Effect of aeration level on water quality and growth performance of tinfoil barb (Barbonymus schwanenfeldii)

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Abstract. This study aims to determine the optimal aeration level for several variables of water quality, physiological conditions and the increase in the weight of juvenile tinfoil barb (*Barbonymus schwanenfeldii*). The design used in this study was a completely randomized design (CRD), as the treatment is the aeration level, which is 2, 6, 10 and 14 L min^{-1} to each aquarium (40 L of water). The observed variables consisted of water quality (temperature, dissolved oxygen (DO), carbon dioxide (CO_2), ammonia (NH_3-N)), physiological variables (lactic acid levels, levels of oxygen consumption, nitrogen retention and energy retention), and absolute weight gain and feed conversion ratio (FCR). The results showed that DO was higher with increasing aeration levels, from an average of 6.49 to 7.99 mg L^{-1}, CO_2 and ammonia (NH_3-N) could still be tolerated by fish to grow. Oxygen consumption and lactic acid levels in the muscles increase with increasing aeration levels. The highest nitrogen retention and energy retention were achieved at 10 L min^{-1} aeration treatments, which were 40.77% and 34.53%, respectively. The use of 10 L min^{-1} aeration can also produce the highest absolute weight gain (WG), which is an average of 404.20 g and the lowest FCR with a value of 1.26.
Key Words: lactic acid, oxygen consumption, tinfoil barb, water quality.

Introduction. Nowadays, awareness of Indonesian people for fish consumption tends to increase. However, in some regions far from the coast and outside the center of marine fisheries production, increased awareness about the importance of fish consumption has not been supported by the availability of adequate fish. So that, the commodities that are marketed are generally freshwater fish that are the catch of open waters (lakes and rivers). The high demand for consumption fish causes fish populations in some areas to decrease. However, to anticipate a drastic decline in fish populations due to the high fishing intensity for these commodities, it is necessary to develop aquaculture of economically valuable freshwater fish species.

Tinfoil barb fish (*Barbonymus schwanenfeldii*) is one of the fisheries commodities that have high economic value and is very prospective to increase the diversity of aquaculture commodities in the future. It is supported by the superiority of fish that has a distinctive meat taste, so that consumers like it. Furthermore, this species can reach large size in natural waters (34 cm long and weigh more than 500 g/fish) (Cholik et al 2005), even in Sentarum Lake in West Kalimantan, it can still be found tinfoil barb fish with a weight reaching 1000 g (Dewantoro et al 2011).

Currently, the hatchery of tinfoil barb fish has been successfully carried out, and the seeds can be mass produced (Dewantoro 2015; Dewantoro et al 2017). Therefore to develop the cultivation of this type of fish, the aspect that still needs attention is efforts to overcome the slow growth of fish. Research to improve the growth performance of tinfoil barb fish through improved nutrition has been carried out several times. Mansour et al (2017) reported that feeding with a protein content of 32% was highly recommended for the maintenance of seeds at 1-2 g $fish^{-1}$ (fry). While fingerling (size 6-7 g $fish^{-1}$) artificial feed with a protein content of 35% and an energy/protein ratio of 10 kcal g^{-1} protein were the best feeds (Dewantoro et al 2018), although these two nutritional studies can increase growth, the results are still not optimal. Therefore, another approach is needed so that the cultivated fish can grow faster.

Besides the feed factor, the problem of slow growth of fish in cultivation conditions is caused by several other aspects, one of which is water quality. Water quality (especially oxygen) is the second limiting factor in increasing aquaculture production after feed availability is met. Fish cannot grow optimally if there is insufficient oxygen availability in the waters (Filho et al 2005; Mallya 2007; Del Toro-Silva et al 2008; Gan et al 2013). This is due to oxygen having a very important role in the process of fish metabolism which will in turn affect growth performance (Qayyum et al 2005; Mallya 2007; Del Toro-Silva et al 2008; Tran-Duy et al 2012; Bagherzadeh Lakani et al 2013ş Gan et al 2013). Although in certain air breathing fish, such as juvenile of snakehead fish, aeration does not have a significant effect on growth (Purnamawati et al 2017), in some fish species an appropriate aeration level is needed in order to anticipate lack of oxygen for growth (Sakakura et al 2006; Das et al 2012; Fui et al 2012; Pawar et al 2014; Zahidah et al 2015).

