THE EFFECTS OF DIFFERENT FEEDS ON GROWTH RATE, SURVIVAL RATE AND MORPHOLOGICAL DEFORMITIES OF AFRICAN CATFISH *(Clarias gariepinus)* LARVAE

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ABSTRAK

Sejak puluhan tahun yang lalu, perternakan tiruan ikan keli dalam kurungan telah semakin diminati di kalangan industri akuakultur disebabkan oleh kebolehan semulajadi ikan tersebut yang istimewa untuk hidup dalam keadaan sekeliling yang kurang memuaskan. Namun, masih lagi terdapat kekurangan maklumat yang tepat dan memadai dengan keadaan di Malaysia dalam makanan harian dan keperluan nutrisi untuk memberi kesan ke atas kadar tumbesaran dan peratusan hidupan larva ikan keli tersebut. Oleh yang demikian, kajian yang dijalankan ke atas larva ikan Keli Africa ini adalah untuk menilai kesan daripada jenis pilihan makanan yang berlainan dalam menentukan kadar tumbesaran, peratusan hidupan dan ketrampilannya yang normal di mana jenis pilihan makan tersebut boleh dikelasifikasikan kepada makanan hidup semulajadi dan makanan tiruan. Makanan hidup yang diaplikasikan dalam kajian ini adalah *Moina* dan *Artemia*, manakala makanan tiruan yang digunakan ialah "Tilapia Starter Feed" yang diperoleh dari industri perkilangan dan "Artificial Compound Feed" buatan hatceri UMS sendiri. Kajian ini dijalankan dalam hatceri UMS selama dua puluh hari dengan sejumlah 180 ekor anak larva ikan dikaji bersama dengan setiap satu jenis makanan pilihan dalam tiga ulangan mulai hari kedua lepasan penetasan dan diberikan makanan ke tahap kepuasan tiga kali sekari, iaitu sebelah pagi, tengah hari dan petang. Pretasi tumbesaran dan peratusan hidupan larva ikan yang diberikan makanan hidup telah menunjukan nilai pembezaan yang ketara ke atas larva ikan yang hanya diberikan makanan tiruan, iaitu larva ikan yang diberikan *Moina* mencatatkan tumbesaran yang paling tinggi antara semua makanan yang disediakan sedangkan larva ikan yang diberikan *Artemia* telah menunjukkan peratusan hidupan yang tertinggi dengan catatan 82.96%, tetapi nilai kadar tumbesarannya adalah lebih mundur kalau dibandingkan dengan larva yang diberikan *Moina* di mana catatan purata kepanjangan badannya (cm) ialah 1.497±0.098 pada hari ke-dua puluh lepasan penetasan. Akan tetapi, kajian ke atas ketrampilan normal yang menujukan terhadap larva ikan tidak menunjukan sebarang keputusan yang relevan untuk analisa yang seterusnya.

ABSTRACT

Decades ago, breeding of Catfishes in captivity has been commonly practiced in the field of aquaculture industry due to their superb environmental adaptability in nature, but yet, there is still lacking of adequate information in Malaysia on the daily intakes and nutritional requirements that affects the survival and growth performance. Hence, this research was conducted to study on the growth, survival and deformities of African Catfish larvae with different types of feeds, which could be basically categorized into live feeds and artificial diets. In this paper, live feeds in preference were *Moina* and *Artemia* whereas the artificial diets were made up of Tilapia Starter Feed and also hatchery-made artificial compound feed. The feeding experiment was carried out in the UMS hatchery for a rearing period of 20 days using the 180 tails newly-hatched larvae for each selected feeds in three replications. All the newly-hatched larvae were given the first feeding equally on the 2 dAH onwards in morning, afternoon and evening till satiation. The results of growth and survival had shown that the larval fish fed with live feeds has a significant ($P<0.05$) difference over the fish fed with artificial diets where *Moina* feeders remained higher than the *Artemia* feeders at 20 dAH. On the other hand, *Artemia* feeders had the highest survival rate of 82.96% but poorer growth rate as compared to the feeders of *Moina* where the total mean body length (cm) has achieved 1.50 ± 0.098 at the age of 20 dAH. However, the deformities study on these larvae didn't show much difference from the effects of the four feeding materials being used here.

