Additional of crocot flour (*Portulaca oleracea l.*) and Mannanoligosaccharides (MOS) in feed for improving growth performance windu shrimp *(Penaeus monodon)*

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Abstract. This study aims to determine the effect of giving purslane flour and MOS to feed on increasing growth performance in Windu shrimp (*Paneus monodon*). The research was carried out at the Balai Perikanan Budidaya Air Payau Ujung Batee (BPBAP) in Ujung Batee. This study was conducted using a Complete Randomized Design (CRD) method with 4 treatments used, namely A (control), B (30 g/kg purslane flour and 10 g/kg MOS), C (40 g/kg purslane flour and 10 g/kg MOS), and D (50 g/kg purslane flour and 10 g/kg MOS). The results showed that the addition of 40 g/kg purslane flour and 10 g/kg MOS resulted in an absolute weight growth of 0.60±0.05 grams, a specific growth rate 16.00±0.24% per day, an absolute length growth of 4.33±0.06 cm, a feed conversion ratio of 0.52±0.03, feed efficiency of 192.08±12.21%, moulting frequency of 1.50 times per head, and a survival rate of 93.20±9.33%.

1 Introduction

Windu Shrimp *(Penaeus monodon)* is one of the leading commodities in Asia. This is a result of the various benefits that Windu Shrimp offer, such as their higher harvest size, savory and sweet flavor, and high nutritional value [1]. Another favorable trait is its resistance to temperature changes known as eurythemal [2]. This commodity is known to have a high economic value compared to several other commodities, both for local consumption and for export markets. Windu Shrimp farming has been widely practiced in several regions of Indonesia still faces some obstacles. The main problem encountered in shrimp farming activities is the low growth rate [3] Some factors that affect the growth and survival of Windu Shrimp include seed quality, feed type, water quality, disease, and moulting success [4]. Stated that during the moulting process, shrimp absorb calcium and magnesium. The content of these substances is needed in high quantities because this molting is an indicator of growth.

One solution that can be done to support growth and increase Windu Shrimp production is the addition of purslane flour and MOS to feed as an alternative raw material. Purslane leaves and stems contain a high potassium content of 46,000 and 68,600 mg/kg, respectively; magnesium averages 4400 mg/kg; and calcium 25,400 and 60,000 mg/kg [5], the content contained in purslane plants is as functional as the formation of the exoskeleton in shrimp during the moulting process. According to [6], purslane has a protein content of 2-2.5%, which is useful for supporting shrimp growth.

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In order to optimize digestibility in shrimp, it is necessary to add supplements to the feed such as the addition of prebiotics. One of the prebiotics that has been studied and applied in aquaculture is mannanoligosaccharide (MOS) [7]. Prebiotic mannanoligosaccharide (MOS) is a prebiotic that is able to spur the growth of beneficial microflora in the gastrointestinal tract so as to increase the growth of organisms [8]. The provision of MOS has so far been applied to several types of shrimp, one of which is vaname shrimp. [9,10] reported that mannanoligosaccharide (MOS) has been tested to improve the growth and survival of vaname shrimp juveniles. [11] reported that giving 1% MOS can effectively improve the growth performance of vaname shrimp. [12] also stated that the provision of prebiotics at a dose of 0.8% can effectively improve the immune response and growth performance of whiteleg shrimp, and the addition of prebiotics is better and safer than antibiotics to be applied in aquaculture because it does not cause residues. Therefore, the addition of purslane flour and MOS to Shrimp shrimp feed is expected to increase growth in these shrimps.

Given above, the research was carried out to determine the effect of giving of purslane flour and MOS to commercial feed will have a significant effect on the growth performance, survival rate, feed conversion, feed efficiency and moulting frequency of shrimp fry.

2 Material and Method

2.1 Location and time of research

The study was conducted from February to March 2023. The research was conducted at the Balai Perikanan Budidaya Air Payau (BPBAP) in Ujung Batee, District Aceh Besar. Experimental Shrimp and Research Containers.

