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Growth Performance and Nutrient Value of *Nereis virens* Fed by *Thalassiosira sp*. and *Navicula* sp.

Pinandoyo, Tita Elfitasari, Seto Windarto, Vivi Endar Herawati*

Department of Aquaculture, Faculty of Fisheries and Marine Science, Universitas Diponegoro, Semarang, Indonesia

Abstract: *Thalassiosira* sp. and *Navicula* sp. phytoplanktons are natural feed for *Nereis* sp. because it has high nutrition and growth and increase of *Nereis* sp. quality nutrition. The objective of the present study was to investigate the effect of feeding with *Thalassiosira* sp. and *Navicula* sp on growth performance and nutrition quality of *Nereis* sp. and to find the optimum feeding formula for *Nereis* sp feed. The research was conduct at Marine Science Techno Park (MSTP) University of Diponegoro, Jepara, Centra Java. The research material used sea worm (*Nereis* sp) with an age average of 15 – 30 days; average length 4 – 6 cm; and average weight 0.09 – 0.12 g. The culture media used mangrove sand substrate with a thickness of 10 cm and stocking density of 140 sea worms. Feed was given twice a day at 07.00 and 19.00 for 35 days. The research used a Completely Randomized Design with three treatments (A: *Thalassiosira* sp. 100%; B: *Navicula* sp. 100%; and C: *Thalassiosira* sp. 50% + *Navicula* sp. 50%) and three replications. Survival Rate (SR), Specific Growth Rate (SGR), Grazing Rate, and Water Quality were obtained in this research. The result showed that the high value of SR, SGR and Grazing Rate was obtained to feed treatment with *Navicula* sp. 100% at 0.045±0.02 g, 0.85±0.30%/days, 159480.57±2077.39 ind/days, protein 53,85%, 23,74%, EPA 7,98%, and methionine 38,46 ppm. Feeding of *Thalassiosira* sp. and *Navicula* sp. gives significant value ($P<0.05$) to length growth but does not give significant value ($P>0.05$) to *Nereis* sp. survival rate.

Keywords: Sea worm (*Nereis* sp.), Survival rate, *Navicula* sp., Growth performance, *Thalassiosira* sp.

由海藻喂养的沙蚕的生长性能和营养价值。和舟形藻属

摘要:

海藻和舟形藻属。浮游植物是沙蚕属的天然饲料。因为它具有高营养和生长和增加沙蚕属的特性。优质营养。本研究的目的是调查用海藻喂养的效果。和舟形藻对沙蚕生长性能和营养品质的影响。并寻找沙蚕饲料的最佳饲养配方。该研究是在爪哇中部杰帕拉的迪波尼哥罗大学海洋科学技术园进行的。研究材料使用平均年龄为15-30天的海虫（沙蚕）；平均长度 4 – 6厘米；平均重量0.09–

0.12克。培养基采用红树林砂基质，厚度为10厘米，养殖密度为140条海虫。每天在 07:00和19:00喂食两次，持续35天。该研究使用完全随机设计，采用三种处理方式（A：海洋藻属物种 100%；B：舟形藻属物种 100%；和 C：海洋藻属物种 50% +舟形藻属物种50%）和三个重复。本研究获得了存活率、比增长率、放牧率和水质。结果表明，舟形藻饲料处理获得了较高的存活率、比增长率和放牧率值。100%在0.045±0.02公克, 0.85±0.30%/天,159480.57±2077.39个人/天, 蛋白质 53,85%, 23,74%,二十碳五烯酸7,98%, 和甲硫氨酸38,46百万分之几。海藻的饲养和舟形藻属。对长度增长给出显着值（$P<0.05$），但对沙蚕属不给出显着值（$P>0.05$）。存活率。

关键词：海蠕虫 (沙蚕), 存活率, 舟形藻, 生长性能, 海藻。

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About the authors: Pinandoyo, Tita Elfitasari, Seto Windarto, Vivi Endar Herawati, Department of Aquaculture, Faculty of Fisheries and Marine Science, Universitas Diponegoro, Semarang, Indonesia

Corresponding author: Vivi Endar Herawati, viviendar23@gmail.com

1. Introduction

Sea worm (*Nereis* sp.) as a natural feed start to be developed for shrimp hatchery in Indonesia that has a high benefit to main shrimp especially for gonad maturity and maturation process, because of containing Poly Unsaturated Fatty Acid (PUFA) [1]. The feed of sea worms in nature is Entomostraca, diatomae, small worm, and residual organic waste.

