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Identification and Prevalence of Parasites in Black Tiger Shrimp (Penaeus monodon) in Ponds of Medan Labuhan District

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Abstract

This study aims to identify the types and prevalence of parasites in tiger shrimp (*Penaeus monodon*) cultivated in ponds in Medan Labuhan District. Sampling was carried out at three semi-intensive pond locations with a total of 150 shrimp measuring 10-15 cm. Parasite identification was carried out through microscopic examination of the carapace, legs, and tail organs. In addition, pond water quality (temperature, pH, salinity, DO, ammonia, nitrate, and nitrite) was measured to assess its relationship with the presence of parasites. The results of the study found two types of parasitic protozoa, namely *Epistylis sp* and *Zoothamnium sp* with prevalences of 12.5% and 8.3%, respectively. Parasites mainly attach to the tail and legs which have fine hairs as attachment sites. Water quality analysis showed that ponds with low dissolved oxygen levels and acidic pH have a higher risk of infection. These findings emphasize the importance of water quality management, especially DO, pH, and nitrite to suppress parasite attacks and maintain the health of tiger shrimp.

Keywords: Tiger prawn; Parasite; *Epistylis* sp; *Zoothamnium* sp; Water quality

1. Introduction

Tiger prawns (*Penaeus monodon*), also known as *black tiger shrimp,* are a type of shrimp that has superior food commodity value in terms of brackish water cultivation in Indonesia and are ranked second largest in the world. This type of *crustacean* is widely cultivated traditionally (semi-intensive) to the development of organic (intensive) cultivation centered in East Kalimantan, Java and Sumatra. Based on data from the Ministry of Maritime Affairs and Fisheries, North Sumatra is ranked 9th among shrimp producers in Indonesia and produced 32,819 tons of shrimp in 2023

(KKP, 2023). As is known, tiger prawns live in brackish water, estuaries (juveniles), and the sea (adults). In its natural habitat, *Penaeus monodon* is often found in water temperatures of 18 to 34.5°C and salinity of 5 to 45 ppt. It can also be cultivated traditionally at salinity of 1 to 5 ppt. *Penaeus monodon* prefers muddy mangrove channels and is often associated with marginal or floating vegetation (FAO, 2023).

A parasite is an organism that lives on or within another organism and obtains its nutrients from it. Parasites can be unicellular (protozoa) or multicellular (worms, arthropods). Parasites are pathogens that simultaneously harm and obtain nutrients from their hosts. Some organisms called parasites are actually commensals, as they neither benefit nor harm their hosts. Unicellular parasites (protozoa) and multicellular parasites (worms, arthropods) are antigenically and biochemically complex, as are their life histories and the pathogenesis of the diseases they cause. During their life, parasitic organisms typically go through several developmental stages involving changes not only in structure but also in biochemical and antigenic composition. Based on their habitat, parasites are divided into two, namely ectoparasites and endoparasites (Munaeni, 2019).

Ectoparasites are parasites that inhabit the external body surface and do not penetrate the internal tissues of the host (Fadilla, 2023). They are usually found on the gills, swimming legs, and skin. These parasites cause stress, injury, and increase the risk of secondary infections in shrimp growth. Some types of ectoparasites that are often found are protozoa from the *Ciliata class*: *Zoothamnium sp*, *Epistylis sp*, *Trichodina sp*, and *Vorticella sp* (Susilo, 2018). Endoparasites are parasites that inhabit the internal body surface of the host and cause infection. These endoparasites can cause various health problems in shrimp, such as decreased appetite, stunted growth, and even death. Endoparasites that are often found in tiger shrimp include microsporidia protozoa that infect the shrimp's internal organs and muscle tissue, which can cause diseases such as *hepatopancreatic microsporidiosis* (Hardi, 2022).