Several studies of water quality in tinfoil barb fish have been done. Increasing the growth of seedlings of tinfoil barb fish through the regulation of salinity and calcium (Islama et al 2014), fry and juvenile of tinfoil barb fish tolerance to the acidity level of water (Nyanti et al 2017), and the effect of temperature, dissolved oxygen and suspended solids on the performance of tinfoil barb juvenile fish growth (Nyanti et al 2018) are known. However, the growth performance of the tinfoil barb fingerling maintained at various aeration levels is unknown. This study was aimed at elucidating the optimal aeration level for several variables of water quality, physiological conditions, and the increase in the weight of fingerling tinfoil barb (*Barbonymus schwanenfeldii*).

Material and Method

Period and place of experiment. This research was carried out at the fish hatchery of Pontianak City (BBI Kota Pontianak) for 60 days of rearing. Analysis of water quality parameters was carried out at the Integrated Laboratory of Muhammadiyah University of Pontianak. Proximate analysis of feed ingredients was carried out at the Animal Husbandry Laboratory of Faculty of Animal Husbandry, Padjadjaran University, and proximate analysis of feed and fish was carried out at the FPIK IPB. The content of lactic acid in fish meat was analyzed at the Saraswanti Genetech Laboratory, Bogor.

Experimental design. This research was conducted in a 16-unit aquaria which was given aeration as a source of oxygen. The design of experiment used in this study was the complete randomized design (CRD) consisting of 4 treatments and 4 replications. As a treatment there was the level of aeration given to each aquarium with a volume of 40 liters of water. The treatment consisted of aeration with an air flow, i.e. 2 L min^{-1}, 6 L min^{-1}, 10 L min^{-1} and 14 L min^{-1}.

As a source of oxygen needed to aerate the rearing medium an air pump (blower) was used. Air from the blower was flowed to each aquarium shelf through a dividing pipe using a PVC pipe with a diameter of 0.5 inches. The air flow from the dividing pipe was distributed into the aquarium using a 0.5 cm diameter plastic hose. At the base of the plastic hose was given a screw which serves to regulate the flow of air in accordance with the required aeration level. While at the end of the plastic hose was given air bubble stone so that the air is scattered in the water. The air entering each aquarium was measured its flow velocity using the AMTAST AMF029 anemometer.

Experimental procedure. As the research containers we used 16 units aquarium size 60 x 40 x 40 cm. The medium used to reare the fish were the water from Kapuas River that had been deposited in reservoir. Before it was used, the water was transferred in container tanks in the hatchery room and redeposited for one day. Then, the water was ready to be used for fish maintenance. The tanks were refilled with new water that was prepared as a backup for water replacement during maintenance.

The experimental fish used was tinfoil barb fingerling, with an average and standard deviation of standard length of 5.79±0.17 cm and weight of 6.67±0.63 g. These fish were reared in an aquarium filled with 40 liters of water. The number of fish was 20 individuals per aquarium. During the maintenance, the fish fed pellets with 35% protein content, energy/protein ratio 10 kcal/g protein. Feed was given until full (ad satiati) with a frequency of twice a day, morning and afternoon. During the study, rearing water was continuously aerated according to treatment. The aeration was given before stocking the fish until the research end. The water change was done by removing 10 L of water from the aquarium every two days and then replacing it with replacement water, so that the rest of metabolism does not degrade water quality.

Every 15 days a sample of fish and feed were weighed to determine the weight gain of the fish and the amount of food eaten. At the end of the study measurements of the level of oxygen consumption and fish sample were taken to observe lactic acid levels. Proximate levels of feed were analyzed before the study began, while proximate levels of fish body were observed at the beginning and at the end of the study.

Observation and calculation of variables. In this study, the observed variables consisted of water quality variables (dissolved oxygen or DO, CO_2, NH_3-N), biochemical variables (muscle lactic acid levels, nitrogen retention and energy retention), oxygen consumption level, weight gain, and feed conversion ratio. Muscle lactic acid levels at the end of the study were observed using high performance liquid chromatography (HPLC). DO was observed every 2 days using a water quality checker. Observations of other water quality variables were done once every 15 days by titration for CO_2 and using a spectrophotometer to measure ammonia (NH_3-N) levels.