Based on Herawati et al. [2], the nutritional needs of sea worm (*Nereis* sp.) are 52,26% of protein, 29,83% fat, 4,35% fiber, and ash for 11,06%. Phytoplankton is a kind of nature feed recommended for sea worm feed because it has nutrition and suitable sea worm growth measures [3]. *Thalassiosira* sp. has the potential to become a natural feed alternative for sea worms. *Thalassiosira* sp. contained a protein value of 44,5%, carbohydrate value of 26,1%, and fat content of 11,8% from dry-based [4]. Based on Kim et al. [5], *Thalassiosira* sp. has Polyunsaturated Fatty Acid (PUFA) contain 10,51%. To grow and increase the survival rate of microorganisms, PUFA is needed [3]. *Navicula* sp. can be used as natural feed for shrimp larvae because *Navicula* sp live attached to the substrate. It corresponds to microorganisms' feeding habits which are "deposit-feeding". Besides, the *Navicula* sp. measure is more suitable for *Nereis* sp mouth opening; the nutrition of *Navicula* sp can be used for *Nereis* sp growth. The research of Luis et al. [6] represents that *Navicula* sp. nutrition has ± 48 % of protein content, ± 19 % of fat content, ± 16 %carbohydrate value, and ± 12,1 % of mineral value. The nutrition of natural feed from *Navicula* sp and *Thalassiosira* sp can be expected to fulfill nutritional needs for sea worms.

Shofiya et al. [7] showed that sea worms fed with phytoprotein feed (Spirulina and Chlorella) have a survival rate of 96,43%. In contrast, sea worms fed with animal protein (Brachionus) showed a survival rate of 78,66%. In terms of giving high growth performance for sea worms, phytoprotein is more needed than animal protein. Rasidi [1] showed that feeding sea worms with chicken intestine flour, head shrimp flour, chicken blood flour, and commercial feed gave a protein value of 37,59%. Ferdian [4] represents that *Thalassiosira* sp. feed to *Polychaete spionid, Polydora ligni, P. ciliata, Pygospio elegans* growth showed high growth performance with feeding concentrate of 500 cel ml-3. *Thalassiosira* consistently are the best feed for Polychaeta larvae than other feed in this research. Research on *Thalassiosira* sp and *Navicula* sp as feed for growth and nutritional enhancement of *Nereis virens* has never been done. It is suspected that the feeding of *Thalassiosira* sp. and *Navicula* sp. can increase the growth and nutritional quality of *Nereis virens*. This research aims to find the growth performance and nutrition quality of *Nereis* sp., *Thalassiosira* sp. and *Navicula* sp. feeding, and to find an optimum feeding formula for *Nereis* sp.

2. Materials and Methods

2.1. Materials

Nereis sp (age at 15-30 days) from PT. Matahari Cipta Sentosa, Banyuglugur, Situbondo, East Java. *Nereis* sp was cultivated for 30 days in a container with 30L water and 10 cm thickness of mangrove sand substrate. During treatment, *Nereis* sp was feed with *Thalassiosira* sp and *Navicula* sp.

2.2. Pre-Treatment

Pre-treatment was conducted to find a natural feed dose for *Nereis* sp. The dose was based on Ferdian [4] that *Thalassiosira rotula* has given in Polychaeta larvae with 500 cells.mm-1 doses. The feed dose given was 50.000 cells/individual of *Thalassiosira* sp. and 80.000 cells/individual of *Navicula* sp.

2.3. Feeding Treatment

The feeding treatment was conducted at Chemical Laboratory, Center of Brackish Water Cultivation Jepara. The treatment was conducted experimentally using three treatments and three replications for each treatment. Treatment A: *Thalassiosira* sp. with solid stock $5x10^4$ cell/ml; treatment B: *Navicula* sp. with solid stock $8x10^4$ cell/ml; Treatment C: *Thalassiosira* sp. and *Navicula* sp. with solid stock $2.5x10^4$ cell/ml and $4x10^4$ cell/ml.

2.4. Absolute Growth

Absolute growth was calculated by biomass average from *Nereis* sp using the following formula [8]

$$Wm = Wt - W_0$$

where:

Wm: absolute growth from biomass average of *Nereis* sp (g)

Wt: average weight at the end of the study (g)

W_0: average weight of *Nereis* sp at the beginning study (g).

2.5. Survival Rate

SGR was calculated by the formula [8]

SGR = ((ln Wt – ln Wo)/t) × 100 %

SGR = specific growth rate (%)

Wt = average weight of *Nereis* sp at the end of the study (g)

Wo = average weight of *Nereis* sp at the beginning of the study (g)

2.6. Feed Conversion Ratio (FCR)

FCR is the value of the given feed efficiency, were calculated by the formula:

$FCR= F/((Wt+D)-W_0)$

FCR: Feed conversion ratio

F: the amount of feed given (g)

Wt: weight of *Nereis* sp biomass at time (g)

W_0: weight of *Nereis* sp biomass at the beginning of the study (g)

D: weight of dead *Nereis* sp biomass during treatment (g)

2.7. Amino Acid Profile

Amino acid profiles were determined by HPLC (waters corporations, USA). The amino acid standard solution used for calibration from Thermo Scientific, Acq Taclumn (3.9 mm x 150 mm), at 370C temperate; mobile phase acetonitrile 60%-AccqTag Eluent A.Flow rate 1.0ml. min-1 with fluorescence detector. The volume injected for each sample was 5µL.