Based on interviews with tiger shrimp farmers in Medan Labuhan District, cases of sudden shrimp death have been found, but this problem has not yet been resolved. Research by Sumiati (2022) states that tiger shrimp contain parasites such as *Zoothamnium sp* ., *Epistylis sp* ., and *Vorticella sp*. The highest prevalence of ectoparasites is *Zoothamnium sp* ., and the lowest prevalence is *Vorticella sp*. with a prevalence of 2%. The sources of disease frequently encountered originate from the aquatic environment and production facilities (Sumiati, 2022).

Tiger shrimp cultivation in ponds in Medan Labuhan District still uses a semi-intensive system. Semi-intensive shrimp farming lacks a proper irrigation system and makes it difficult to achieve high yields. Seawater quantity and quality are also monitored for tiger shrimp cultivation to maintain optimal yields. In semi-intensive cultivation, shrimp are fed natural feed such as *phytoplankton*, *zooplankton*, moss, and others (Farras, 2017). Unsuitable environmental conditions for tiger shrimp cultivation make them susceptible to various diseases, such as bacteria, viruses, and fungi. Continuously ignored pathogens in shrimp can lead to death, thus reducing the survival rate of tiger shrimp. One such pathogen is parasites (Rosnizar, 2018).

Parasites that attack tiger shrimp will cause several health problems such as difficulty breathing due to the presence of a white membrane that covers the gills and restricts movement in searching for food, and so on. In addition, shrimp also have difficulty molting, slow growth and can even cause death (Putra, 2018). It is known that there are two types of parasites that are pathogenic to shrimp: ectoparasites and endoparasites. Some ectoparasites from the protozoa class that often disturb shrimp are *Zoothamnium*, *Vorticella*, and *Epistylis.* Endoparasites that are often found are *Microsporidia*, *Gregarinida, Myxozoa* , and so on (Zulkarnain, 2011).

2. Methods

This research was conducted in May 2025 at 3 community pond locations on Jalan Seruwai, Medan Labuhan District, Medan City, North Sumatra.The sampling method used in this study was purposive sampling, where the locations were intentionally selected based on their active use as community-managed tiger shrimp ponds, similar cultivation practices, and ease of access for repeated sampling. Jalan Seruwai was chosen because it represents a coastal aquaculture area with intensive shrimp farming activities and has not been extensively studied, making it relevant for assessing parasite presence in local pond systems. The tools used in this study were a stereo microscope, tweezers, scissors, petri dishes, *object glass* , *cover glass* , surgical tub, millimeter paper, gloves, napkins, 1L mineral bottles, styrofoam, plastic bags, and a camera.Sample collection was carried out in the morning during the harvest process, as morning conditions provide more stable water temperature and dissolved oxygen levels, thereby minimizing stress and potential degradation of shrimp samples prior to examination. The materials used in this study were tiger shrimp, pond water samples and 0.9% NaCl. Shrimp sampling was carried out during the harvest process, shrimp were taken randomly as needed then the shrimp samples were put into a container containing a little pond water added with ice cubes to keep them fresh. Next, the pH and temperature of the water samples were taken and measured directly with a pH meter and temperature.

Water samples from the ponds were taken and taken to the Medan Public Health Laboratory Center to be checked for salinity using the electrometric test method, DO using the SNI 06-6989.72:2009 test method, nitrate using the spectrophotometric test method, nitrite using the SNI 06-6989.9-2004 test method, and ammonia using the spectrophotometric test method. These measurements were used as parameters for the presence of parasites that attack tiger shrimp. Then, for the ectoparasite identification stage, it refers to the research of Sumiati *et al.,* (2022). This examination includes organs such as the carapace, legs, and tail, each of which is cut and placed on a petri dish/object glass and then observed with a stereo microscope at 40-100x magnification. Next, the prevalence, intensity, and degree of infestation are calculated.

