http://dx.doi.org/10.22161/ijeab.4429 ISSN: 2456-1878

The Utilization of Sweet Potatoes as Prebiotics on the Performance of *Lactobacillus* sp. in the Vanamei Shrimp Digestion (*Litopenaeus vannamei*)

Maria Theresia D. Tei[1], Siti Aslamyah[2], Sriwulan[2]

[1]Student in Fisheries Science Magister, Marine Science and Fishery Faculty, Hasanuddin University, Indonesia
Email: resa.bapa@yahoo.co.id
[2]Marine Science and Fishery Faculty, Hasanuddin University, Indonesia

Abstract**—***The use of probiotics (Lactobacillus sp.) in feed is one alternative that is done to improve immunostimulants, growth stimulants, and can be used as a balance of microorganisms in digestion.This study aimed to evaluate the growth performance of vanamei shrimp fed with the addition of Lactobacillus sp. with sweet potatoes in feed. This study used a completely randomized design (CRD) with 4 treatments and 3 replications. The treatment were by feeding with different sweet potato concentrations: A) The dose of sweet potato in feed was 0% (as control); B) The dose of sweet potato in feed was 10%; C) 1The dose of sweet potato in feed was 15%; and D) The dose of sweet potato in feed was 20%. Data were analyzed using variance analysis (ANOVA) and continued with W-Tuckey's further test. The research parameters were digestive enzyme activity, nutrient digestibility and growth. The results of the variance analysis showed the addition of various sweet potato concentrations with Lactobacillus sp. has no significant effect (p> 0.05) of the growth rate. The specific growth rate of vannamei shrimp ranges from 3.06 to 3.23% / day. Based on the results of the analysis on the utilization of sweet potatoes as a prebiotic on the performance of Lactobacillus sp. in the vannamei shrimpis (Litopenaeus vannamei) digestive tract can be concluded that the growth performance does not have a significant effect after being fed with the addition of Lactobacillus sp. and sweet potatoes in feed.*

Keywords**— Enzymes, Digestion, Growth, Lactobacillus sp., Prebiotic, Probiotic.**

I. INTRODUCTION

The intensive system of vanamei shrimp farming in feed ponds is the largest component in shrimp farming. Emphasis on feed production costs is another alternative that is easy to obtain, cheap price and nutrient requirements in shrimp are still fulfilled so as to increase digestibility because if the digestibility level is high then feed efficiency increases (Putra, 2016). Shrimp require certain amounts of certain nutrients for growth, body maintenance and self defense against disease. These nutrients include protein, fat and carbohydrates (Zainuddin et al., 2009). One alternative is using probiotics (Suri, 2017).

Probiotics function as immunostimulants, growth boosters, and can be used as a counterweight to microorganisms in digestion (Khasani, 2007). One of the probiotics that is often used is Lactobacillus sp. Like the statement (Angelis & Gobbeti, 2011) Lactobacillus sp. including in the group of lactic acid bacteria so it is safe for digestion. In order for probiotics to grow well in the digestive tract, prebiotics are needed as nutrients. Prebiotics are generally carbohydrates (poly- and oligosaccharides) which cannot be digested in the host's digestive tract. High carbohydrate content can be found in tubers, one of which is sweet potato (Lesmanawati et al., 2013). Sweet potatoes contain ologisaccharides which have the potential to provide beneficial nutrients for microbial intestines (Marlis, 2008).

Sweet potato (Ipomoea batatas L) is a food crop with quite high productivity. Sweet potato productivity in Indonesia has increased from year to year. In addition to the content of beta carotene, anthocyanin, phenol compounds and dietary fiber and having a low glycemic index value, sweet potato is also very potential to be developed as a prebiotic source mainly due to its oligosaccharide content (Lesmanawati et al., 2013). Sweet potato fiber extract (ESU) has been shown to contain Fructo-Oligosaccharide (FOS) and Raffinosa and is able to enhance immunity and increase the composition

http://dx.doi.org/10.22161/ijeab.4429 ISSN: 2456-1878

of beneficial bacteria Bifidobacterium sp. and Lactobacillus sp. (Suri, 2017).

Descriptively, the prebiotic treatment of sweet potato extract in synbiotics gave better performance on absolute weight growth, daily growth rate, survival rate, and vanamei shrimp feed conversion ratio compared to control treatment. In addition, the results of research by Mustafa (2017) showed that feeding with sweet potato prebiotics contributed significantly to the activity of amylase enzymes, carbohydrate digestibility and vanamei shrimp digestibility. Based on the results of these studies, it is necessary to conduct further research on the utilization of sweet potato as a prebiotic on the performance of Lactobacillus sp. in the digestive tract of shrimp vanamei. The purpose of this study was to evaluate the growth performance of vanamei shrimp fed by adding Lactobacillus sp. and sweet potatoes in feed.