The formula used to measure the level of oxygen consumption is as follows:

$$MR = ([O_2]t - [O_2]o) \times V/W \times T$$

where: MR = oxygen consumption rate (mg O_2 g^{-1} $hour^{-1}$);
$[O_2]o$ = oxygen concentration at the start of measurement (mg L^{-1});
$[O_2]t$ = oxygen concentration at the end of measurement (mg L^{-1});
V = water volume (L);
W = fish biomass weight (g);
T = time of measurement (hour).

Result of proximate analysis of fish feed and body were used for calculation of nitrogen retention and energy retention using formulae:

$$NR = \text{body nitrogen gain (g)/nitrogen consumed (g)} \times 100$$

$$ER = \text{body energy gain (kcal)/energy consumed (kcal)} \times 100$$

where: NR = nitrogen retention (%);
ER = energy retention (%).

Weight gain was calculated using the formula:

$$WG = Wt - Wo$$

where: WG = weight gain (g);
Wo = the average weight of fish at the beginning of the study (g);
Wt = the average weight of fish at the end of the study (g).

Feed conversion ratio was calculated by using the formula:

$$FCR = FI/(Wt-Wo)$$

where: FCR = feed conversion ratio;
Wo = the weight of fish biomass at the beginning of the study (g);
Wt = the weight of fish biomass at the end of the study (g);
FI = the weight of feed consumed (g dry weight).

Analysis method. Water quality data were analyzed descriptively. While the biochemical data (lactic acid in the muscle, nitrogen and energy retention), the level of oxygen consumption, absolute growth and feed conversion ratio were analyzed using the IBM SPSS Statistics 20 program.

Results

Dissolved oxygen, carbon dioxide and ammonia. The value of DO increased along with increasing aeration level, from 6.49 mg L^{-1} in aeration 2 L min^{-1} to 7.99 mg L^{-1} in aeration 14 L min^{-1}. This happens because if we increase the aeration, of course more air will be pumped, so the diffusion process will be faster, and DO will increase. Unlike DO,

CO_2 does not have a certain pattern of tendency. The lowest level of CO_2 was found in water aeration of 10 L min^{-1}, i.e. 6.88 mg L^{-1}, while the highest value was found in water aeration of 6 L min^{-1} wich had concentration of 7.61 mg L^{-1}. Conversely, for the concentration of ammonia (NH_3) there is a tendency that is almost the same as DO. Ammonia concentration in this study also increased with increasing aeration level, from an average of 0.0136 mg L^{-1} in aeration of 2 L min^{-1} to 0.0187 mg L^{-1} in aeration of 14 L min^{-1} (Table 1).

Table 1

The values of dissolved oxygen (DO), carbon dioxide (CO_2) and ammonia (NH_3) in the water for rearing of tinfoil barb fish that were maintained at some aeration levels

Aeration to each aquarium	*DO (mg L^{-1})*	*CO_2 (mg L^{-1})*	*NH_3 (mg L^{-1})*
2 L min^{-1}	6.49±0.58	7.30±0.58	0.0136±0.0023
6 L min^{-1}	6.97±0.36	7.61±0.71	0.0150±0.0025
10 L min^{-1}	7.60±0.67	6.88±0.92	0.0167±0.0033
14 L min^{-1}	7.99±0.73	7.27±0.53	0.0187±0.0028

Oxygen consumtion and muscle lactic acid. The oxygen consumption rate (MR) of tinfoil barb increased significantly with high aeration levels were given. MR of fish kept in water aeration 14 L min^{-1} was the highest ($p < 0.05$). However, there were no significant differences in the MR between the groups of the water aeration of 2, 6 and 10 L min^{-1}. For lactic acid, the concentration tends to increase with increasing aeration level of water. The concentration of lactic acid of tinfoil barb muscles were given aeration of 14 L min^{-1} was the highest, but it was not significantly different from giving aeration of 10 L min^{-1}. Both treatments resulted in higher concentrations of lactic acid when compared to aeration of 6 and 2 L min^{-1} ($p < 0.05$) (Table 2).

Table 2

Oxygen consumption level and lactic acid content of tinfoil barb fish after 60 days rearing at some aeration levels

Aeration to each aquarium	*Oxygen consumption rate (mg O_2 g^{-1} hour^{-1})*	*Lactic acid (ppm)*
2 L min^{-1}	196.44±23.84^a	4,069.74±1,020.55^a
6 L min^{-1}	220.59±22.15^a	5,394.31±871.90^a
10 L min^{-1}	223.69±31.22^a	10,458.25±1,497.63^b
14 L min^{-1}	284.01±43.77^b	11,697.87±1,517.64^b

Different superscript letters in the same column show a significant difference ($p < 0.05$).

