HALALAN TAYYIBAN IN AQUACULTURE PRACTICE – A CASE STUDY ON PARASITE IN HATCHERY

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ABSTRACT

Halal is an important issue in aquaculture since this industry produces food for human consumption. This paper aimed to discuss the procedures and practices in the current aquaculture in relation to the concept of halal as a subject while tayyib is a process where clean and pure food will be produced and gives comfort to the user or consumer, thus the product is recognized and certified as *Halalan Tayyiban*. Fish brood stock obtained from a river and kept under a hatchery condition was assigned for the case study. The ectoparasite species found on Tilapia under hatchery cultured condition was investigated. The weight and total length of the Tilapia were measured, and mucus coating was swapped to 10% buffered formalin using the scraping technique. The morphology of copepod parasites was observed under a compound microscope for identification. Hosts with infection of ectoparasite showed reduced weight and increased mortality. A comprehensive understanding of the importance of adopting *Halalan Tayyiban* principles in aquaculture procedures will improve the aquaculture product thus bringing forward local farmers in the halal supply chain.

Keywords: *aquaculture practice, ectoparasite, farming management, halal supply chain*

1. Introduction

In the context of food safety, Alzeer et al. (2018, p. 266) summarized that Halal is the subject, whereas Tayyib is a process that should lead to clean and pure food as a main objective and generate comfortable feelings as a main goal. While the concept and definition of halal are very precise as defined by Al Quran, Tayyib as it is a process, could refer to a quality standard or product (Mohd Yunus et al. 2010, p. 242).

In aquaculture, fish is reared in a confined area, thus, the process will involve the whole production procedures, harvesting, and marketing aspects. Kartika et al. (2020, p. 278) in their mini-review emphasize on fish reared in a pond that does not adhere to Shariah compliance, for instance using filthy sources for feeding, the halalan tayyiban specification will not be achieved. Aquaculture in Malaysia at this point still facing Tayyib issues, particularly in the feeds and feed composition which may affect the effort to bring forward fish farming and small farmers into the halal supply chain (Kartika et al. 2022). While at the same time, the Food and Agriculture Organization of the United Nations (FAO) in their Blue Transformation Roadmap 2022-2030 aimed to intensify sustainable aquaculture to satisfy global demand for food. This aim is planned to achieve through the implementation of different targets including minimizing environmental impact and the use of resources efficiently (FAO 2022, p.7).

Adding to the feed issue is the disease which has become the main threat to the aquaculture industry. Aquaculture practices and environmental quality in the operation are related to fish health. Water quality deterioration showed a direct impact on the high prevalence of ectoparasites on cultured fish (Fahmy et al. 2022). Fish being cultured in overcrowded and poor water quality conditions had been reported as the factors responsible for the development of parasitic copepod disease (Johnson et al. 2004). Environmental quality obviously relates to the Tayyib concept. Water parameters such as dissolved oxygen,

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temperature, and ammonium level, when are outside the preferable of the fish species range, will induce stress, compromising their immune system and making them vulnerable to many opportunistic pathogens (Vatsos & Angelidis, 2010). This is where the concept of Halal and Tayyib needs to be highlighted as a comprehensive approach to support the FAO roadmap and become the opportunity to influence the government policies in implementing mandatory Good Aquaculture Practise for aquaculture operators. Looking at the aquaculture industry in Malaysia, the adoption of a good aquaculture practice (GAqP), is still not mandatory. There is a scheme, Aquaculture Farm Certification Scheme (Skim Persijilan Ladang Akuakultur Malaysia, SPLAM) is voluntary for the farmers to improve their farm management and production. SPLAM has undergone a rebranding process into Malaysian Good Agricultural Practices (MyGAP) in 2013. Nonetheless, MyGAP is also a voluntary program, but no doubt that the report showed that farmers that have a high level of good aquaculture practices will have a high level of aquaculture production (Samah, 2020).

The Tilapia farming industry by Malaysian farmers and young agropreneurs is experiencing rapid growth since the hybrid tilapia, *Oreochromis niloticus* was introduced to the commercial culture level in the 1980s. It has represented 86% of the total local tilapia production (Karuppannan et al., 2013). There were reports on the infestation of ectoparasites on cultured Tilapia in Malaysia. Marina et al. (2013) reported on heavy infestation of *Caligus epidemicus* on marine Tilapia cultured in an earth pond in Johor possibly due to the source of water from the nearby river estuary. Noor-Shahirah et al. (2018) reported a 56-60% prevalence of ectoparasites in Tilapia cultured in the earth marine ponds in Setiu Terengganu. The low content of dissolved oxygen (2.50-3.14 mg/L) could be the reason for the infestation. *Caligus* from Family Caligidae is a highly diverse group with the most specious genera when more than 250 ectoparasite species found mostly in marine fishes of warm water areas (Ho & Lin, 2004). Maran et al., (2009) reported five species of *Caligus* from fish cultured in floating cages such as *C. chiastos*, *C. longipedis*, *C. punctatus*, *C. rotundigenitalis*, and included *C. epidemicus* from Penang and Langkawi Island, Malaysia.