2.2 Experimental Shrimp and Research Containers

The test shrimp used were PL 12 stage shrimp prawn fry obtained from the Balai Perikanan Budidaya Air Payau (BPBAP) Ujung Batee, District Aceh Besar. As many as 900 individuals with each treatment container containing 45 (3 individuals/L) Shrimp prawn fry. The selected fish were allowed to adapt before being treated for approximately 24 hours. The research containers consisted of 20 units with a volume of 15 liters of water and were placed at random.

2.3 Making Purslane Flour

The process of making purslane flour begins with collecting purslane plants. Then the collected purslane is washed thoroughly with running water, separating unwanted parts such as the roots and flowers. The drying process was carried out with the help of an oven at 500ºC for 60 minutes. The dried purslane is then ground with a blender and sifted through a sieve for smoother results.

2.4 Preparation of Test Feed

The feed to be used in this study is commercial feed with a protein content of 40%. Furthermore, the feed is added with CMC at a dose of 5%. Then it was added to purslane flour that has been weighed according to the dose of each treatment. Then, MOS was added, which has been weighed according to the treatment dose. Furthermore, all the ingredients are

stirred until evenly mixed and then dried by aerating. After the feed is dry, it is put in a container and stored until use.

2.5 Experimental Design and Fish Rearing

The research method used was a Completely Randomized Design (CRD) consisting of four treatments with five replications. The manipulated factors were the addition of purslane flour and MOS. Determining the dose used as treatment refers to the dose modification used by [4],[9]. The treatments given to Windu shrimp fry were, A = 0 ml/kg feed, B = purslane flour 30g/kg+MOS 10g/kg, C = purslane flour 40g/kg+MOS 10g/kg and D purslane flour 50g/kg+ MOS 10g/kg.

Before being put into the rearing container, the Windu shrimp prawn fry were counted, weighed, and recorded as initial research data. Windu shrimp were reared based on the guidelines of the Institutional Animal Care and Use Committee (IACUC, 2018) and have ethical approval B/034SN/XII/2022 from the animal ethic committee of the School of Marine and Fisherie Faculty, Universitas Syiah Kuala. During the rearing period, the Shrimp prawn fry were fed five times a day, starting at 06.00, 10.00, 14.00, 18.00, and 22.00 WIB, with feed as much as 5% of the body weight of the Windu shrimp fry throughout a rearing period of 40 days.

Growth data was collected by calculating the weight of the fish and the length of the fish. During the sampling period, the number of fish was regularly counted to calculate survival and overall weight (biomass) of fish that lived and died in each period in order to measure feed efficiency.

Data were collected once every 10 days, on days 0, 10, 20, 30, and 40, by weighing the biomass from each research container. Parameters observed were absolute length gain, absolute weight gain, specific growth rate, feed conversion ratio, feed efficiency, and survival. Then, the observations of water quality observed in this study includes temperature, pH, and dissolved oxygen. These parameters were measured every day during the study.

2.6 Test parameters

Growth performance parameters include Specific Growth Rate (SGR), absolute length gain, absolute weight growth, and Feed Conversion Ratio (FCR) according to [13], feed use efficiency (EP) according to [14], Moulting frequency according to [15], and survival rate (SR) according to [16]. The equation is as follows:

$$SGR = (\ln Wt - \ln Wo)/t \times 100\%$$
$$PPM = Lt - L0$$
$$W = Wt - Wo$$
$$FCR = F/Wt\text{-}W0 \times 100$$
$$EP = Wt\text{-}W0/F \times 100\ \%$$
$$MFq = Xmolt/Ntot$$
$$SR = Nt/No \times 100\%$$

Note: PPM = Absolute length growth (cm); Lt = The average length of the end of the study (cm); Lo : The average length of the start of the study (cm); W = Weight gain (gram); Wt = Weight of biomass at the end of the study (gram); W0 : Weight of biomass at the beginning of the study (gram); t = Time (maintenance period); F = Amount of feed consumed (gram); Xmolt = Overall number of moulting shrimp (time); Ntot = number of Shrimp prawns used in the study; Nt = Number of live fish at the end of rearing; N0 = Number of fish that live at the beginning of maintenance.

2.7 Data analysis

The research data were analyzed by one-way analysis of variance (ANOVA). Significant results of ANOVA were followed up with Duncan's multiple distance test (P<0.05).

