrianto and Liviawaty, 1992). Energy retention is the amount of feed energy that can be stored in the body of a fish (Chusminah et al., 2018). Meanwhile, ANOVA statistical test results showed that the administration of amino acid lysine in commercial feed showed no significant difference in the energy retention of carp. Based on Duncan's Multiple Range Test, there was a difference between treatments with the highest supplemented amount at P_3 and the lowest amount at P_0. This shows that the supplementation of lysine in commercial feed can increase energy retention in comparison with feed without the addition of lysine.

Increased energy retention can occur due to lysine; because it's one of the essential amino acids that cannot be synthesized by the animal body. So it must be included through feed, with proper feeding and the appropriate dosage then an increase in energy retention can occur because the main source of energy in fish is a protein (Zhang et al., 2009). The dietary addition of lysine which is a monomer from protein causes absorption will be faster because it occurs directly in the intestine (Zhang et al., 2009). It is well known that protein is an important component of energy compilers in fish (Lovell, 1998). Therefore, amino acid metabolism can occur through two stages, namely transamination, and deamination (Buwono, 2000). Through these events, amino acids can be converted into acetyl Co-A which then generates to the Krebs cycle to produce energy (Buwono, 2000).

The mean value of energy retention ranged from 23.36 to 37.42% with the highest energy retention in P_3 with the addition of lysine as much as 2%. This can be interpreted that out of every 3149.8179 Kcal/kg of feed energy consumed, it can be utilized for daily growth and metabolism in carp (0.3742 x 3149.8179 Kcal /kg) or 1,178.66 Kcal/kg. On the other hand, the lowest energy retention calculation results are at P_0 as many as 23.36%. Such conditions indicate that energy that can be utilized for the growth and metabolism of carp is (0.2336 x 3044.2726 Kcal/kg) or 711.14 Kcal/kg.

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Through this matter, it is known that energy retention is related to protein feed levels because they also contain protein in addition to carbohydrates and fats (Saravanan et al., 2012). Analysis of feed protein for P_0, P_1, P_2, P_3, and P_4 are 25.15; 27.82; 28.94; 30.61; 32.06. Moreover, energy analysis levels of P_0, P_1, P_2, P_3, and P_4 are 3138.47; 3317.91; 3323.779; 3238.94; 3360.34. The highest energy retention is P_3 with the addition of lysine as many as 2%, the protein content of the feed is 30.61%, and the energy content of 3238.94 Kcal/kg. The protein-energy level is the optimal ratio for carp because the protein content of the feed approaches the minimum requirement for its protein feed in the growth phase of 32%.

The addition of 2.5% lysine possibly produced a protein content of feed in accordance with the protein requirements of carp feed is 32.06% in P_4 but the resulting energy retention was lower than P_3. This is due to an imbalance between protein-energy requirements in feed, so excess protein will cause extra energy demands to do the deamination process so that the energy that should be used for growth will be reduced (NRC, 1989). Therefore, without the right energy-protein balance will not have an impact on growth, the level of protein-energy in the feed also affects feed consumption, if the protein-energy level exceeds the need, it will reduce consumption so that the uptake of other nutrients including protein will decrease (Lemos et al., 2014). Comparison between protein retention and energy must be optimal in order to stimulate growth. In fact, high energy intake can reduce protein consumption as an energy source (Souto et al., 2013).

Feed Conversion Rate

The results showed the FCR of carp ranged from 3.39 to 5.05. Data on average FCR can be seen in Table 2.

The results of the statistical analysis of lysine amino acids in commercial feed, in Table 2, showed results that were not significantly different ($p > 0.05$) to the conversion ratio of carp feed. Based on Duncan's Multiple Range Test, it was found that there were no differences between treatments. Therefore, it is known that the FCR is the ratio between the dry weights of the food consumed and fish weight gain (Afrianto and Liviawaty, 1992) The FCR is used as one of the benchmarks of success both technically and financially. On the other hand, the value of the FCR is inversely proportional to the growth in fish weight. The higher FCR shows that the feed given is increasingly ineffective in the growth of carp.

Meanwhile, ANOVA statistical results and Duncan's Multiple Range Test showed that the supplementation of lysine in commercial feed did not affect the FCR value in carp ($p > 0.05$). Based on the calculation of feed consumed, the amount of feed consumed P_0 and P_3 has a small difference but the addition of P_3 fish weight is greater than that of P_0. Consequently, there is a tendency to decrease the value of feed conversion to occur at P_3. Feed consumption data can be seen in Table 2. The value of the P_3 FCR is 3.39, which means that 3.39 grams of feed give 1 gram of carp weight gain. P_0 FCR value is 5.05, which means to add 1 gram of carp weight, feed consumption of 5.05 grams is required.

