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Effect of Phytase Enzyme on Growth Boost in the Artificial Feed Made of Plant Protein to Shorten Production Time of Giant Tiger Prawn [*Penaeus monodon*, (Fabricus 1798)]

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Abstract

The use of plant protein in the artificial feed needs to be reckoned since plant protein contains phytate acid. To solve the problem is by adding phytase enzyme. This study aims to identify effect of phytase enzyme in the artificial feed and determine optimal dose of phytase enzyme on feed digestibility, nutrient efficiency utilization, and growth of giant tiger prawn (*Penaeus monodon*). The shrimp used in the study was giant tiger prawn (*P. monodon*) with the average weight of (1.19 ± 0.06) g per shrimp and the density of one shrimp per L. Methodology used in this study was experimental treatments with complete random design. The study consisted of four treatments and three repetitions. The treatments were by adding phytase enzyme in the different doses, namely: A (0 FTU · kg^{-1} diet), B (500 FTU · kg^{-1} diet), C (1 000 FTU · kg^{-1} diet) and D (1 500 FTU · kg^{-1} diet). Data collected were from variables of digestibility raw protein (DRP), digestibility total protein (DTP), nutrient efficiency utilization (NEU), relative growth rate (RGR), survival rate (SR) of giant tiger prawn (*P. monodon*) and water quality. The results show that the treatments significantly ($p < 0.01$) affected on the DRP, DTP, NEU, and RGR; however, they did not significantly ($p > 0.05$) influence on the survival rate. The optimum dose of phytase enzym for feed digestibility, feed utilization and the growth of giant tiger prawn (*P. monodon*) was 1 000 FTU · kg^{-1} feed. The water quality was still in the viable range for giant tiger prawn cultivation.

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Keywords: Artificial feed; tiger prawn (*Penaeus monodon*, Fabricus 1798); growth; phytase enzyme; production

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1. Introduction

Giant tiger prawn (*Penaeus monodon*, Fabricus 1798) is an endogenous species of Indonesia. The popularity has faded since the introduction of vannamei shrimp which is able to live in more dense population per unit area, has more disease resistant, and has higher sale price. The success of giant tiger prawn cultivation depends on the artificial feed and disease outbreak. One of the ingredients in the artificial feed is soybean meal, but unfortunately it contains anti-nutrient, phytate acid (Kumar et al., 2011). Cao et al. (2007) has reported that phytate acid in the soybean meal was 3.88 g · kg^{-1}. Phytate acid bind minerals which have valence of two or three (calcium, ferrum, zinc, magnesium) to form compound is difficult to digest (Baruah et al., 2007). Besides binding with minerals, phytate acid also binds with protein and amino acid; therefore it reduce feed digestibility (Ravindran, 2000).

One way to mitigate the problem was by adding phytase enzyme (Chung, 2001), and this idea was supported by Jobing (2002) and NRC (1983) that to reduce phytate acid content can be used phytase enzyme. The enzyme in the artificial feed can improve nutrient absorption and regulate nutrient excretion, such as phosphor, nitrogen, and mineral, and hydrolyze phytate acid to become inositol and phosphate acid. Hydrolyzation can break the minerals from the compound (Chung, 2001). Moreover, Baruah et al. (2007) found those phytase enzymes can hydrolyze phytate acid (mio-inositol hexaphosphat) into mio-inositol mono, di, tetra, and pentaphosphate and organic phosphate.

Some studies on the effect of phytase enzyme in the artificial feed were conducted by Debnath et al. (2005), Baruah et al. (2004), Rachmawati and Hutabarat (2006), Suprayudi et al. (2012), Shapawi et al. (2003), Bulbul et al. (2015), and Danwitz et al. (2016). Debnath et al. (2005) studied that the addition of phytase enzyme as much as 500 FTU · kg^{-1} diet can increase growth of *Pangasius pangasius* (Fawler, 1937) fingerings, while Baruah et al. (2004) found that the additional phytase enzyme of 750 mg · kg^{-1} soybean meal can improve growth and digestibility of *Labeo rohita* (Hamilton, 1822). Rachmawati (2006) and Hutabarat (2010) also discovered that the addition of 1 000 unit of phytase enzyme · kg^{-1} soybean meal can increase growth of *Epinephelus fuscoguttatus* **(**Forsskal, 1775) and *Osphronemus gouramy* (Lacepede, 1801). The additional pyhtase enzyme of 500 unit · kg^{-1} soybean can increase phosphor digestibility and growth of *Lipopenaeus vannamei* (Boone, 1931) (Suprayudi et al., 2012). Shapawi et al. (2013) detected that and 200 mg · kg^{-1} 30 % soybean meal of diet can improve nutrient digestibility and growth of kuruma shrimp (*Marsupenaeus japonicas*, Bate 1888), meanwhile Danwitz et al. (2016) mentioned that the addition of phytase enzyme of 2 000 FTU · kg^{-1} diet can increase growth, protein and phosphor digestibility of turbot fish (*Psetta maxima*, Linne 1758). This study aims to identify effect of phytase enzyme in the artificial feed and determine optimal dose of phytase enzyme on feed digestibility, nutrient efficiency utilization, and growth of giant tiger prawn (*P. monodon*).

2. Materials and methods

Shrimp used in the study was giant tiger prawn (*P. monodon*) with the average weight of (1.19 ± 0.06) g per shrimp. Experimental shrimp was selected based on the homogeneity, completeness of body parts, and overall healthiness. To adapt to the feed and the new environment, experimental shrimp was put in the media for one week. And the shrimp was allowed to fast for one day to give time for excretion of the metabolism waste (Rachmawati and Hutabarat, 2006). The growth for the samples was measured every week.

The media used in the experiment was 12-black buckets with the size of 25 L each. The buckets were disinfected using kalium permanganat (K_2PO_4) and sunbathed until dry. Then the buckets were arranged randomly and poured with 20 L water each. After filling the buckets with the water, they were aerated and covered with clear plastics as biosecurity.

Feed used in the study was in the form of pellet with the size of 0.2 mm to 0.5 mm. The feed contained minimum of 38 % protein and 3 200 kcal DE · kg^{-1} (Suprayudi et al., 2012). Shrimp was fed at satiation four times a day at 07:00, 11:00, 15:00, and 19:00 a clock. The feed made of fish meal as a source of animal protein, soybean meal as a source of plant protein, corn meal, rice bran, and wheat flour as a source of carbohydrate, fish and corn oil as sources of fat, minerals and vitamin mix (aquamin) as sources of vitamin, CMC as a binder, 1 % of Cr_2O_3 as an indirect indicator of digestibility (NRC, 1993) and phytase enzyme as a breaker phytate acid compound. The brand of phytase enzyme used in the study was Natuphos® 5000 produced by PT. BASF Indonesia. Composition of