3. Results and Discussion

Parasite Identification Results

Based on the research results, several types of parasitic protozoa were found that infect tiger prawns (*Penaeus monodon*) from ponds in Medan Labuhan District, namely *Epistylis* sp, *Zoothamnium sp* , etc. These types of parasites are often found in the periopod and pleopod areas. **Figure 1.**

Epistylis sp. with 100x magnification and reference (Souza et al ., 2024)

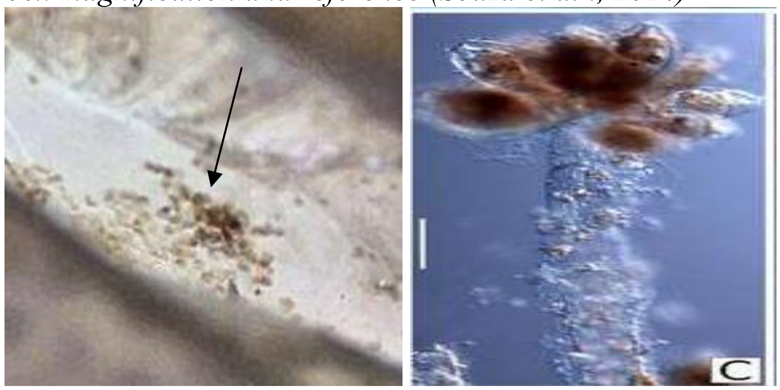
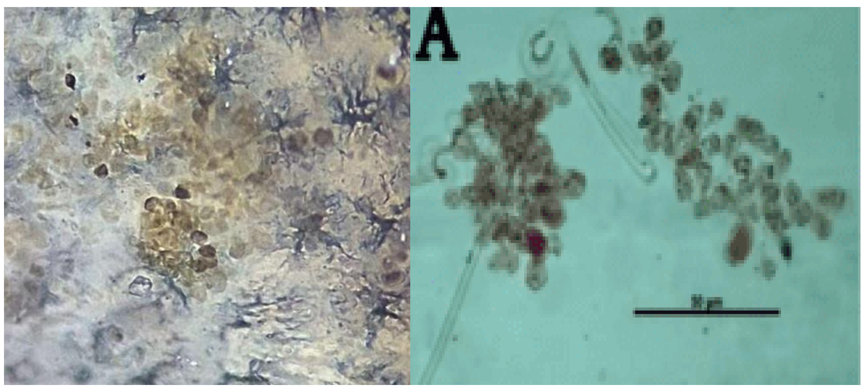


Figure 2.
Zoothamnium sp. with 100x magnification and reference (Sergee et al ., 2022)



Parasite Prevalence and Seawater Quality Testing

The number of parasites found in tiger prawn (*Penaeus monodon*) samples can be seen in Table 1 as follows:

Table 1.
Number of Parasites in Tiger Prawn Organs (Penaeus monodon) in the Medan Labuhan District Pond.

No	Types of Parasites	Amount
1.	*Epistylis sp.*	56
2.	*Zoothamnium sp*	49

The prevalence of parasites infesting tiger prawns (*Penaeus monodon*) in ponds in Medan Labuhan District is seen in **Table 2** as follows:

Table 2 .
Prevalence of Parasites in Tiger Prawn Organs (Penaeus monodon) in the Medan Labuhan District Pond.

Types of Parasites	Prevalence (%)	Attack rate	Information
Epistylis sp	12.5	Often	Frequent infections
Zoothamnium sp	8.3	Sometimes	Infection sometimes

Calculations are made on parasites through the level of parasite intensity as in **Table 3.** As follows:

Table 3.
Intensity in Tiger Prawns (Penaeus monodon) in the Medan Labuhan District Pond.

Infected Shrimp	Parasites that infect	Intensity Level	Intensity Degree Category
15	56	3.7	Low
10	49	4.9	Low

The degree of infestation in tiger prawns was calculated as shown in **Table 4.** As follows:

Table 4.
Degree of Infestation in Tiger Prawns (Penaeus monodon) in Ponds in Medan Labuhan District.