On the other hand, the ANOVA statistical results of giving lysine in commercial feed to FCR were not significantly different, it possibly could be due to the content of lysine used in this study. In addition to achieving optimal growth, feed energy must meet the needs for daily activities, metabolism, and maintenance needs. Energy in feed is still used for the daily needs of fish, namely for metabolic processes so that maximum growth has not yet occurred. These conditions are in accordance with circumstances where not all the incoming energy can be digested and utilized for growth (Handajani and Widodo, 2010; Zuidhof, 2019). In this case, the dietary energy is physiologically used for maintenance and metabolism; if there is residual it will be deposited as body tissue in the growth process (Zuidhof, 2019).

Table 1. Average energy retention in carp

Treatment	Energy Retention ± SD (%)	Energy Retention √y±SD
P_0	$23.36^b \pm 9.84$	4.76 ± 1,01
P_1	$23.90^b \pm 4.53$	4.87 ± 0.46
P_2	$24.73^b \pm 4.58$	4.95 ± 0.46
P_3	$37.42^a \pm 8.61$	6.09 ± 0.73
P_4	$26.03^{ab} \pm 5.16$	5.08 ± 0.49

Notes: P_0: Lysine 0%, P_1: Lysine 1%, P_2: Lysine 1.5%, P_3: Lysine 2%, P_4: Lysine 2.5 %, and SD: standard deviation. Different superscripts in the same column show significant differences in Duncan's Multiple Range Test (*Duncan's Multiple Range Test*).

Table 2. FCR in different treatment in carp feed conversion ratio

Treatment	Feed Conversion Rate ± SD	Feed Conversion Rate √y+0.5±SD
P_0	5.05 ± 1.55	2.33 ± 0.32
P_1	4.50 ± 0.91	2.23 ± 0.20
P_2	4.15 ± 0.85	2.15 ± 0.19
P_3	3.39 ± 1.00	1.96 ± 0.25
P_4	3.82 ± 0.75	2.07 ± 0.18

Notes: P_0: Lysine 0%, P_1: Lysine 1%, P_2: Lysine 1.5%, P_3: Lysine 2%, P_4: Lysine 2.5 %, and SD: Standard Deviation

CONCLUSION

Based on present findings, it can be concluded, the supplementation of lysine as much as 2% in commercial feed can increase the energy retention of carp *(Osphronemus gouramy*). As well as, the dietary supplementation of lysine to commercial feed by giving up to 2.5% may not reduce the feed conversion ratio in carp (*Osphronemus gouramy*) breeding.

DECLARATIONS

Authors' contribution

Authors (Ataina Thaiin, Agustono, and Mohammad Anam Al Arif) had equal roles in conducting, writing, and editing manuscript as teamwork.

Competing interests

The authors have declared that no competing interest exists.

Ethical considerations

All authors approved the final draft of the manuscript for submission to this journal. Ethical issues (Including plagiarism, consent to publish, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been checked by the authors.

REFERENCES

Afrianto E, and Liviawaty E (1992). Pengendalian Hama dan Penyakit Ikan. Kanisius. Yogyakarta, p. 89. Available at: https://opac.perpusnas.go.id/DetailOpac.aspx?id=211610

Alam MS, Teshima S, Koshio S, Ishikawa M, UyanL O, Hernandez LHH, and Michael FR (2005). Supplemental effects of coated methionine and/or lysine to soy protein isolate diet for juvenile kuruma shrimp, Marsupenaeus japonicas. Aquaculture, 248: 13-19. DOI: https://www.doi.org/10.1016/j.aquaculture.2005.04.015

Buwono ID (2000). Kebutuhan asam amino esensial dalam ransum ikan ibnu dwi buwono, Kanisius, p. 668. Available at: http://opac.lib.ugm.ac.id/index.php?mod=book_detail&sub=BookDetail&act=view&typ=htmlext&buku_id=646123&obyek_id=1

Chusminah C, Haryati RA, and Kristiani D (2018). Efektifitas implementasi e-tilang kendaraan bermotor dalam rangka tertib berlalu lintas pada korps lalu lintas polri. Widya Cipta: Jurnal Sekretari dan Manajemen, 2(2): 217-224. Available at: https://ejournal.bsi.ac.id/ejurnal/index.php/widyacipta/article/view/4318

Gan L, Liu YJ, Tian LX, Yue YR, Yang HJ, Liu FJ, Chen YJ, and Liang GY (2013). Effects of dissolved oxygen and dietary lysine levels on growth performance, feed conversion ratio and body composition of grass carp, Ctenopharyngodon idella. Aquaculture Nutrition, 19(6): 860-869. DOI: https://www.doi.org/10.1111/anu.12030

Güroy D, Karadal O, Güroy B, Mantoğlu S, Çelebi K, Şimşek O, Eroldoğan OT, Genç MA, and Genç E (2017). The effects of dietary protein levels with amino acid supplementation on the growth performance, haematological profile and histology of meagre (Argyrosomus regius) in two different size classes. Aquaculture Research, 48(12): 5751-5764. DOI: https://www.doi.org/10.1111/are.13398