Earth ponds and floating cage culture are the most common technique of aquaculture in most countries including Malaysia. These systems are very much dependent on wild sources of water and other materials related to the water used on the farm. Nonetheless, as production surges, aquaculture facilities increasingly rely on the heavy input of formulated feeds, antibiotics, antifungals, and agrochemicals to ensure fish could fight pathogenic organisms in the culture system (Sapkota et al. 2008). On the other hand, this practice agitates the integrity of the whole production and supply chain process as it gives a negative impact on the sustainability of the industry itself. Under the training guide on ASEAN Good Aquaculture Practices of Fish Food 2020, four key aspects of focus include food safety, animal health and welfare, environmental integrity, and socio-economic responsibility (ASEAN, 2020). It could support the initiative to align aquaculture practice with the halal and tayyib concepts. The objective of this paper is to highlight the issue of disease in aquaculture which should be an important element when considering the halalan tayyiban aspect of aquaculture production and supply chain.

2. Materials and methods

2.1 Experimental design

One hundred fish species (host) of *Oreochromis niloticus* (mean weight is 500g/ind.) were collected from cage culture at the nearby river of Kg. Cherok Paloh, in Kuantan. This cage culture of the Red Tilapia area received fresh water from the Cherok Paloh River and marine water from the South China Sea during high tide. Collected hosts were incubated for 4 days in an incubation tank under hatchery conditions. After 4 days, live host species were

divided into two different tanks with different stocking densities. Tank 1 was stocked with 68 hosts and Tank 2 with 25 hosts. The mean percentages of mortality were counted for an 18-day period. The host's conditions were monitored daily. Since the host showed poor condition and higher mortality, random diagnoses were conducted, and the appearance of a copepod parasite was then noted.

2.2 Laboratory analysis

On the same day, hosts were randomly caught with 6 replicates of each tank. The total length (in centimetres) and weight (in kilogram) of each host were measured and recorded. Ectoparasite specimens were removed from the host using a scraping technique. A clean slide functioning as a scalpel was used to scrap the mucous from the lateral and tail end of the host body. Mucous was placed in 10 % buffered formalin. Parasite copepods were enumerated into non-gravid and gravid stages. Adult copepods were randomly selected for morphological studies and were mounted on a semi-permanent slide for whole-body observation under a compound microscope. Female copepods were dissected, and their parts were transferred into a small drop of CMCP-9 before covering them with a cover slip. The details on its structures were drawings with the aid of a lucida tube attached to a compound microscope.

3. Results and Discussion

3.1 Physical-chemical parameter and host condition.

Table 1 summarized the physical-chemical parameters of the water inside and outside the cages in the study area. The water is considered brackish water with a range of salinity of 24.27-24.41ppt. The oxygen content (DO) in the water is rather low (4.22-4.47 mg/L) while the pH is stable and in an alkaline condition. The temperature is typically warm in tropical water conditions.

Table 1. Mean physical-chemical parameter at Cherok Paloh cage culture.

Cherok Paloh	Inside cage	Outside cage
Temperature (^oC)	30.29	30.29
DO (mg/L)	4.22	4.47
pH	8.79	8.81
Salinity (ppt)	24.27	24.41

From Day 1 to Day 5, all hosts were in incubation tanks, and they were separated into two tanks Tank 1 and Tank 2 starting Day 6 until Day 18. The temperature ranged between 27^{o}C and 31^{o}C, while dissolved oxygen showed a good supply for the fish. pH and salinity were high and favoured the fish culture condition (Fig. 1).

The result of the infestation of ectoparasite in Tank 1 and Tank 2 is shown in Table 2. Weight gain and total length of the hosts in Tank 2 were higher than in Tank 1. This could be related to the high number of parasitic copepods found in Tank 1. The mean number of ectoparasites was 43.8 in Tank 1 and 0.3 in Tank 2. In addition, there are many parasites with eggs (gravid copepods) found in Tank 1. The mortality rate was also higher in Tank 1.

Loss of body weight and higher mortality of Tilapia in Tank 1 showed higher infection of *C.epidemicus*. All of the parasite life stages (gravid, non-gravid) found in the samples collected from Tank 1 indicated the favourable condition that supports parasite infestation on hosts. The high number of hosts stocked in the tank and the warm condition could affect the oxygen supply, thus infestation becomes active.