Types of Parasites	Infested Shrimp	Degree of Infestation	Infestation Degree Category
Epistylis sp	15	3	Light
Zoothamnium sp	10	4.9	Light

This study tested the quality of different seawater samples from aquaculture ponds in Medan Labuhan District. Parameters analyzed included ammonia (NH_3), dissolved oxygen (DO), nitrate (NO_3^-), nitrite (NO_2^--N), salinity, temperature, and pH. These values were compared with seawater quality standards for marine biota as stipulated in Government Regulation No. 22 of 2021 to assess their suitability for shrimp cultivation needs. These values are shown in the following table.

Table 5.
Results of Seawater Quality Test Parameters from Three Pond Sample Locations.

Location Point	Observed Parameters						
	Ammonia (NH_3)	DO	Nitrate (NO_3)	Nitrite (NO_2-N)	Salinity	Temperature	pH
Pond 1	0.203 mg/L	0.76 mg/L	0.9 mg/L	0.125 mg/L	7.07%	30.0 °C	6.76
Pond 2	0.194 mg/L	2.01 mg/L	3.7 mg/L	2,853 mg/L	7.35%	32.3 °C	7.94
Pond 3	<0.010 mg/L	2 mg/L	0.008 mg/L	0.06 mg/L	4.36%	32.0 °C	6.73
Quality Standards	0.3	>5	0.06	<0.1 mg/L	34	28-32°C	7-8.5

Table 5 presents the results of seawater quality measurements from three community pond locations in Medan Labuhan District. The observed ammonia (NH_3) concentrations ranged from <0.010 to 0.203 mg/L. Although all values were still below the maximum permissible limit (0.3 mg/L), elevated ammonia levels in Pond 1 and Pond 2 may indicate the accumulation of organic waste from uneaten feed and shrimp metabolism. Dissolved oxygen (DO) values were relatively low across all ponds (0.76–2.01 mg/L), falling below the recommended standard (>5 mg/L), which may create stressful conditions for shrimp and increase their susceptibility to parasitic infections.
Nitrate (NO_3^-) concentrations varied among ponds, with Pond 2 showing the highest value (3.7 mg/L), while Pond 1 and Pond 3 exhibited lower concentrations. Nitrite (NO_2^--N) levels in Pond 1 and Pond 3 remained below the quality standard (<0.1 mg/L), whereas Pond 2 showed a markedly higher nitrite concentration, suggesting suboptimal nitrification processes and potential toxicity risk for shrimp. Salinity values ranged from 4.36% to 7.35%, which were lower than the general seawater standard (34‰) but still within the tolerance range for tiger shrimp cultured in brackish water ponds.
Water temperature across the three ponds ranged from 30.0 to 32.3 °C, which generally aligns with the optimal temperature range for tiger shrimp growth (28–32 °C), although Pond 2 slightly exceeded the upper limit. The pH values (6.73–7.94) were within the acceptable range for shrimp cultivation (7.0–8.5), indicating relatively stable acid–base conditions. Overall, deviations in dissolved oxygen and nitrite levels suggest that water quality stressors may contribute to the occurrence and intensity of ectoparasite infestations observed in tiger shrimp from these ponds.

Discussion

From the data above, it can be seen that several types of parasitic protozoa infect tiger shrimp (*Penaeus monodon*) from ponds in Medan Labuhan District, namely *Epistylis* sp, *Zoothamnium sp* , etc. These types of parasites are often found in the periopod and pleopod areas. *Epistylis sp* . is an elongated parasite with periostome cilia. This parasite lives in colonies with branched, noncontractile stalks. *Epistylis sp.* lives in colonies where one stalk contains one individual (Setiyaningsih, et al., 2014).