2.8. Fatty Acid Profile

The Fatty acid profile was determined by gas chromatography (GC) after converting the lipid to their methyl esters after conversion of fatty acid components. The GC analysis was performed on a Shimadzu GC-14B (Shimadzu Seisakusho, Japan) equipped with a flame ionization detector and a capillary column. Fatty acid content was expressed as a relative weight percentage of total fatty acids.

2.9. Proximate Analysis

The proximate chemical composition of the samples was determined using a standard procedure [9]. The crude protein content was calculated by multiplying the total nitrogen factor. The difference estimated the carbohydrate content. Proximate analysis (Table 1) of the protein content of *Thalassiosira* and *Navicula* was 45.23% and 48.00%. *Navicula* has a 2,77% higher protein content. Fatty acid profile of *Thalassiosira* and *Navicula* as feed on *Nereis* sp. presented in Table 2. The highest fatty acid profile analysis of *Navicula* sp. was in Linoleic fatty acids, equal 6.83%. The highest fatty acid profile for grated coconut was in EPA fatty acids, equal 8.13%. The amino acid profile of *Thalassiosira* sp. and *Navicula* sp. as *Nereis* sp. feed was presented in Table 3. The highest amino acid profile of *Thalassiosira* sp was lysine of 48.75 ppm, and *Navicula* sp was valine 28.87 ppm.

Table 1 Proximate analysis *Thalassiosira* sp. dan *Navicula* sp. as feed in %, dry weight (processed in Laboratory of Nutrition and Feed)

Contents (%)	**Natural Feed**	
	Thalassiosira	***Navicula***
Protein	45.23	48.00
Fat	12.08	19.00
Ash	11.80	10.20
Crude fiber	10.11	6.33
Nitrogen-free extract	20.78	16.47
Total	100.00	100.00

Table 2 Fatty acid profile of *Thalassiosira* and *Navicula* sp. (processed in Saraswati Indo Genetech Laboratory)

Fatty acids profile (%)	***Thalassiosira***	***Navicula***
Myristic	1.92 ± 0.05	0.48 ± 0.09
Pentadecanoic	1.09 ± 0.06	1.15 ± 0.08
Palmitic	4.14 ± 0.09	4.59 ± 0.04
Stearic	2.51 ± 0.07	2.91 ± 0.09
Oleic/ω9	3.07 ± 0.02	2.61 ± 0.01
Linoleic/ω6	4.83 ± 0.09	7.07 ± 0.02
Linolenic/ω3	7.54 ± 0.05	5.32 ± 0.01
Arachidonic	0.07 ± 0.02	0.13 ± 0.08
DHA	1.03 ± 0.05	3.23 ± 0.03
EPA	7.95 ± 0.02	8.13 ± 0.08

Table 3 Amino acids profile of *Thalassiosira* and *Navicula* sp. as *Nereis* sp feed (processed in Saraswati Indo Genetech Laboratory)

Amino acids (ppm)	***Thalassiosira***	***Navicula***
Aspartic acid	38.92±0.08	23.94±0.01
Serine	15.61±0.03	17.62± 0.01
Glutamic acid	36.61±0.04	22.37±0.07
Glycine	19.36±0.04	19.19±0.01
Histidine	9.78±0.03	19.70±0.01
Arginine	20.51±0.04	27.28±0.01
Threonine	19.02±0.09	20.37±0.01
Alanine	40.65±0.05	32.51±0.09
Proline	20.25±0.05	19.00±0.06
Valine	30.24±0.05	28.87±0.04
Methionine	21.10±0.08	21.40±0.04
Lysine	48.75±0.04	44.16±0.01
Isoleucine	19.97±0.03	12.79±0.04
Leucine	32.44±0.05	26.88±0.05
Phenylalanine	15.49±0.07	15.98±0.10

2.10. Water Quality

The parameters of water quality in sea worm maintenance media for 30 days are presented in Table 4.

Table 4 Water quality parameters of the media during 30 days treatment [7], [10], [11]

Variable	**Range**	**References**
DO (mg/L)	5-7	4.20-9.40[b]
Salinity (ppt)	29-31	5-35[a]
pH	7.5-8.5	7.0-8.5[c]
Temperature (^{0}C)	28-30	18-28[b]

2.11. Data Analysis

The significant effect of natural feed by *Thalassiosira* sp. and Navicula sp. on growth and quality nutrition of *Nereis* sp as measured by the chemical (SR; SR; FCR; SGR; proximate, amino acids and fatty acids) were determined by the ANOVA method with Completely Randomized Design.

2.12. Ethics Statement

The research did not need any ethical approval to be conducted.

3. Result

3.1. Absolute Growth

The absolute growth of sea worms (*Nereis* sp.) during the study was presented in Fig. 1. Fig. 1 showed the highest absolute weight value was treatment B (0.045 g), while the lowest absolute weight was in treatment A, 0.025 g. Analysis of variance (ANOVA)

showed no significant effect (P <0.05) on the absolute weight.