II. MATERIALS AND METHODS

Time and Place

This research was conducted from December to February with the location of the trial treatment at the Brackishwater Aquaculture Center Takalar (BPBAP). Analysis of enzyme activity and analysis of digestibility levels were carried out at the Research and Development Center for Brackish Water Cultivation (BPPBAP) Maros. Feed making and probiotic analysis at the Takalar Brackish Aquaculture Fisheries Center (BPBAP).

Research Containers The

The containers used in this study were container boxes 63.1 cm x 41.4 cm x 30.7 cm with a volume of 50 L as many as 12 pieces, which were placed in the room (indoor) and each was equipped with resikurlasi. Tubs and all equipment used are first disinfected with chlorine and neutralized with nitrosulfate. Sterile containers are each filled with seawater that has been filtered with a salinity of 27-32 ppt.

Test Animals

The test animals used in this study were juvenile shrimp vanamei (Litopenaeus vannamei) which was taken from the Payau Takalar Aquaculture Fisheries Center with a weight of ± 1.1 g / head, with a stocking density of 50 per liter.

Artificial Feed and Prebiotics The

The feed used was formulated with nutritional composition according to the needs of vanamei juvenile shrimp and sweet potato flour was added as a prebiotic. The formulation of feed raw materials is presented in (Table 1), while the results of the proximate analysis of treatment feed are presented in (Table 2). The bacteria that will be used as probiotics are Lactobacillus sp. isolated from yakult at the Hasanuddin University Faculty of Marine and Fisheries Pests and Diseases Laboratory with a colony density of 2.14 x 109 CFU / mL.

Table 1. Formulation of feed used

Ingredients Raw materials	Composition (%)			
	A	B	C	D
Fishlocal	40	40	40	40
Soybean flour	22	22	22	22
Corn flour	10	10	10	10
Sweet potato flour	0	10	15	20
CMC	20	10	5	0
Fish oil	4	4	4	4
Vitamin and Mineral mix	4	4	4	4

Description: A (control), B (addition sweet potatoes of 10%), C (addition sweet potatoes of 15%), D (addition sweet potatoes of 20%)

Table 2 Proximate analysis of feed treatment

No.	Treatment	Content (%)					
		Air	Crude protein	Crude fat	Crude Fiber	BETN	Abu
1.	Feed A	10.05	30.25	10.27	4.25	45.26	9.97
2.	Feed B	8.63	31.98	11.05	3.63	45.19	8.15
3.	Feed C	7.94	32.37	11.03	3.41	47.23	5.96
4.	Feed D	11.27	30.31	9.95	2.66	52.11	4.97

Description: 1. Except of water, All fractions are analyzed in dry materials; 2. BETN = Extra Material without Nitrogen

Experimental Design and Treatment The

This study was designed in Completely Randomized Design (CRD) with 4 treatments and 3 replications each. Thus there are 12 experimental units. The treatment is: A) Sweet potato dosage in 0% feed (control); B) The dose of sweet potato in feed is 10%; C) 15% dose of sweet potato in feed; D) The dose of sweet potato in feed is 20%.

Observation

Parameters The research parameters included enzyme activity (α-amylase & protease), nutrient digestibility and growth of vannamei shrimp. Observation of the activity of α-amylase &protease enzymes is guided by the method of Bergmeyer and Grassi (1983). The activity of the α-amylase & protease enzyme is measured using the following formula:

$$Enzyme\ activity\ \alpha amylase\ /\ protease\ = \left(\frac{Act - Abl}{Ast - Abl}\right) \times \frac{P}{T}$$

http://dx.doi.org/10.22161/ijeab.4429 *ISSN: 2456-1878*

Description:
Act = Sample absorbance value
Abl = Absorbance value blank
Ast = Standard absorptive value
P = Dilution factor
T = Incubation time in days

Analysis of feed nutrient digestibility was carried out by indirect method, using an indicator of chromium oxide (Cr2O3) of 1% mixed evenly in feed. Chrome feces collection is done every day until 1 g of dried feces. Analysis of chromium using a Shimadzu UV-VIS 2401PC spectrophotometer. The chromium concentration in feces can be calculated based on the formula according to Takeuchi (1988) as follows:

$$Nutrient\ digestibility\ = 100 - 100\left[\times \frac{(ax\ b')}{(\ a'xb)}\right]$$