Epistylis sp. , found in this shrimp sample, attaches to the swimming legs and tail of the tiger shrimp (*Peaneus monodon*). Research by Rukyani (2000) indicates that this parasite naturally inhabits shrimp farming areas and often causes problems when the environment around the pond deteriorates and is not controlled. According to Dias *et al.* (2006), the classification of *Epistylis sp.* is as follows:

Kingdom : Animalia
Phylum : Protozoa
Class : Ciliata
Order : Peritrichida
Family : Epistylidae
Genus : *Epistylis*
Species : *Epistylis sp.*

Furthermore, another type of parasite was discovered , namely *Zoothamnium sp* . *Zoothamnium sp.* is a parasite that has a zooid shape with cilia on the periostome. This parasite also lives in colonies with its contractile stalk branching dichotomously and has the same movement in its colony. This parasite is found attached to the body, walking and swimming legs of shrimp living in colonies and branching into two where from these two branches grow two more branches and so on. (Irvansyah *et all* , 2012). The classification of *Zoothamnium sp* according to Idrus (2014) is as follows:

Kingdom : Animalia
Phylum : Protozoa
Class : Ciliata
Order : Peritrichida
Family : Zoothamniidae
Genus : *Zoothamnium*
Species : *Zoothamnium sp* .

From the two parasites found in the shrimp samples, it was discovered that *Epistylis sp. is an aquatic parasite frequently found in aquatic organisms, both plants and aquatic animals. Epistylis sp.* cells are shaped like an inverted bell and live in colonies. Symptoms experienced by organisms infected with this parasite result in difficulty breathing and slow growth in the shrimp (Susanto, 2012). *Epistylis sp* . also infects many types of fish, crabs, shrimp, and seaweed because this parasite can move freely and attaches itself to the surface with a faster reproductive range depending on the species (Hardi, 2022).

Furthermore, Table 1 shows that the most common type of parasite infestation is *Epistylis sp* with a prevalence of 12.5%, followed by *Zoothamnium sp* with a prevalence of 8.3%. Table 2 shows that *Epistylis* is the most common infector with a total of around 56 and *Zoothamnium* has 49 parasites. *Epistylis sp* is more commonly found than *Zoothamnium sp* . These two parasites are more commonly found in the tail and legs where the tail is the outermost organ of the shrimp's body as well as the walking legs and swimming legs of the shrimp. The parasites found in the tail and legs of the shrimp are attached because the shrimp use their legs to move on the bottom of the pond waters with a mud substrate. This factor also causes the large number of parasites found in these body parts. (Istiqomah, 2019).

Table 3 shows that the intensity of the *Epistylis sp parasite* is 15 shrimp infected with an intensity level of 3.7, in *Zoothamnium sp* as many as 10 shrimp infected with an intensity level of 4.9. As is known that both have a low intensity degree category. Table 4 shows that the degree of infestation in tiger shrimp parasite *Epistylis sp* as many as 15 shrimp infested with an infestation degree of 3, in *Zoothamnium sp* as many as 10 shrimp infested with an infestation degree of 4.9 As is known that both have a light infestation degree category.

This study tested the quality of different seawater samples from aquaculture ponds in Medan Labuhan District. Parameters analyzed included ammonia (NH_3), dissolved oxygen (DO), nitrate (NO_3^-), nitrite (NO_2^--N), salinity, temperature, and pH. These values were compared with seawater quality standards for marine biota as stipulated in Government Regulation No. 22 of 2021 to assess their suitability for shrimp cultivation.

Comparisons between each location show a close relationship between infection levels and water quality, as shown in Table 5. It is known that Pond 1 has an ammonia level of 0.203 mg/L, Pond 2 with a value of 0.194 mg/L, Pond 3 with a value of <0.010 mg/L. These values are still not included in the optimal level for shrimp growth. The normal limit of a good ammonia value is 2 mg/L. The level of non-ionized ammonia should not exceed 0.3 mg/L because levels above this will be toxic to shrimp (Putra, 2023).

The dissolved oxygen value in Pond 1 had the lowest dissolved oxygen (DO) level at 0.76 mg/L, while in Pond 2 the dissolved oxygen (DO) level was 2.01 mg/L, and in Pond 3 the DO level was 2 mg/L. These three DO levels in each pond were not yet considered optimal. Water samples taken in the same morning yielded different results. As stated by (Saprillah, 2020), the optimal dissolved oxygen level is >5 mg/L (Saprillah, 2020).