Nitrogen retention and energy retention. In this study, different levels of water aeration had significant effect on nitrogen retention (NR) and energy retention (ER) of tinfoil barb ($p < 0.05$). Both the best NR and ER were achieved in the group of treatment of 10 L min^{-1} with the values of 40.77% and 34.53%, respectively. However, the lowest NR and ER values were generated by aeration level of 2 L min^{-1} (Table 3).

Table 3

Nitrogen retention (NR) and energy retention (ER) of tinfoil barb fish after 60 days rearing at some aeration levels

Aeration to each aquarium	*NR (%)*	*ER (%)*
2 L min^{-1}	22.36±2.49^a	18.67±2.11^a
6 L min^{-1}	29.91±1.52^b	26.82±1.38^b
10 L min^{-1}	40.77±2.12^c	34.53±1.93^c
14 L min^{-1}	39.26±2.54^c	32.27±2.03^c

Different superscript letters in the same column show a significant difference ($p < 0.05$).

Weight gain and feed conversion ratio. During maintenance, the aeration concentration has a significant effect on the weight gain of the fish. The average increase in weight from 228.90 to 404.20 g occurred simultaneously with increasing aeration from 2 to 10 L min^{-1} ($p < 0.05$). After that, weight gain decreased even though it was not significant (Table 4). For the FCR, there was an improvement in the FCR value with increasing aeration given from average of 2.23 in water aeration of 2 L min^{-1} to average of 1.26 in water aeration of 10 L min^{-1} ($p < 0.05$). However, if the aeration was increased to 14 L min^{-1}, the FCR value also increased, but it was not significantly different from the FCR produced by water aeration of 10 L min^{-1} (Table 4).

Table 4

Initial biomass (IB), final biomass (FB), weight gain (WG) and feed conversion ratio (FCR) of tinfoil barb fish were reared at some aeration levels for 60 days

Aeration to each aquarium	*IB*	*FB*	*WG*	*FCR*
2 L min^{-1}	133.20±14.78	362.10±29.47	228.90±20.20^a	2.23±0.24^c
6 L min^{-1}	133.20±14.27	461.90±20.38	328.70±7.91^b	1.58±0.08^b
10 L min^{-1}	133.45±13.58	537.65±42.36	404.20±42.77^c	1.26±0.08^a
14 L min^{-1}	133.55±13.37	523.95±24.42	390.40±12.42^c	1.31±0.09^a

Different superscript letters in the same column show a significant difference ($p < 0.05$).

Discussion. DO is an important and critical component of water quality in aquaculture, so that a slight shock of oxygen can be directly felt by fish. The presence of oxygen in waters is influenced by salinity, altitude, temperature, gas partial pressure and turbulence/water movement (Soderberg 1982; Colt 1986; Boyd 1998a; Effendi 2003). This research was carried out in the same place and used freshwater media, so the effect of differences in altitude and water salinity on DO can be ignored. Although in this study there was an influence of temperature, it was relatively small and not caused by treatment. The factors that allow the differences in the solubility of the oxygen are the partial pressures of gas and turbulence caused by water aeration. According to Boyd (1998b) the source of oxygen in natural waters or extensive cultivation is from diffusion and photosynthesis, but in intensive aquaculture the DO in water only comes from diffusion whose quantity depends on the difference in gas partial pressure and turbulence.

The concentration of CO_2 in water is determined by several factors, such as the occurrence of diffusion, respiration of plants and aquatic animals, and decomposition of organic matter (Boyd 1998a). In the maintenance of fish in a controlled container such as in an aquarium, there are no plankton and aquatic plants that live, so the main factor influencing the presence of CO_2 in the maintenance media is the result of decomposition of organic material and fish breathing. The low CO_2 at the aeration level of water 10 and 14 L min^{-1} were caused by the available oxygen which is quite a lot, so that the feed provided can be digested and metabolized completely, thus the CO_2 formed is not too high.