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RM	Ringgit Malaysia
%	Percentage
cm	Centimetre
mm	Milimetre
µm	Micronmetre
g	Gramme
kg	Kilogramme
l	Litre
ml	Mililitre
ppt	parts per thousand
° C	Degree Celsius
hAH	Hours After Hatching
dAH	Days After Hatching
am	Morning
pH	Water acidity and alkalinity parameter
DO	Dissolved Oxygen
TSF	Tilapia Starter Feed
ACF	Artificial Compound Feed
i.e.	that is

CHAPTER 1

INTRODUCTION

1.1 Aquaculture

The term of aquaculture is usually regarding to the cultivation and farming of aquatic animals and plants in seawater, brackish water and freshwater surroundings (Welcomme, 1988). Fisheries supply to the consumer market has long ago been recognized to obtain from capture fishery practices by mean of trawling boat and purse seines but nevertheless, in some of the undeveloped regions, aquatic farming is still the fundamental practice to grow fish and other aquatic animals in a pond or cage or by captivity in the river or sea to learn self-providing earnings despite the facts that landings of captured fisheries has gradually declining along these years (Department of Fisheries, 2004).

The aquaculture practices are encompassing the keeping of many indigenous species that is native to the breeding grounds, as well as the exotic species of finfish and shellfish in hopeful to generate better revenues. Among those species being commonly

farmed in the industry, catfishes, carps, snappers, trouts, groupers, barramundis, cockles, abalones, clams and oysters opted to be at better position for production due to the preferences in consumer market.

1.2 African Catfish

African catfish, scientifically known as *Clarias gariepinus* (Picture 1.1), is a freshwater species and well-known as sharp tooth catfish (Appelbaum & McGeer, 1998) and also recognized as walking catfish as well (Pillay, 1990). It is called "Keli Afrika" in local and has been recognized as one of the most popular freshwater species in aquaculture industry and categorized into the Clariidae family along with *Clarias lazera*, *Clarias mossambicus* and *Clarias senegalensis* (Baidya & Senoo, 2002).

Picture 1.1 Female brood stocks of African Catfish, *Clarias gariepinus* selected out from cultivation tank in UMS hatchery.

This species of catfish is the largest freshwater catfish within the Clariidae family, where it can grow up to 60kg in body weight and more than 170cm in total body length (Robin *et al.*, 1991). This catfish is native to Niger and Nile Rivers and can be found easily throughout Africa (Welcomme, 1988) where it has been so popular in aquaculture industry and was widely introduced to many European countries and Southeast Asian countries in the 1980s, including Malaysia as well.

1.2.1 Problems in African Catfish Larval Rearing

Rearing and farming of this exotic African Catfish in Malaysia has been very common and successfully done in the past time where bundles of seedlings can be easily produced for each rearing cycle. But, due to the high fecundity condition of the matured female African Catfish in nature, the survival rate and growth rate of this African Catfish from the early stage of total eggs being produced till the late larval stage has not been studied thoroughly and sufficiently with different sources of feeding materials under hatchery-reared condition.

Also, there is another major problem that usually occurs in African Catfish larval rearing process that will always degrade the fish value very well, is the deformities that take place during the larval development stage. These African Catfish larvae will undergo some sort of abnormal transformation morphologically or impaired body functions.

1.3 Feeding Materials

The African Catfish usually started with first feeding during their nutritional transition period of 48-hAH onwards where their mouth and anus part are formed and paired with intestinal activity as well. Delayed feeding or wrong estimation on nutritional transition period of the larval will cause energy exhaustion and malnutrition condition to the larval fish. In this piece of paper, four different types of feeding materials had been recruited to study on the effects of these feeds towards the growth rate, survival rate and morphological deformities of this African Catfish larval stage:

1.3.1 Brine shrimp nauplii (*Artemia)*

Artemia are the brine shrimp nauplii belonging to the phylum of Arthropoda and class of Crustacea (Picture 1.2) where the lacking of a carapace in them has categorized the *Artemia* in the suborder of Anostraca and further into the family of Artemiidae (Tamaru *et al.*,1993). *Artemia* are zooplanktons that are naturally found in the lakes and pools of extremely high salinities, the nauplius stage is normally used as live food for marine finfish and crustacean larval rearing (Treece, 2000). The adult form of *Artemia* is more commonly used as live, frozen or freeze-dried food in the aquarium trade (Tamaru *et al.*, 1993).