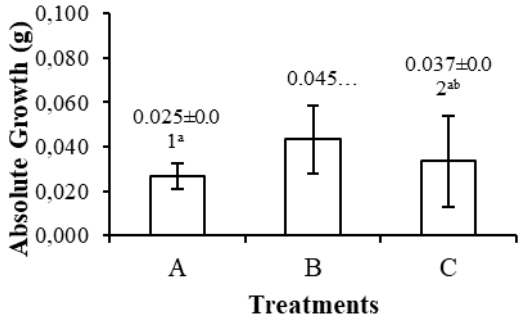

Fig. 1 Absolute growth of sea worms (*Nereis* sp.) during the study (Note A: Fed by *Thalassiosira* sp. with a stocking density of $5x10^4$ cells/ml, B: Fed by *Navicula* sp. with a stocking density of $8x10^4$ cells/ml, C: Fed by *Thalassiosira* sp. and *Navicula* sp. with a stocking density of $2.5x10^4$ cells/ml and $4x10^4$ cells/ml)

3.2. Specific Growth Rate

The specific growth rate of sea worms (*Nereis* sp.) during the study was presented in Fig. 2. Fig. 2 showed that the highest SGR was treatment B (0.85%/day), while the lowest SGR was in treatment A, 0.51%/day. Analysis of variance (ANOVA) showed that there was no significant effect (P <0.05).

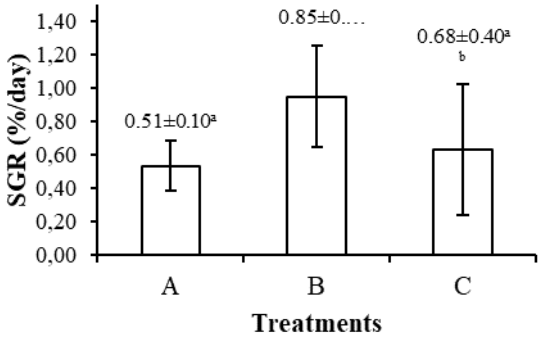

Fig. 2 The specific growth rate of sea worms (*Nereis* sp.) during the study (Note A: Fed by *Thalassiosira* sp. with a stocking density of $5x10^4$ cells/ml, B: Fed by *Navicula* sp. with a stocking density of $8x10^4$ cells/ml, C: Fed by *Thalassiosira* sp. and *Navicula* sp. with a stocking density of $2.5x10^4$ cells/ml and $4x10^4$ cells/ml)

3.3. Survival Rate

The survival rate of sea worms (*Nereis* sp.) during the study was presented in Fig. 3. It showed that the highest SR was treatment A and C (98.7%), while the lowest SR was in treatment B (95.3%). Analysis of variance (ANOVA) showed that there was no significant effect (P <0.05).

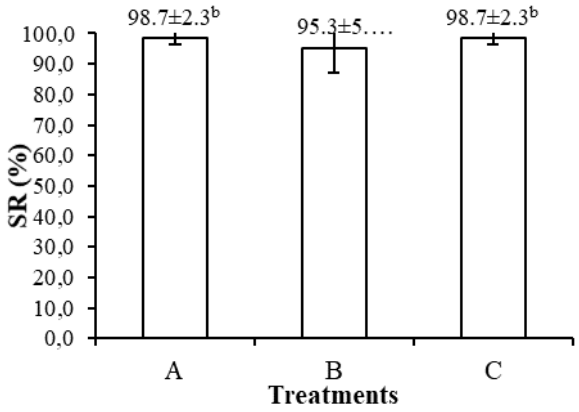

Fig. 3 The survival rate of sea worms (*Nereis* sp.) during the study (Note A: Fed by *Thalassiosira* sp. with a stocking density of $5x10^4$ cells/ml, B: Fed by *Navicula* sp. with a stocking density of $8x10^4$ cells/ml, C: Fed by *Thalassiosira* sp. and *Navicula* sp. with a stocking density of $2.5x10^4$ cells/ml and $4x10^4$ cells/ml)

3.4. Grazing Rate

The grazing rate of sea worms (*Nereis* sp.) during the study was presented in Fig. 4. Fig. 4. showed that the highest grazing rate was treatment B (159480.57 individuals/day), while the lowest grazing rate was in treatment B (99638.33 individuals/day). Analysis of variance (ANOVA) showed that there was no significant effect (P <0.05).