In general the levels of CO_2 dissolved in the water are still within the threshold of tolerance for fish growth. Although fish try to avoid if the waters contain CO_2 around 5 mg L^{-1}, it can grow optimally with CO_2 levels of 1-10 mg L^{-1} (Boyd 1998a). The concentration of CO_2 is critical for fish at 20 mg L^{-1} (Hargreaves & Brunson 1996). However, fish can still live with 60 mg L^{-1} of CO_2 if these waters have high content of DO (Boyd 1998a).

Ammonia found in water comes from the decomposition of organic matter which consists of excretion of metabolic waste and food waste. Although the ammonia concentration is quite high at high aeration levels, in general ammonia levels are still below the threshold that can interfere with fish growth. Ammonia lethal concentrations vary from one aquatic organism to another. Generally at concentrations between 0.4 and 2.0 mg L^{-1} can kill fish and crustaceans within 24-96 hours (Boyd 1998a). Chronic effects of ammonia in water at a concentration of 0.06 mg L^{-1} can cause damage to the gills and kidneys, impaired brain function, decreased oxygen carrying capacity of waters by fish, and cause a decrease in growth (Durborow et al 1997). Water containing NH_3 < 0.02 mg L^{-1} is an ammonia level that is safe for reproduction (Levit 2010).

The MR is an indicator of the speed of fish metabolism. The more oxygen consumed, means that fish metabolism is also faster (Del Toro-Silva et al 2008; Mamun et al 2013; Yang et al 2013). The tendency of an increase in oxygen consumption in line with the increased aeration level and high oxygen content in the aeration group of 14 L min^{-1} is thought to be related to the movement or flow of water which is getting tighter as the aeration level increases at the beginning of measurement. The strength of this water movement causes fish to release energy for greater voluntary activity, so that the amount of oxygen consumed is also greater (Yang et al 2013).

Moreover the high oxygen content in the aeration water treatment of 14 L min^{-1} is also caused by the greater amount of feed consumed for each individual fish in the treatment. The level of oxygen consumption in fish increases with the availability of oxygen for standard metabolic needs, digesting a limited amount of feed until the need to digest a large amount of feed is met (Wang et al 2009).

The amount of MR value is influenced not only by the amount of feed consumed but also by the level of DO in water, temperature and fish size (Das et al 2005; Katersky et al 2006; Barnes et al 2011; Mamun et al 2013; Tirsgaard et al 2014). However in great sturgeon fish (*Huso huso*) there is no difference in oxygen consumption between fish kept in water with low oxygen levels (2-3 mg L^{-1}), normal (5-6 mg L^{-1}) and high (9-10 mg L^{-1}), both in small size fish (an average of 280.9 g $fish^{-1}$) and large fish (1217.9 g $fish^{-1}$) (Bagherzadeh Lakani et al 2013). In common dentex (*Dentex dentex*) the increase in the level of oxygen consumption occurs only to critical oxygen (DO 2.5 mg L^{-1}), after passing through the oxygen solubility, the increase in DO is not followed by an increase in oxygen consumption (Valverde et al 2006).

Lactic acid is one of the parameters that can be used as an illustration of the optimal environment and secondary indicators of stress on fish (Barton et al 2002). Lactic acid is the result of anaerobic glycolysis or the breakdown of glucose that takes place without or lacking oxygen (Tornheim & Ruderman 2011). Plasma lactic acid and fish muscle levels depend on the activity of the fish. Lactic acid levels will increase with increasing fish activity (Van Ginneken et al 2004; Smit et al 2009). In addition, limited oxygen in water both during maintenance and recovery after experiencing very high activity can also affect the concentration of lactic acid (Suski et al 2006; Shultz et al 2011; Gaulke et al 2014). Under stress conditions, the concentration of lactic acid in fish muscles will increase, so that it can be used as a secondary indicator that fish are experiencing stress (Barton et al 2002).

The high concentration of lactic acid in tinfoil barb maintained at water aeration of 10 and 14 L min^{-1} was not caused by lack of oxygen, because the oxygen content in the water in both treatments was higher when compared to 2 and 6 L min^{-1} (Table 2). The increase in lactic acid along with the increased level of aeration is caused by the increasingly active fish moving to compensate for the stirring of water caused by the blower when pumping air. This phenomenon also occurs in carp and trout which are given a swift flow of water with rotor speed (Van Ginneken et al 2004). With the movement of fast water even though there is a lot of oxygen available, it is still insufficient for the process of glycolysis because the ability of fish to utilize oxygen is also limited, so glucose which should be changed to pyruvate experiences oxygen deficiency and lactic acid is formed (Tornheim & Ruderman 2011).