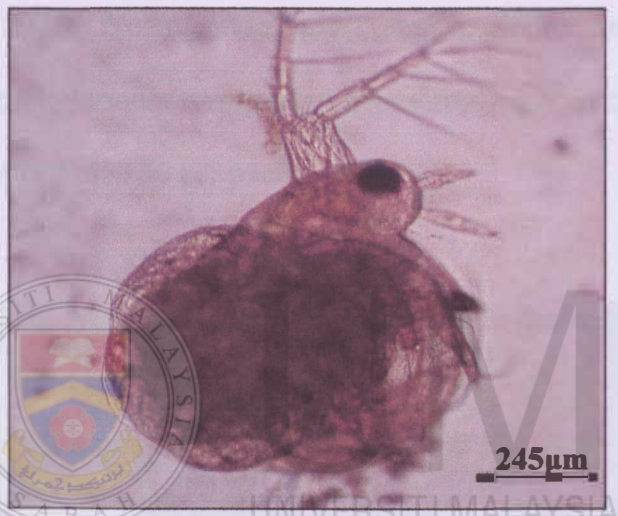
Picture 1.2 Morphological structure of newly-hatched *Artemia* nauplius under microscopic view which is ready to feed on larval fish.

Treece (2000) reported that *Artemia* can thrive in water salinities ranging from 3ppt to 30ppt and survive well in temperatures from 15-55 °C. Also, *Artemia* can survive in fresh water for a short period of time but they can't reproduce in this condition. With the size of fresh nauplius in 400-450µm, *Artemia* has been recognized as the only suitable food for most fish and crustacean larvae during the early stage and each gram of good quality *Artemia* cysts can hatch out an approximate amount of 200,000-300,000 nauplii under proper incubation condition (Tamaru *et al.*, 1993).

1.3.2 *Moina*

Moina is recognized as a freshwater zooplankton (Picture1.3) which belongs to the class of Crustacea and further categorized into the suborder of Cladocera (Lavens & Sorgeloos,

1996). *Moina* and *Daphnia*'s genera are closely-related and sometimes they are clustered as daphnia, but *Moina* is much smaller in size but contains higher protein value than *Daphnia* (Rottmann & Graves, 2003). The carapace covered the whole trunk of the *Moina* while the head projects ventrally in a beak-like snout (Lavens & Sorgeloos, 1996) and *Moina* can be found in ponds and high nutrition-loaded reservoirs but mainly inhabits ditches.



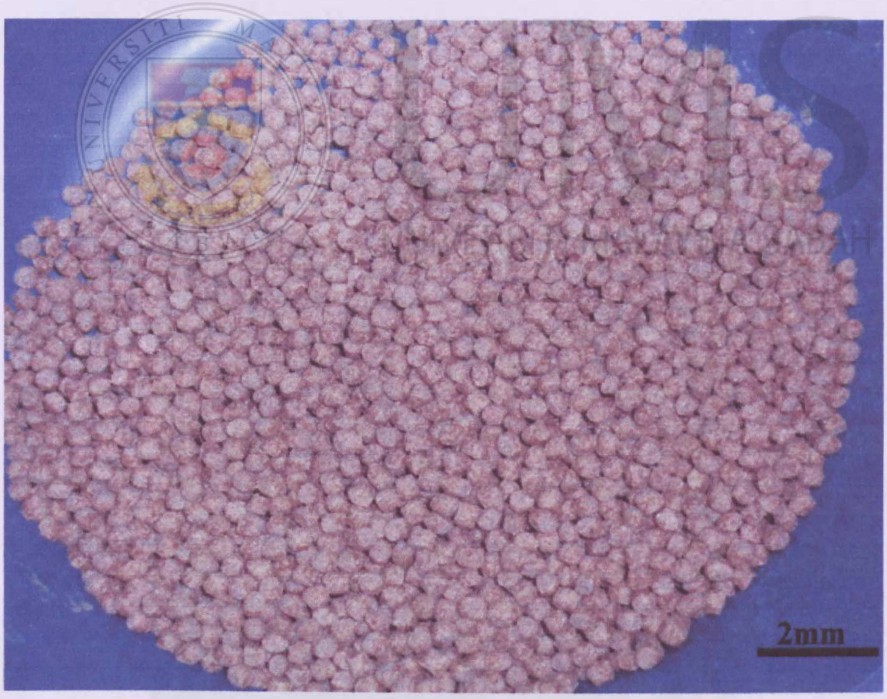
Pictuer 1.3 Microscopic view of an adult female *Moina* collected from natural pond for feeding purpose.