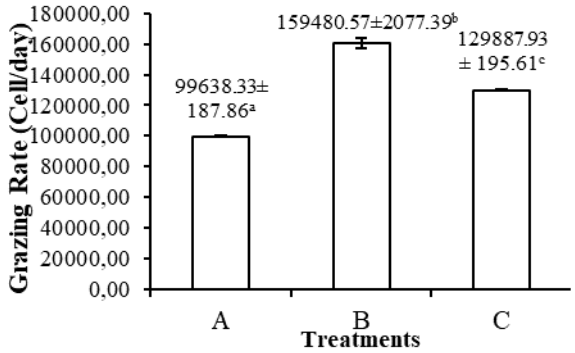

Fig. 4 Grazing rate of sea worms (*Nereis* sp.) during the study (Note A: Fed by *Thalassiosira* sp. with a stocking density of $5x10^4$ cells/ml, B: Fed by *Navicula* sp. with a stocking density of $8x10^4$ cells/ml, C: Fed by *Thalassiosira* sp. and *Navicula* sp. with a stocking density of $2.5x10^4$ cells/ml and $4x10^4$ cells/ml)

The analysis of the nutritional quality showed the highest protein and fat was treatment B, 53.85% and 23.74%, respectively. The lowest nutritional content of protein and fat was *Nereis* sp. and *Thalassiosira* sp. feed, 50,65%, and 21,04%, respectively. Table 6 presents the nutritional value of sea worms (*Nereis* sp.) for 30 maintenance days. Based on the amino analysis, in treatment B, methionine was the highest amino acid (38.46 ppm). The amino acid analysis of sea worms (*Nereis* sp.) for 30 days was presented in Table 7. Fatty acids analysis showed that treatment B had the highest EPA (7.98%), and the lowest was treatment A (6.88%). The analysis of the fatty acids of sea worms (*Nereis* sp.) for 30 maintenance days was presented in Table 8.

Table 6 Nutritional value of sea worms (*Nereis* sp.) for 30 days (processed in Laboratory of Nutrition and Feed)

Proximate	***Nereis* sp. before treatment (%)**	***Nereis* sp after treatments (%)**

		A	B	C
Protein	33.19± 004	51.65± 0.03[b]	53.85± 0.05[b]	50.12± 0.03[a]
Fat	19.98± 0.03	21.04± 0.09[b]	23.74± 0.02[b]	22.22± 0.02[a]
Crude fiber	15.89± 0.02	11.25± 0.07	9.89± 0.05	10.92± 0.07
Ash	15.57± 0.04	9.18± 0.09	6.49± 0.02	9.61± 0.01
Carbohydrate	15.37± 0.01	6.88± 0.01	6.03± 0.01	6.83± 0.02

4. Discussion

Growth is the increase in weight or length of an individual after feeding. Jin [12] stated that growth increases size, weight, or length over time. Growth can occur due to mitotic cell division due to the feed's input of energy and protein. Feed is very important in supporting the growth rate of sea worms because feed-in cultivation availability significantly affects growth. Based on the research results, the highest growth rate in Navicula sp. (B) feeding treatment was 0.85 ± 0.50% / day. That is because *Navicula* sp. has a living nature attached to the substrate, making it easier for *Nereis* sp. living in the sand to consume it. Also, the high absolute length growth in the treatment of *Navicula* sp. due to the protein content factor in *Navicula* sp. is higher than *Thalassiosira* sp. That is confirmed by Luis [6] that the nutritional composition of *Navicula* sp is as follows: ± 48% protein, ± 19% fat, ± 16% carbohydrates, ± 12.1% minerals. As for the research results, the lowest growth rate is 0.51% / day in the treatment of *Nereis* sp. by feeding *Thalassiosira* sp. Factors that affect the growth rate are due to the nature of *Thalassiosira* sp. which floats on the surface makes *Nereis* sp. difficult to consume. It is supported by Asnawi et al. [13] that the habit of marine worms that live in the substrate by digging for the substrate and coming out when looking for food, the substrate contained in the given media affects cultivation (*Nereis* sp.). Besides, there is a lack of additional protein intake from other types of natural feed. According to Machado [14], protein is an essential nutrient to maintain life and spur growth. Protein is also an essential component in the feed. Research results on the growth rate of marine worms (*Nereis* sp.) show that natural feeding *Thalassiosira* sp. and *Navicula* sp. has a real influence on absolute length growth. According to Luis [6], *Navicula* sp. was selected as feed-in cultivation because of the nature of its life attached to the substrate. It follows the way of eating the cultivated benthic organisms, deposit-feeding. It has a tiny size and high protein, fat, and carbohydrate content *Nereis* sp. with natural feeding *Thalassiosira* sp. and *Navicula* sp. indicates growth in all treatments. Herawati [15] stated that the more feed is consumed and can be used efficiently, it will increase retention or storage of protein in the body and increase growth.