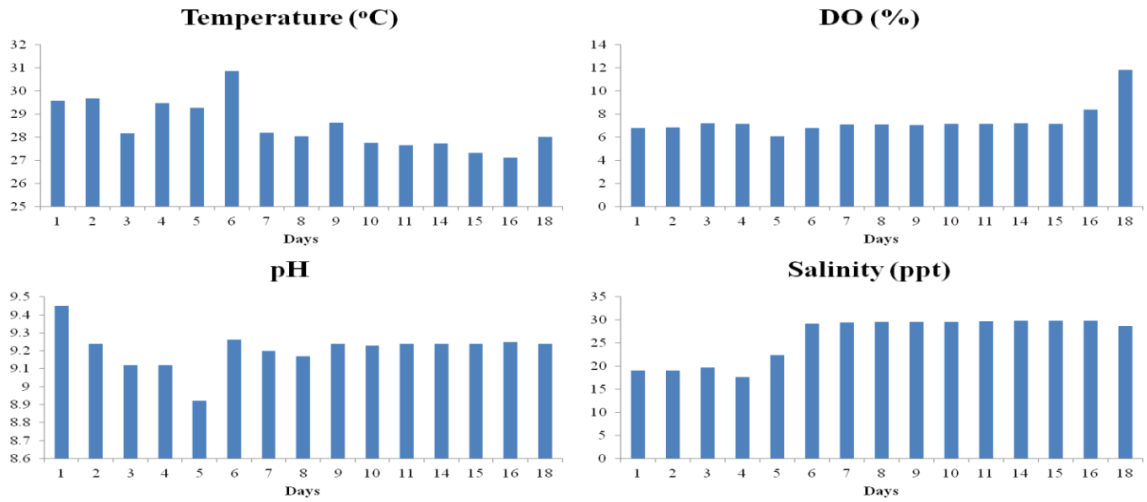

Fig. 1. Physical-chemical parameter for incubation tank (Day 1-Day 5) and Tank 1 and Tank 2 (Day 6-18).

Table 2. Detail of host and copepod parasite cultured in hatchery.

Description	Tank 1		Tank 2	
	Mean	SD	Mean	SD
Weight (kg)	0.433	0.09	0.650	0.02
Total length (cm)	28.0	1.4	30.6	2.1
Gravid copepod	12.7	11.2	0.2	0.4
Non-gravid copepods	31.2	25.0	0.3	0.5
Total Parasite (ind.)	43.8	36.0	0.3	0.5
The mortality rate for the host	14%		7%	

3.2. Morphology feature of *C. epidemicus*

The morphological features of the ectoparasite found infesting Tilapia in this study are shown in Fig. 2. The mouthparts and appendages were adapted to crawl and attached to the outer skin of the host. Their flattened dorso-ventrally body shape increases the adaptability to live on the host.

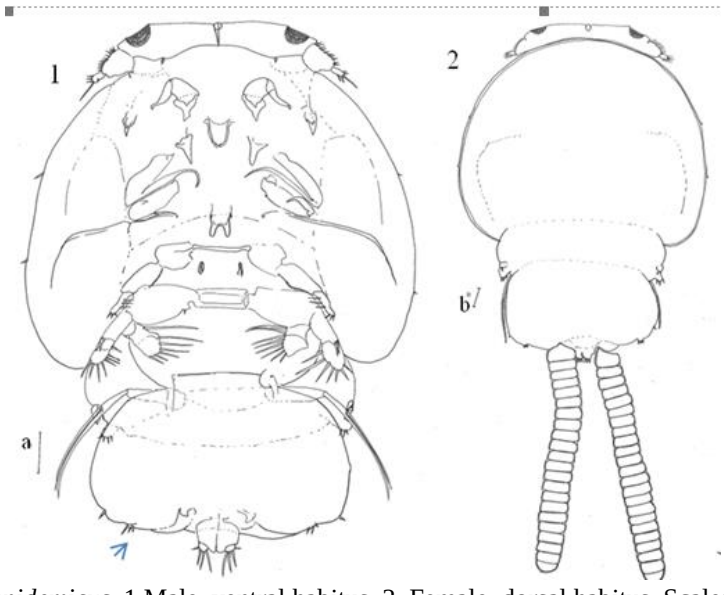

Fig.2. *Caligus epidemicus*. 1 Male, ventral habitus. 2, Female, dorsal habitus. Scale: 0.05mm. (Drawing was made under a 10 x 1000 magnification with the help of a Lucida camera)

The poor water condition was noticed from the low oxygen content in the river itself where the source specimen was collected. This possibility of early infestation by ectoparasites, while they were in the wild, was proved by the high number of gravid parasites found when they were kept under the hatchery condition. This mode of disease attack is frequently reported in cultured fish due to poor water quality conditions on the farm. Farm management is considered one of the critical points in the aquaculture halal supply chain (Kartika et al. 2022). Failure to comply with the standard procedure in maintaining good water quality, and practising an unhygienic approach in handling fish and their waste will trigger the growth of pathogenic organisms which will be infesting the fish.

Maintaining a strict protocol for aquaculture activities could be a way to improve the tayyib practice in the industry. Starting from the site selection (choosing the source of water for culture activity), the culture technique chosen and standard operating procedures in the production process will affect the quality of the product from the farm. Healthy fish will increase demand and activate the halal supply chain.

4. Conclusion

The aquaculture industry should determine its practices to be in accordance with the standard which will meet the definition of tayyib. In addition to the issues of feed and feed content, maintaining animal health and welfare and environmental integrity is seen as an important aspect that should be considered in the focus of halalan tayyib. Disease and parasite infestation are major threats in the aquaculture industry and the cause is directly related to the environmental integrity of the aquaculture farm. Handling the issues following the concept of halal and tayyib would help the industry and the aquaculture halal supply chain to move forward.

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