3 Result

The 40-day research's showed that MOS and purslane flour considerably the growth performance of Windu shrimp fry. The parameters of absolute weight growth, specific growth rate, absolute length growth, feed conversion ratio, feed utilization efficiency, and moulting frequency were all affected by the addition of purslane flour and MOS, but had no effect on survival rate. This is shown in Table 1 down below:

Table 1. Measurement results of absolute weight growth, absolute length growth, specific growth rate (SGR), feed conversion ratio (FCR), feed efficiency (EP), moulting frequency, and survival rate (SR).

Parameters	**Treatments of purslane flour and MOS**			
	A (0g/kg)	**B (30g+10g/kg)**	**C (40g+10g/kg)**	**D (50g+10g/kg)**
Absolute Weight Growth (G)	0.36±0.06^{a}	0.47±0.00^{b}	0.54±0.00^{c}	0.60±0.05^{d}
Specific Growth Rate (%/Day)	14.71±0.43^{a}	15.43±0.05^{b}	15.75±0.02^{bc}	16.00±0.24^{d}
Absolute Length Growth	3.46±0.17^{a}	3.77±0.01^{b}	3.96±0.05^{c}	4.33±0.06^{d}
Feed (Cm)Conversion Ratio	0.75±0.19^{a}	0.58±0.02^{b}	0.57±0.03^{b}	0.52±0.03^{b}
Feed Efficiency (%)	139.76±36.57^{a}	170.85±7.44^{b}	175.36±10.21^{b}	192.08±12.21^{b}
Moulting Frequency (Time/Tail)	0.69±0.02^{a}	0.91±0.15^{b}	1.23±0.17^{b}	1.50±0.23^{c}
Survival Rate (%)	88.40±9.07^{a}	89.20±7.79^{b}	90.60±9.73^{a}	93.20±9.33^{a}

Note: Significant differences (P<0.05) are indicated by different superscript letters in the same column.

The ANOVA (Analysis of Variant) test results showed that while the addition of MOS and purslane flour in the feed had no significant effect (p>0.05) on survival, it did have a significant effect (P<0.05) on the parameters of absolute weight growth, specific growth rate, absolute length growth, feed conversion ratio, feed efficiency, and moulting frequency

The highest absolute weight growth of Windu Shrimp fry was obtained in the D treatment (purslane flour 50 g/kg + MOS 10 g/kg) with a value of 0.60 ± 0.05 grams and the lowest was obtained in the A treatment which was 0.36 ± 0.06 grams. Based on the results of the BNT further test showed that the D treatment was significantly different from all treatments. The specific growth rate value in the D treatment (purslane flour 50 g/kg + MOS 10 g/kg) had the highest value of 16.00 ± 0.24% / day and the lowest was obtained in the P0 treatment with an average value of 14.71 ± 0.43% / day. Based on the results of the BNJ further test showed that the D treatment (purslane flour 50 g/kg + MOS 10 g/kg) was significantly different from all treatments. The highest absolute length growth of Windu Shrimp fry was

obtained in the D treatment feed with a value of 4.33 ± 0.06 cm and the lowest value was obtained in the A (control) treatment feed which was 3.46 ± 0.17 cm. Based on the results of the BNJ further test showed that the D treatment was significantly different from all treatments. The best feed conversion ratio was obtained in the D treatment (purslane flour 50 g/kg + MOS 10 g/kg) with a value of 0.52 ± 0.03, and the highest in the P0 treatment with a value of 0.75 ± 0.19 Based on the results of Duncan's further test, it shows that the D treatment is significantly different from the P0 treatment (control) but not significantly different from the B and C treatments.

The highest feed efficiency was obtained in the D treatment (purslane flour 50 g/kg + MOS 10 g/kg) with a value of 192.08 ± 12.21% and the lowest was obtained in the A treatment (control) with an average value of 139.76 ± 36.57%. Based on Duncan's further results showed that the D treatment was significantly different from the A treatment (control) and but not significantly different from B and C. The highest moulting frequency was obtained in the D treatment (purslane flour 50 g/kg + MOS 10 g/kg) with a value of 1.50 ± 0.23 times/head and the lowest was obtained in the A treatment (control) with an average value of 0.69 ± 0.02 times/head. Based on the results of Duncan's further showed that the treatment D is significantly different from the other treatments. Windu Shrimp survival ranged from 88.40%-93.20%. Although each treatment was not significantly different, but each treatment showed an increase as the dose given increased and the best value was in D (purslane flour 50 g/kg + MOS 10 g/kg).