Table 7 Results of amino acid analysis of Sea Worms (*Nereis* sp.) for 30 days

Amino Acid (ppm)	*Nereis* sp. before treatment	A	B	C
L Histidine	9.96± 0,04	13.96 ± 0,04[b]	18.07 ± 0,04[b]	15.32 ± 0,08[b]
L-Threonin	12.30 ± 0,03	20.30 ± 0,03[b]	25.48± 0,06 [b]	23.30 ± 0,05[b]
L-Proline	10.79 ± 0,01	20.79 ± 0,01[b]	28.49 ± 0,04[ab]	25.59 ± 0,03[b]
L-Tyrosine	8.63 ± 0,03	20.63 ± 0,03[b]	27.79 ± 0,03[ab]	24.23 ± 0,02[ab]
L-Leucine	12.93 ± 0,01	32.93 ± 0,01 [b]	36.12 ± 0,02[ab]	34.93 ± 0,05[b]
L-Aspartate	14.04 ± 0,04	31.04 ± 0,04[b]	35.68 ± 0,03[ab]	33.04 ± 0,06 [ab]
L-Lysine	7.99 ± 0,06	22.99 ± 0,06[ab]	24.30 ± 0,02[b]	20.99 ± 0,03[b]
Glycine	16.99 ± 0,01	36.99 ± 0,01[b]	48.61 ± 0,03[ab]	44.99 ± 0,02[ab]
L-Arginine	6.41 ± 0,03	7.25 ± 0,03[b]	9.71 ± 0,01[ab]	8.60 ± 0,03[b]
L-Alanine	15.49 ± 0,03	20.49 ± 0,03[ab]	30.88 ± 0,03[ab]	26.49 ± 0,09[ab]
L-Valin	11.64 ± 0,03	21.65 ± 0,03 [ab]	28.37 ± 0,01[ab]	25.65 ± 0,06[ab]
L-Isoleucine	14.81 ± 0,02	19.81 ± 0,02 [ab]	26.34 ± 0,01[ab]	25.81 ± 0,01[b]
L-Phenylalanine	16.33 ± 0,04	26.33 ± 0,04[ab]	35.15 ± 0,05[ab]	32.93 ± 0,04[ab]
L-Glutamic	16.15 ± 0,04	25.15 ± 0,04[ab]	28.14 ± 0,04[ab]	29.75 ± 0,04[b]
L-Serin	11.18 ± 0,01	21.18 ± 0,01[ab]	28.53 ± 0,04[ab]	24.98 ± 0,01[ab]
L-Tryptophan	4.72 ± 0,04	7.72 ± 0,04[a]	8.98 ± 0,06 [a]	8.92 ± 0,04[a]
L-Methionine	18.26 ± 0,03	32.26 ± 0,03[b]	38.46 ± 0,04[ab]	35.26 ± 0,03[b]
L-cystine	12.34 ± 0,04	16.34 ± 0,04[ab]	21.60 ± 0,04[ab]	25.32 ± 0,04[ab]

Table 8 Results of analysis of fatty acids in sea worms (Nereis sp.) for 30 days (processed in Saraswati Indo Genetech Laboratory)

Fatty acids (%)	*Nereis* sp before treatment	A	B	C
C 6:0	0,12 ± 0,05	0,42 ± 0,05[b]	0,47 ± 0,09[ab]	0,37 ± 0,01[b]
C 8:0	0,25 ± 0,01	0,35 ± 0,01[b]	1,59 ± 0,01[ab]	0,52 ± 0,08[b]
C 10:0	0,17 ± 0,03	0,17 ± 0,03[b]	1,36 ± 0,04 [ab]	0,19 ± 0,01[b]
C 11:0	0,29 ± 0,04	0,29 ± 0,04 [ab]	0,38 ± 0,02[b]	0,33 ± 0,01[b]
C12:0	2,10 ± 0,01	3,39 ± 0,01[b]	4,45 ± 0,01[ab]	3,79 ± 0,02[b]
C 13:0	0,75 ± 0,03	0,75 ± 0,03[b]	2,42 ± 0,04[ab]	0,12 ± 0,01[b]
C 14:0	1,57 ± 0,03	1,57 ± 0,03[b]	2,68 ± 0,04[ab]	1,98 ± 0,01[b]
C 14:1	0,77 ± 0,01	0,77 ± 0,01[b]	1,79 ± 0,01[ab]	0,27 ± 0,01[b]
C 15:0	0,51 ± 0,03	0,51 ± 0,03[b]	0,98 ± 0,03[b]	0,63 ± 0,03[b]
C 16:0	3,79 ± 0,01	3,79 ± 0,01[b]	5,67 ± 0,03[ab]	4,53 ± 0,03[b]

C 16:1	0,15 ± 0,05	0,37 ± 0,05^{b}	0,65 ± 0,03^{b}	0,38 ± 0,01^{b}
C 17:0	0,13 ± 0,04	1,13 ± 0,04^{b}	3,52 ± 0,04^{ab}	0,57 ± 0,04^{b}
C 18:0	0,02 ± 0,04	1,67 ± 0,04^{a}	1,93 ± 0,02^{a}	1,86 ± 0,01^{a}
C 18:1	0,55 ± 0,04	1,58 ± 0,04^{b}	2,98 ± 0,03^{ab}	2,58 ± 0,04^{ab}
C 18:2	1,01 ± 0,01	1,18 ± 0,01^{b}	4,53 ± 0,05^{ab}	2,43 ± 0,04^{ab}
C 18:3	0,04 ± 0,03	0,45 ± 0,03^{ab}	6,55 ± 0,04^{ab}	4,37 ± 0,02^{ab}
C 20:0	0,16 ± 0,05	0,39 ± 0,05^{a}	0,44 ± 0,06^{a}	0,48 ± 0,04^{a}
C 20:1	0,12 ± 0,04	0,67 ± 0,04^{a}	0,96 ± 0,04^{a}	0,58 ± 0,03^{a}
C 20:2	0,34 ± 0,02	0,79 ± 0,02^{b}	1,78 ± 0,04^{ab}	0,98 ± 0,02^{b}
C 20:4	0, 15 ± 0,04	0,55 ± 0,04^{a}	0,78 ± 0,04^{a}	0,64 ± 0,05^{a}
EPA	2,04 ± 0,05	6,68 ± 0,05^{b}	7,98 ± 0,01^{b}	5,09 ± 0,02^{b}
DHA	1,63 ± 0,02	3,68 ± 0,02^{ab}	6,36 ± 0,03^{ab}	5,58 ± 0,03^{ab}