Handajani H (2007). Perendaman larva gurami (Osphronemus gouramy) dengan umur yang berbeda pada hormon metiltestoteron terhadap keberhasilan pembentukan monosex jantan. jurusan Perikanan Universitas Muhammadiyah Malang. Hal. Available at: https://onesearch.id/Record/IOS1.INLIS000000000242746

Handajani H, and Widodo W (2010). Nutrisi Ikan. Universitas Muhammadiyah Malang Press. Malang, p. 271. Available at: https://ummpress.umm.ac.id/katalog/detail/nutrisiikan.html

Hidayat T (2016). Quality deteoration gourami fish *(Osphronemus gouramy*) during storage. International Journal of Materials Chemistry and Physics, 2(1): 40-44. Available at: https://docplayer.net/47678606-Quality-deteoration-gourami-fish-osphronemus-gouramy-during-storage.html

Lemos MV, Antunes de A, Thiago Q, Souto CN, Martins GP, Janaína Gomes A, and Gomes GI (2014). Effects of digestible protein to energy ratios on growth and carcass chemical composition of siamese fighting fish (*Betta splendens*). Ciência e Agrotecnologia, 38(1): 76-84. DOI: https://www.doi.org/10.1590/S1413-70542014000100009

Lovell T (1998). Fish nutrition and feeding experiments. Nutrition and Feeding of Fish, pp. 123-134. Available at: https://link.springer.com/chapter/10.1007/978-1-4615-4909-37

Mahasri G, Mubarak AS, Alamsjah MA, and Manan A (2009). Bahan ajar: Manajemen kualitas air. fakultas perikanan dan kelautan. Universitas Airlangga hal. Available at: https://sinta.ristekbrin.go.id/journals/detail?page=4&id=3997

Muzdalipah I, and Yulianto E (2018). Ethnomathematics study: The technique of counting fish seeds (Osphronemus gouramy) of sundanese style. Journal of Medives, 2(1): 25-40. DOI: https://www.doi.org/10.31331/medives.v2i1.555

National Research Council (NRC) (1989). Diet and health: Implications for Reducing Chronic Disease Risk, p. 768. Available at: http://www.nap.edu/catalog/1222.html

Nguyen MV, Espe M, Conceição L, Le HM, Yúfera M, Engrola S, Jordal AO, and Rønnestad I (2019). The role of dietary methionine concentrations on growth, metabolism and N-retention in cobia (*Rachycentron canadum*) at elevated water temperatures. Aquaculture Nutrition, 25(2): 495-507. DOI: https://www.doi.org/10.1111/anu.12875

Saravanan S, Schrama JW, Figueiredo-Silva AC, Kaushik SJ, Verreth JA, and Geurden I (2012). Constraints on energy intake in fish: the link between diet composition, energy metabolism, and energy intake in rainbow trout. PloS One, 7(4): e34743. DOI: https://www.doi.org/10.1371/journal.pone.0034743

Simanjuntak SBI, Wibowo ES, and Indarmawan I (2016). Stimulation of deprivation cycles with spirulina platensis feed supplementation on osphronemus gouramy physiological responses. Biosaintifika Journal of Biology and Biology Education, 8(3): 377-384. DOI: https://www.doi.org/10.15294/biosaintifika.v8i3.7274

Souto CN, Lemos MVA, Martins GP, Araújo JG, Lopes KLAM, and Guimarães IG (2013). Protein to energy ratios in goldfish (*Carassius auratus*) diets. Ciência Agrotecnologia, 37(6): 550-558. DOI: http://www.dx.doi.org/10.1590/S1413-70542013000600008

Viola S, Lahav E, and Angconi H (1992). Reduction of feed protein levels and of nitrogenous N-excretions by lysine supplementation in intensive carp culture. Aquatic Living Resources, 5(4): 277-285. DOI: https://www.doi.org/10.1051/alr:1992026

Zakaria R (2008). Kemunduran mutu ikan gurami (*Osphronemus gouramy*) pasca panen pada penyimpanan suhu chilling. Program Studi Teknologi Hasil Perikanan, IPB, Bogor, pp. 1-90. Available at: https://docplayer.info/38896934-Kemunduran-mutu-ikan-gurami-osphronemus-gouramy-pasca-panen-pada-penyimpanan-suhu-chilling-rijan-zakaria.html

Zhang Q, Ames JM, Smith RD, Baynes JW, and Metz TO (2009). A Perspective on the maillard reaction and the analysis of protein glycation by mass spectrometry: Probing the pathogenesis of chronic disease. Journal of Proteome Research, 8(2): 754-769. DOI: https://www.doi.org/10.1021/pr800858h

Zuidhof MJ (2019). A Review of dietary metabolizable and net energy: Uncoupling heat production and retained energy. Journal of Applied Poultry Research, 28(2): 231-241. DOI: https://www.doi.org/10.3382/japr/pfx062

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