The nitrate value in Pond 1 showed a result of 0.9 mg/L, in Pond 2 as much as 3.7 mg/L, and in Pond 3 as much as 0.008 mg/L. These values are not yet classified as normal limits according to the quality standard set by Government Regulation No. 22 of 2021 of 0.06 mg/L. Nitrate is a major form of nitrogen in water and is included in the main nutrients for the life of aquatic plants and algae. Nitrate is stable and easily soluble in water (Bahri, 2016). The results of the nitrite test were obtained in Pond 1 with a value of 0.125 mg/L, Pond 2 with 2,853 mg/L, and Pond 3 with a value of 0.06 mg/L. In all three ponds, the levels were far from the optimal limit as known to the maximum limit of the nitrite content quality standard referred to in Government Regulation No. 22 of 2021, which is <0.1 mg/L (Hendrawati, 2018).

The salinity results obtained in pond 1 were 7.07%, in pond 2 7.35%, and in pond 3 4.36%. Referring to research (Rahi *et al.,* 2021), it states that the optimal salinity level is 15-25 ppt. Thus, it is known that all three pond salinity levels are far from the normal threshold and can be said to be too salty for the recommended range. This can also cause decreased shrimp growth due to stress and shrimp will be more susceptible to attacks by protozoan parasites. This is because the protozoa *Zoothamnium sp* or *Epistylis sp* can thrive when water quality is poor and shrimp are stressed. High or low salinity does not directly impact parasites but can lead to infections due to decreased resistance in shrimp (Li, 2023).

The temperature in pond 1 was 30°C, in pond 2 it was 32.3°C, and in pond 3 it was 32°C. These values are considered within the normal optimum range based on research (Bin *et al.,* 2021), which states that the optimal range for shrimp growth is 28-32°C. The pH measurements for each pond yielded results: pond 1 had a value of 6.76, pond 2 had a value of 7.94, and pond 3 had a value of 6.73. All three values fall within the optimal range of 6.5-9. A pH that is too high or too low will cause stress in the shrimp and cause the shrimp's skin to soften, thus initiating the spread of protozoan parasitic infections into the shrimp's body (Supriatna, 2020).

Based on the results of parasite identification and seawater sample quality measurements, it was found that the highest prevalence was found in *Epistylis sp.* at 12.5%, while *Zoothamnium sp.* was only 8.3%. The high number of *Epistylis sp.* is in line with previous reports. Water quality can also affect the presence of parasites. This parasite is more adaptable to semi- intensive cultivation conditions with limited water circulation (Setiyaningsih et al., 2014). The presence of *Epistylis sp.* can disrupt shrimp growth, inhibit the moulting process, disrupt shrimp respiration, and even cause death (Putra, 2018).

The water quality analysis of pond 1 showed the lowest DO (0.76 mg/L) with a relatively acidic pH (6.76), a condition that will reduce the shrimp's immune system and facilitate infection in shrimp. Pond 2 had a high nitrite level (2.85 mg/L) which could potentially suppress the shrimp's immune system. However, in contrast, pond 3 had water quality approaching the ideal standard with sufficient DO and low nitrite, so the risk of infection was lower. These findings confirm that water quality management, especially for dissolved oxygen (DO), pH, and existing nitrite levels, is maximized to suppress the prevalence of parasites in tiger shrimp (*Penaeus monodon*) cultivation. According to (Mangampa, 2003), it shows that the optimal quality limit in waters, especially in tiger shrimp pond cultivation, is at a temperature of 28-32°C, all three locations have a good temperature. At a salinity of 15-25 ppt, the salinity values of the three ponds are not ideal or far from the normal salinity limit. (Mangampa, 2003).

From research (Mahasri, 2008) states that *Zoothamnium sp* and *Epistylis sp* usually live in normal environments in good water quality but this type of parasite will gradually increase in number if the water quality is poor such as low dissolved oxygen values in Pond 1 causing many types of protozoa such as *Epistylis sp to be found* higher than the other two ponds. The high degree of infestation found in these protozoa is because these parasites both have fast reproduction and live in colonies. (Schuwerack, 2011). Nitrite found in the three ponds were; 0.125, 2.853, 0.06 mg/L. Based on research (Adiwijaya, 2003) the optimal limit of nitrite for shrimp cultivation waters is <0.25 mg/L. Meanwhile, according to other sources, the optimal quality of cultivation waters is 0.1-0.05 mg/L (Kasnir, 2014).