Description: a =% Cr2O3 in feed
a ' =% Cr2O3 in feces

Growth value is obtained from the formula Hardjamulia et al. (1986):

$$SGR\ = \frac{lnWt\ - lnWo}{T} \times\ 100$$

Description:
SGR = average growth rate for specific weights (%)
lnWo = average initial growth rate (g)
lnWt = average final growth rate (g)
T = time used during the experiment (g)

Data on growth and enzyme activity obtained were analyzed using variance analysis (ANOVA) while nutrient digestibility data and water quality parameters were analyzed descriptively based on the feasibility of live vanamei shrimp.

III. RESULTS AND DISCUSSION

Digestive Enzyme Activity The

The results of variance analysis (ANOVA) showed the treatment of feeding with the addition of sweet potato concentration and *Lactobacillus* sp. no significant effect (p> 0.05) on the activity of protease and amylase enzymes in the vanamei shrimp digestive tract (Table 3). In Table 3 shows the highest protease enzyme activity at 15% prebiotic sweet potato concentration, that is (0.09 u / mL) and amylase enzyme (0.46 u / mL).

Table 3. Average digestive enzyme activity (u / mL)

	Treatment	Digestive enzyme activity (u / mL)	
		Protease	Amilase
A	Sweet potato dose in feed 0%	0.06 ±0.005[a]	0.33 ±0.041[a]
B	Sweet potato dose in feed 10%	0.07 ±0.012[a]	0.41 ±0.031[a]
C	Sweet potato dosage in feed 15%	0.09 ±0.013[a]	0.46 ±0.097[a]
D	Sweet potato dosage in feed 20 %	0.07 ±0.008[a]	0.43 ±0.039[a]

Description: The same letter shows no significant effect between treatments at the level of 5% (p> 0.05).

Nutrient digestibility

The results of the variance analysis (Anova) showed feed treatment with the addition of sweet potato concentration and *Lactobacillus* sp. no significant effect (p> 0.05) on nutrient digestibility of vanamei shrimp (Table 4). Digestion values describe the amount of nutrients in digestible feed. The high digestibility of protein and crude fiber produced in feeding fe ed concentrates 15% sweet potatoes in feed due to increased enzyme activity in the digestive tract o f the test shrimp (Table 4).

Table 4. Average nutrient digestibility of vanamei shrimp during maintenance.

Treatment	Digestibility (%)		
	Protein	Rough Fiber	BETN
A. Sweet potato dosage in feed 0%	70,214	56,034	93,602
B. Sweet potato dose in feed 10%	61,654	73,308	90,885
C. Doses of sweet potato in feed 15%	80,085	76,869	90,989
D. Doses of sweet potato in feed 20%	78,157	71, 101	81,538

Description: Different superscript letters in the same column show significantly different results (P> 0.05).

Specific Growth Rate The

The results of the variance analysis showed that the treatment of adding various sweet potato concentrations with *Lactobacillus* sp produced a growth rate that had no significant effect (p> 0.05), (Table 5). Based on the table above, it can be seen that the specific growth rate of vanamei shrimp ranges from 3.06-3.23% / day, thus that all sweet potato concentrations (prebiotics) can be utilized by vanamei shrimp to provide the same response rate of growth for all treatments.

Table 5. Average specific growth rate (% / day)

Treatment	Specific Growth Rate (% / day)
Dosage of sweet potatoes in feed 0%	3.12 ± 0.280[a]
Doses of sweet potato in feed 10%	3.06 ± 0.557[a]
Dosage of sweet potato in feed 15%	3.23 ± 0.456[a]
Sweet potato dosage in feed 20%	3.06 ± 0.569[a]

Description: The same letter shows no significant difference between treatments at the level of 5% (p> 0.05)

This study shows growth in the treatment of the addition of *Lactobacillus* sp. into sweet potatoes is thought to be due to the ability of probiotics *Lactobacillus* sp. found in the vanamei shrimp digestive tract increases the activity of digestive enzymes so that the use of feed and digestive processes can be more selective. In addition, it is suspected that the given prebiotics also contribute to maintaining a bacterial population that supports shrimp growth performance, so the application of prebiotics and probiotics is very suitable for shrimp (Lesmanawati et al., 2013).