Adult *Moina* are usually 700-1,000µm in size which are longer than the newly-hatched brine shrimp nauplii. The young or newly-born *Moina* which is approximately 400 µm in size or less, is smaller than newly-hatched brine shrimp (Rottmann & Graves, 2003). With the advantage of this feature, *Moina* has been served as an ideal food in freshwater larviculture and ornamental fish industry due to the readily acceptance of newly-hatched fry of most freshwater species on young *Moina* as their first feeding.

Besides that, *Moina* is readily exposable to extreme temperature of 5 - 31 °C and survive well in oxygen-poor environment (Rottmann & Graves, 2003).

1.3.3 Extruded Tilapia Starter Feed 6113-S (Commercial Pellet Feed)

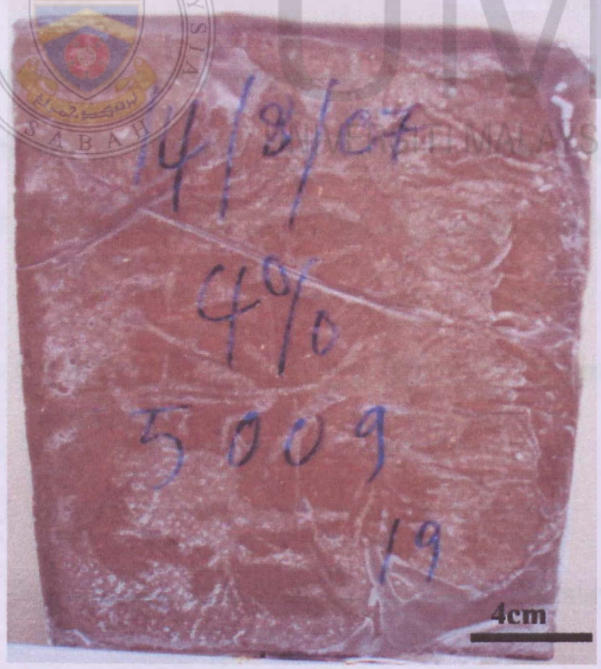
In this study, artificial diet which is commercially available will be included to evaluate the effects of different feed source onto the African Catfish larvae (Picture 1.4). This commercial pellet is mainly recommended as a complete diet for fingerlings of less than 100g which has palatable formula to stimulate strong feeding activity. The retail price of this commercial feeds is RM50.50 per packet of 20kg.



Picture 1.4 Commercial Tilapia Starter Pellet feed in close view from Desa Cargill Sdn. Bhd with floating ability.

1.3.4 UMS-hatchery self-formulated compound feed (Artificial Compound Feed)

UMS hatchery has long ago been producing self-formulating artificial compound feed for better brood fish management which is higher in protein and lipid content (Picture 1.5). However, the content of the ingredients can be manipulated to meet the requirements of target species. This artificial diet can be produced into moisture and dry form depending on the acceptance of the species as well. The formulation of this artificial compound feed in my study will be a mixture of 46% fresh trash fish, 46% of commercial marine finfish mash (Seabass powder from Desa Cargill Sdn. Bhd), 3% of commercially-available pure cod liver oil, 3% of omega-3 & 6-riched vegetable oil and 2% of veterinary-used vitamins mix.



Picture 1.5 Self-formulated artificial compound feed being prepared domestically in UMS Hatchery for fish cultivation.

1.4 Justification of Study

Although there are some studies has been done on growth rate and survival rate of African Catfish larvae, but little is known about the growth rate, survival rate and morphological deformities of this fish under hatchery-reared condition in adapting Malaysia's local weather conditions and in fact, there are still many more feeding materials for larval rearing that have not be been explored on their effects towards the African Catfish larval rearing. As successive development of fish larvae will differ with different application of feeding materials. Hence, carrying out this study will enable us to have a better understanding about the growth development of these African Catfish larvae.

1.5 Objective

This study was carried out to gather information about growth rate, survival rate and morphological deformities in African Catfish larval rearing under hatchery-reared condition and this had further led to the three objectives of this study:

1. To determine the effects of the different feeds on the growth rate of African Catfish larvae.

2. To determine the effects of the different feeds on the survival rate of African Catfish larvae.