The results of water quality measurements during the study include physical and chemical parameters and show that water quality is still in the normal range. The results of water quality tests during this research process can be seen in table 2 below:

Tabel 2. Water quality parameters were measured during the study

Chemical physics parameters	Measurement data	Literature data	Source literature
Temperature (^{0}C)	29	28-30	[17]
DO (mg/L)	7,5-7,7	4-8	
pH	7,27-7,28	7,5-8,5	
Salinity	18	15-20	

4 Discussion

Growth can be increased by feeding high-protein foods. Low protein levels in feed can affect shrimp growth [18]. The results showed that the D treatment with a dose of 50 g/kg purslane flour and 10 g/kg MOS had the highest results in absolute weight growth (0.60 grams) and specific growth rate (16.00%/day). It is suspected that the test shrimp in D were able to utilize the nutrients in the feed well compared to the other treatments. The more feed that can be absorbed, the more protein that can be metabolized in order to produce energy. If the energy produced exceeds the need for body maintenance, the more energy will be used for growth [19]. This is in accordance with the statement of [4] that, in his research, showed a significant effect ($p < 0.05$), and the addition of purslane flour 40 g/kg in vannamei shrimp feed also gave the highest absolute weight of 1.08 ± 0.25 grams compared to control and other treatments. The increase in the growth rate of Windu Shrimp fry was also due to the provision of purslane flour and MOS. This indicates that the application of purslane flour and MOS can increase the utilization of nutrients for growth. The addition of purslane flour and MOS in artificial feed as a whole caused an increase in the specific growth rate of Windu Shrimp fry, which, based on the results of the BNJ further test in this study, showed significantly different results

(P <0.05). Feeding with the addition of purslane flour and MOS was able to increase the specific growth rate of Windu Shrimp fry to a value of 16.00% / day. The same thing also happened to the absolute weight growth of Windu Shrimp fry fed with the addition of 50 g/kg purslane flour and 10 g/kg MOS. There was an increase in absolute weight of 0.60 grams when compared to the absolute weight of shrimp that were not given purslane flour and MOS (control). The increase in specific growth rate and absolute weight of Windu Shrimp fry fed with purslane flour and MOS is thought to be because MOS is a food that cannot be digested but is able to increase the growth and activity of beneficial microflora in the shrimp digestive tract.

Adding MOS to feed can increase its digestibility, which in turn affects the growth and survival of shrimp larvae [20]. The same statement was also stated by [21]: the adding prebiotics to feed can enhance the host's gastrointestinal microflora so as to spur growth. The addition of purslane flour and MOS in artificial feed as whole causes an increase in absolute length growth in Windu Shrimp fry, as can be seen in Table 1. that the absolute length growth in each treatment is significantly different (P <0.05), the highest length treatment is in the D treatment with a dose of 50 g/kg purslane flour and 10 g/kg MOS, and the area with the least absolute length growth is the A treatment with a dose of 0 (control). The provision of purslane flour and MOS in different doses had a significant effect on the length growth of Windu Shrimp fry. Under optimal environmental conditions and adequate nutritional needs, the seeds will grow optimally, and vice versa.

The best feed conversion ratio results were found in the D treatment with a dose of 50 g/kg purslane flour and 10 g/kg MOS, with an average value of 0.52 ± 0.03. The provision of purslane flour and MOS with different doses had a significant effect on the feed conversion ratio of Windu Shrimp fry. This is in accordance with the opinion of [22], who states that the value of the feed conversion ratio is small. It can be interpreted that the amount of feed consumed is well met for growth, so the value of the feed efficiency given is good.

The highest feed efficiency results in this study were found in D with a dose of 50 g/kg purslane flour and 10 g/kg MOS with a value of 192.08 ± 12.21%. The high feed efficiency in D indicates that the feed can be utilized well by shrimp. This is in accordance with what is stated by [23]: high feed efficiency indicates the use of feed is also efficient in growth, so that only a little protein will be broken down to meet energy needs and the rest for growth.