The findings above indicate that parasite infestation of tiger prawns in community ponds in Medan Labuhan District is not severe and does not impact the sustainability of shrimp used for consumer products. However, if a large number of shrimp are infected with parasites, it can affect shrimp quality, causing disease, weight loss, and even death. Parasites attached to shrimp can cause stress in some shrimp and affect harvest yields (Rahayu, 2013).

Although the prevalence found in this study is relatively low, this condition does not necessarily indicate that the parasites do not play a role in shrimp health. A low prevalence may instead suggest that most shrimp are still in a sufficiently stable physiological condition to withstand infection, yet it still reflects environmental pressures that trigger the emergence of waterborne parasites such as *Epistylis* sp. and *Zoothamnium* sp.

Low DO levels, acidic pH in several locations, and nitrite and nitrate concentrations exceeding the quality standards set by Government Regulation No. 22 of 2021 have the potential to reduce the immune capacity of shrimp. Chronic stress caused by suboptimal water quality can weaken the shrimp's non-specific immune responses, such as phagocytic activity and moulting ability, thereby providing opportunities for colonial protozoa like *Epistylis* sp. and *Zoothamnium* sp. to attach and proliferate on the shrimp's body surface.

In ponds with low DO (0.76 mg/L), the risk of infection increases because oxygen deficiency directly disrupts the shrimp's respiration and basic metabolic processes. Such hypoxic environments also benefit aquatic protozoa, as the host organisms become slower, weaker, and tend to have body surfaces more easily colonized by parasites. Low DO may even slow down the moulting process, making it easier for parasites to maintain their colonies.

Meanwhile, the high nitrite levels in Pond 2 (2.85 mg/L) reinforce the likelihood of mild infection. Nitrite is known to be toxic because it inhibits the shrimp's hemolymph from binding oxygen, causing a condition similar to "nitrite poisoning," which leads to reduced immunity. Shrimp under such conditions tend to show higher susceptibility to protozoan colonization, even though the overall population prevalence remains low. Thus, the low prevalence observed is more closely related to the physiological resilience of individual shrimp rather than an absence of environmental parasite-triggering factors.

Pond 3, which shows water quality closest to optimal standards, has the lowest infection rate, further emphasizing that water quality parameters such as DO, pH, temperature, salinity, and nitrite–nitrate levels are important determinants in the dynamics of parasite prevalence in *Penaeus monodon*. This indicates that the better the water quality, the lower the likelihood of colonial protozoa to reproduce and infect the host. Conversely, the poorer the water quality, the greater the environmental stress that opens opportunities for infection, even if the prevalence remains low.

Thus, the relationship observed between low prevalence and varying water quality across the three ponds indicates that suboptimal environmental conditions are already sufficient to trigger mild infections. Without proper water quality management, the potential for increased prevalence may arise in the next cultivation period, especially if ecological conditions continue to deteriorate. Therefore, the low prevalence in this study reflects more of an "early warning" than a condition that is entirely safe.

4. Conclusion

This study shows that tiger shrimp (Penaeus monodon) cultivated in ponds in Medan Labuhan District are infected with two types of parasitic protozoa, namely *Epistylis sp* with a prevalence of 12.5% and *Zoothamnium sp* with a prevalence of 8.3%.This relatively low prevalence value indicates that parasitic infections have not reached a level that threatens the survival of shrimp, but still reflects the presence of environmental stress in semi-intensive ponds. Therefore, these findings confirm that good water quality management, particularly controlling dissolved oxygen, neutral pH, and nitrite levels in accordance with the quality standards stipulated in Government Regulation No. 22/2021, is essential to suppress the presence of protozoan parasites.

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