The results obtained in accordance with the statement of Aslamyah (2006) which states that one of the mechanisms of probiotics is to improve growth performance by increasing the nutritional value of feed through increased activity of digestive enzymes in the digestive tract of shrimp. Enzymes produced by microbes found in probiotics are amylase, protease and lipase enzymes. These enzymes that hydrolyze complex molecules such as breaking down carbohydrates, proteins and fats into simpler molecules make it easier for the digestion and absorption of nutrients in the digestive tract of fish (Putra, 2016). The secreted enzymes will increase as the bacterial population increases. The use of this enzyme which then increases the digestibility of feed, so that it directly affects the growth and survival of vanamei shrimp.

Fish growth is closely related to the availability of protein in feed, because protein is an energy source for vanamei shrimp and protein is also a nutrient that is needed by vanamei shrimp. According to Suprapto (2005) that the speed of growth depends on the amount of feed consumed, water quality and other factors such as heredity, age, endurance and the ability of the fish to utilize feed. The amount of feed given is very important because if too little will result in slow fish growth and competition for feed will occur which results in variations in the size of the fish produced. Conversely, if too much feed will cause environmental pollution and inefficient.

The water quality for the whole treatment is at the same optimum optimum range for vanamei shrimp. This is supported by an increase in the growth of test shrimp. The temperature of maintenance media is 29-32.5 ^{o}C, salinity ranges from 30-35 ppt, pH range obtained during research 7-8. The dissolved oxygen content of the media obtained during maintenance ranged from 4.35-5.80 ppm, the ammonia (NH_3) content was 0.06-0,019 ppm.

IV. CONCLUSION

Based on the results of the analysis of research on the use of sweet potatoes as a prebiotic on the performance of *Lactobacillus* sp. in the vanamei shrimp digestive tract (*Litopenaeus vannamei*) it can be concluded that the growth performance of vanamei shrimp does not have a significant effect after being fed with the addition of *Lactobacillus* sp. and sweet potatoes in feed.

ACKNOWLEDGMENT

The researcher would like thank to Faculty of Marine Science and Fisheries Hasanuddin University for the rearing facilities.

REFERENCES

[1] Angelis, M. D. & Gobbetti, M. (2011). Lactic Acid Bacteria Lactobacillus spp General Characteristics. Encyclopedia of Dairy Sciences (Second Edition). 78–90.
[2] Aslamyah, S. (2006). Penggunaan Mikroflora Saluran Pencernaan sebagai Probiotik untuk Meningkatkan Pertumbuhan dan Kelangsungan Hidup Ikan Bandeng. Disertasi. Progam Pascasarjana, Institut Pertanian Bogor.
[3] Khasani, I. (2007). Aplikasi Probiotik Menuju Sistem Budidaya Perikanan Berkelanjutan. Media Akuakultur. 2(2): 86-90.
[4] Lesmanawati, W., Widanarni, Sukenda, & Purbiantoro, W. (2013). Potensi Ekstrak Oligosakarida Ubi Jalar sebagai Prebiotik Bakteri Probiotik Akuakultur. Jurnal Sains Terapan Edisi III Vol-3 (1):21-25.
[5] Marlis, A. (2008). Isolasi Oligosakarida Ubi Jalar (Ipomoea batatas L.) dan pengaruh Pengolahan terhadap

Potensi Prebiotiknya. Tesis. Institut Pertanian Bogor. Bogor.

[6] Mustafa, Y. (2017). Aplikasi Prebiotik Berbeda pada Pakan Terhadap Kinerja Bakteri Lactobacillus Sp. dalam Saluran Pencernaan Udang Vaname (Litopenaeus Vannamei). Tesis. Program Pascasarjana Universitas Hasanuddin.

[7] Putra, A. N. (2016). Kajian Probiotik, Prebiotik Dan Sinbiotik untuk Meningkatkan Kinerja Pertumbuhan Ikan Nila (Oreochromis Niloticus). Tesis. Program Pascasarjana. Institut Pertanian Bogor. Bogor.

[8] Suprapto. (2005). Petunjuk Teknis Budidaya Udang Vannamei (Litopenaeus vannamei). CV. Biotirta, Bandar Lampung.

[9] Suri, R. (2017). Studi tentang Penggunaan Pakan Komersil yang Dicampur dengan Bakteri Bacillus coagulans terhadap Performa Litopenaeus vannamei. Skripsi. Universitas Lampung. Bandar Lampung.

[10] Zainuddin, Abustang & Aslamyah, S. (2009). Penggunaan Probiotik pada Pakan Buatan untuk Pembesaran Udang Windu. Laporan Penelitian Hibah Kompetitif Prioritas Nasional. Universitas Hasanuddin. Makassar.