The addition of purslane flour in feed can accelerate the moulting of Windu Shrimp fry. The lower the dose of purslane flour given, the fewer shrimp moulted, and it depends on the amount of calcium content in the flour. The calcium and protein content in purslane flour can affect carapace formation in shrimp during moulting [4]. Based on the results of the research that has been done, the highest moulting frequency is obtained in the P3 treatment with a dose of 50 g/kg purslane flour and 10 g/kg MOS with an average value of 1.50 ± 0.23 times/head. The high number of shrimp moulting is due to the amount of protein and calcium content in D of 45.06% and 4.1% respectively. This is clarified by [24]. Overall, giving 4% calcium with high feed protein (45%) can increase calcium stores in body tissues, although directly aquatic animals can absorb calcium from the media environment. Increased calcium retention indicates that feed protein and calcium treatments have an effect mainly on maintaining calcium homeostasis in shrimp.

Based on the results of this study, the value of the survival range of Windu Shrimp fry in a row starting from treatments A, B, C, and D is 88%, 89%, 90%, and 93%. Based on the ANOVA test, the addition of purslane flour and MOS in the feed did not have a significant effect (p>0.05) on the survival of Windu Shrimp fry. This is because there is no significant difference between the treatment of the addition of purslane flour and MOS with the control treatment, but the survival rate of Windu Shrimp fry during this study was classified as good. This is in accordance with the opinion of [25], which states that the specific growth rate is categorized as good if the specific growth rate value is> 70%, for a medium specific growth

rate of 50-60%, and a low specific growth rate value < 50%. This is because the appropriate feeding ensures that the availability of shrimp feed is sufficient, and the value of good water quality during the study greatly supports the survival of the Windu Shrimp fry. This is in accordance with the statement in [26], which states that the factors that most influence the survival of shrimp are management in feeding and good water quality management in the maintenance medium. The death of shrimp during this study is thought to be due to stress due to lack of oxygen during the study. This is in accordance with the statement [27], which states that the level of shrimp consumption will decrease if the need for oxygen in the water is not fulfillet resulting in decreased health conditions in shrimp that will cause death.

Based on the results of protein and calcium tests of purslane flour, it shows that purslane flour has a protein content of 40.75% and calcium 2.4%, from the results of protein and calcium tests that have been carried out on each treatment feed, the best protein and calcium values for Windu Shrimp fry growth are shown in the D treatment with a dose of 50 g / kg purslane flour and 10 g / kg MOS with a content value of 45, 06% and 4.1%, followed by treatment with a dose of 40 g / kg purslane flour and 10 g / kg MOS with a value of 44.84% and 3.5%, then A treatment with a dose of 30 g / kg purslane flour and 10 g / kg MOS with a value of 43.27% and 3.1% and the last at P0 treatment (control) with a protein content of 40%.

During the 40-day research period, water quality measurements were taken, including temperature, DO, pH, and salinity. The temperature in this study was 29^0C, DO ranged from 7.5-7.7 mg/l, pH ranged from 7.27-7.28 and salinity was 18 ppt. Based on the results of the water quality measurements obtained, it can be seen that the percentage of water quality is still in a safe range for shrimp survival and shrimp growth. As stated by [28], a good temperature for the life of widu shrimp is in the range of 28-30^0C, DO 4-8, pH 7.5-8.5 and salinity of 15-25 ppt. The checking of water quality parameters is done every 10 days to keep water quality under control.

5 Conclusions

Based on the research that has been done, the conclusion is that the addition of purslane flour with different doses and the addition of MOS 10 g/kg into the feed has a significant effect on absolute weight growth, absolute length growth, specific growth rate, feed conversion ratio, feed efficiency, and moulting frequency but does not have a significant effect on the survival of Windu Shrimp fry. The results during the study showed that the best treatment in all parameters was obtained in the D treatment (purslane flour 50 g/kg + MOS 10 g/kg) with an absolute weight growth value of 0.60 grams, a specific growth rate of 16.00%/day, an absolute length growth of 4.33 cm, a feed conversion ratio of 0.52, a feed efficiency of 192.08%, a moulting frequency of 1.50 times/head and a survival rate of 93.20%.

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