Based on the research results, the biomass weight is calculated based on the difference between the final weight and the initial weight, marine worms' biomass weight (*Nereis* sp.) It shows that natural feeding *Thalassiosira* sp. and *Navicula* sp. did not significantly affect the biomass weight of marine worms (*Nereis* sp.). The highest biomass weight was 0.045 grams in the feeding treatment of *Navicula* sp. (B), as for the lowest absolute weight in the treatment of *Thalassiosira* sp. (A), which is 0.025 grams. The high weight of treatment A, because the nutritional content in *Navicula* sp. that is, 48% protein and 19% fat, can be appropriately utilized to support its growth compared to other treatments. However, the results of the biomass weight at other treatment doses are not much different. It shows that the protein content of *Thalassiosira* sp. and *Navicula* sp were not much different, so that the weight of biomass obtained was not much different either. This research confirmed the study results by Yustianti et al. [16] that high feed protein does not always result in good growth. Still, the nutritional content that can be utilized optimally will increase growth. The low weight of biomass in *Nereis* sp. by feeding *Thalassiosira* sp. was caused by the size that is not suitable with the mouth opening of *Nereis* sp in the larval phase. According to Gustrifandi [17], the requirements for good natural food are to have a shape and size that follows the larva's mouth opening, high nutritional content, dense cell contents, and a thin cell wall so that it is easily digested, reproduces quickly and has a reasonably high tolerance against environmental factors that do not release toxic compounds, and inactive movement so that the larvae can quickly catch it.

The research results on the rate of utilization of natural food from *Nereis* sp. show that the number of *Thalassiosira* sp. and *Navicula* sp. maximally utilized the increasing age of *Nereis* sp indicates this. that is being maintained. The utilization of natural food is thought to affect the absolute length growth of *Nereis* sp indirectly. The highest average utilization rate of natural feed at the treatment dose of 100% *Navicula* sp. (B) of 159480.57ind/day was based on the research results obtained. That is because *Navicula* sp. has higher nutrition to support the growth of *Nereis* sp. Based on the nutritional value of protein *Navicula* sp. higher than *Thalassiosira* sp. The nutritional content of *Navicula* sp. is as follows: ± 48%, ± 19% fat, ± 16.47% carbohydrates. The results of the research support the study by Luis [6], that the nutritional content of *Navicula* sp. is ± 48% protein, ± 19% fat, ± 16% carbohydrate, and ± 12.1% minerals.

Meanwhile, *Thalassiosira* sp. has 45.23% protein, 20.78% carbohydrates, and 12.08% fat. The nutritional content can affect the growth rate of *Nereis* sp. The rate of utilization of natural feed (grazing rate) *Navicula* sp. is 100% higher than other treatments. Feed with optimal protein content will produce maximum growth. It can be seen from the nutritional content of marine worms (*Nereis* sp.). The results showed a significant increase in the growth of marine worms (*Nereis* sp.) before cultivation until the end of the experiment. The protein content of marine worms (*Nereis* sp.) during cultivation, the highest value results in the feeding treatment of *Navicula* sp. (B) with a stocking density of 8x104 cells/ml of 53.85% protein and 23.74 fat with a value before treatment 33.19% protein and 19.98% fat. The lowest nutrient content was obtained in the feeding treatment (C) *Thalassiosira* sp. and *Navicula* sp. with a stocking density of 2.5x104 cells/ml and 4x104 cells/ml of 50.12% protein and 10.92% fat. The nutritional composition of feed greatly influences the protein and body fat content. The results showed that sea worms (*Nereis* sp.) could convert feed protein into body protein. According to Jayaseelan [18], a feed's nutritional composition dramatically affects the protein and body fat content.

Kuang et al. [19] also stated that an essential component is a protein because protein can increase growth directly depending on the quality and quantity of protein supplied. These natural foods are given to sea worms at the peak of the population, namely in the exponential phase, so that the nutritional content is at the optimal nutritional content. Population growth of *Thalassiosira* sp. and *Navicula* sp. includes several phases, including the adaptation phase (Lag phase), the exponential phase, the stationary phase, and the death phase. The exponential phase is a phase of individual multiplication within a certain period due to the reproductive process. The exponential phase is thought to occur in less than 24 hours to the 4th day, which is indicated by a drastic exponential increase. In this phase, the cultivated microalgae will experience a rapid increase in biomass. The cell structure is still in normal

conditions, and nutrient balance occurs between the media's nutrients and the nutrient content in the cells. Generally, in the final exponential phase, the protein content in cells is very high.

The fatty acid content based on the highest fatty acid profile of EPA was 7.98% in the treatment of *Nereis* sp. by feeding with *Navicula* sp. (B). In comparison, the lowest value was obtained in the feeding treatment (C) *Thalassiosira* sp. and *Navicula* sp. 5.09%. EPA and DHA are needed for the function of cell membranes of nerve tissue and as precursors for the formation of eicosanoids, namely several types of hormones [20]. AA functions as a precursor to eicosanoic fatty acids (prostaglandins, thromboxane, and leukotriene) in fish [21] and is one of the main components of phosphatidylinositol (PI). *Nereis* sp. by feeding *Thallasiosira* sp. and *Navicula* sp. contains the highest EPA essential fatty acids. That is due to the nutritional content in natural feed *Thalassiosira* sp. and *Navicula* sp. high levels; it is confirmed by Lee [22] that plankton contains several essential fatty acids high and good for growth. The high EPA essential fatty acids in *Nereis* sp. by feeding with *Navicula* sp. is essential for larvae's survival, especially shrimp for growth. This statement is reinforced by the results of Tocher's [20] study that the essential fatty acid eicosapentaenoic acid (EPA; 20: 5n-3) plays a role in the survival of larvae, especially shrimp, for growth. EPA essential fatty acid is a significant component of phospholipids in membranes and nervous tissue. When they eat for the first time, Larvae have a very high neurosomatic index, so they need a high (n-3 HUFA) to not experience abnormalities in nerve formation. The two types of essential fatty acids, namely AA and EPA, are the substrates needed to form eicosanoids, which play a role in various physiological functions, including ion regulation and egg maturity in female mothers [23].

Based on the amino acid profile of *Nereis* sp. by feeding *Navicula* sp. (B), the highest was the essential amino acid methionine 38.46 ppm. Methionine amino acid has an essential role in tissue protection, DNA modification, and cell function maintenance, besides being a protein building block component. Methionine plays an essential role in the body because it can produce other essential molecules, such as cysteine and other amino acids containing sulfur. Cysteine is then used by the body to produce protein in the body. The body can also convert methionine into a compound called S-adenosylmethionine; S-adenosylmethionine plays a role in various chemical reactions in the body and makes creatine for cellular energy. Methionine and cysteine are the primary sources of amino acid sulfate for animals; however, cysteine is not essential because it can be synthesized from methionine [18]. The body needs methionine for the formation of nucleic acids and the synthesis of tissues and proteins. Besides, it forms other amino acids (cysteine) and vitamins (choline). Methionine works with vitamin B12 and folic acid to help the body to regulate excessive protein in a high-protein diet. The methionine requirement for fish feed is 2.30%. The synthesis of tissue proteins is mostly determined by the completeness and level of amino acids that enter or are transported into tissue cells. Fish need methionine to initiate protein synthesis and affect muscle growth. It has been proven that methionine to the feed increases the growth and immune response [18, 19, 24, 25, 26].

Nereis sp. with natural feeding *Thalassiosira* sp. and *Navicula* sp. did not significantly affect the survival of marine worms (*Nereis* sp.). The highest survival rate was 98.7% in *Thalassiosira* sp. (A) feeding treatment, while the lowest was 95.3% in *Nereis* treatment with feeding *Navicula* sp (B). The high survival rate indicates that the quality and quantity of feed given are sufficient to meet basic needs and increase growth. The size of survival is influenced by internal factors, including gender, heredity, age, reproduction, disease resistance, and external factors, including water quality, stocking density, and the number and composition of amino acid completeness in the feed [21]. Environmental factors that are maintained can also support survival and reduce stress conditions that result in death during maintenance. According to Prawira [27], the factors that most influence the survival rate of larvae are the quality of water in the maintenance medium and the quality of feed because the nutritional content contained in feed can affect the survival rate. The availability of feed during the rearing period can also affect the survival rate.

5. Conclusion

Research on the feeding of *Thallasiosira* sp. and *Navicula* sp. to increase the growth and nutritional quality of *Nereis virens* has never been done, so feeding *Thallasiosira* sp. and *Navicula* sp. can increase the growth and nutritional quality of *Nereis virens* as shrimp feed. The result showed that a high value of SR, SGR dan grazing rate of *Nereis* sp was obtained by feeding with *Navicula* sp. 100% at 0.045±0.02 g, 0.85±0.30%/days,159480.57±2077.39 individual/days, protein 53,85%, 23,74%, EPA 7,98%, and methionine 38,46 ppm. Feeding of *Thalassiosira* sp. dan *Navicula* sp. give significant value ($P<0.05$) to length growth but does not give significant value ($P>0.05$) to *Nereis* sp. survival rate.

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