The nitrogen retention (NR) and energy retention (ER) of tinfoil barb maintained for 60 days increased with increasing aeration levels from 2 to 10 $Lmin^{-1}$, but when the aeration is increased it tends to decrease in both NR and ER. This has something to do with the availability of oxygen that meets the needs along with the increased aeration provided. So that the metabolic process can take place more quickly and the nutritional content that can be utilized more and complete. Thus the nutrients and energy stored in the body are also higher. This can be seen from the increasing level of oxygen consumption (Table 2), along with the increase in nitrogen and energy retention.

In turbot fish (*Scophthalmus maximus*), increased levels of DO from saturated to super saturated (O_2 supersaturation) have no significant effect on protein retention but can increase lipid content in fish bodies (Person-Le-Ruyet et al 2002). Whereas in Nile tilapia (*Oreochromis niloticus*), nitrogen retention and energy retention increased significantly with the addition of DO from 1.33 to 3.66 mg L^{-1} in small fish and from 1.58 to 6.08 mg L^{-1} in large fish (Tran-Duy et al 2012). Likewise in grass carp (*Ctenopharyngodon idella*), there was an increase in nitrogen retention and lipid retention if the DO of the rearing media was increased from 3.5 mg L^{-1} (low oxygen) to 6.0 mg L^{-1} (high oxygen) (Gan et al 2013).

The weight gain of the tinfoil barb increased along with the increasing aeration level of the water supplied. This shows that increasing the level of water aeration can swell of DO in the maintenance media needed for fish metabolic processes. Furthermore the provision of aeration can maintain the dissolved CO_2 and ammonia within the tolerance range for the tinfoil barb fingerling to grow optimally. In the cultivation of silver barb fingerling in the tank, giving aeration results in higher water pH and an abundance of DO, thereby increasing the growth in length and weight of the fish (Das et al 2012). The presence of aeration in cultivation water of rohu (*Labeo rohita*) fingerlings at night significantly increases fish survival, fish size at harvest, specific growth rate and net biomass production (Pawar et al 2014).

In yellowtail kingfish (*Seriola lalandi*), DO has a significant effect on growth. Specific growth rates in normal (normoxic) DO are higher when compared to low DO (hypoxic) at temperatures of 21, 24 and 27°C (Bowyer et al 2014). This is due to the amount of feed consumed by fish in normal DO is higher than in low DO. In this regard, Del Toro-Silva et al (2008) stated that oxygen limitations in *Paralichthys lethostigma* fish have a very large impact on growth at temperatures around the optimum point (temperature of 29°C). At this temperature, the reduction of oxygen solubility from 6.00 to 4.00 mg L^{-1} causes a decrease in growth rate to 50%, but at 27°C the oxygen reduction does not significantly influence the growth rate. This phenomenon occurs because at near optimal temperature, the process of catabolism and anabolism in cells are slower as a result of decreased oxygen availability.

The positive effect of increasing water aeration on the physiological activity of tinfoil barb can be seen from the increased value of oxygen consumption and nitrogen and energy retention. Increasing oxygen levels from 3.5 mg L^{-1} (low DO) to 6 mg L^{-1} (high DO) can significantly increase the growth of grass carp. The rapid growth of the fish is in line with the increase in feed consumption, nutrient digestibility, protein retention and most amino acid retention in the fish's body (Gan et al 2013). The sturgeon fish with an average size of 280.9 g and 1217.9 g after being maintained for 8 weeks at low DO (2-3 mg L^{-1}), normal (5-6 mg L^{-1}) and high (9-9 10 mg L^{-1}), increased feed consumption by increasing oxygen solubility, so that growth also increases (Bagherzadeh Lakani et al 2013). Whereas in Nile tilapia, the growth rate increases with increasing oxygen solubility although there is a tendency to decrease the use of energy for basic metabolism together with a decrease in DO (Tran-Duy et al 2012).

The use of aeration has a direct effect on DO of cultivation water. Increased oxygen content in grass carp maintenance media can significantly reduce the FCR from 1.10-1.48 to 1.05-1.15 (Gan et al 2013). FCR in channel catfish (*Ictalurus punctatus*) maintenance is getting better with increasing DO and in order to achieve a reasonably good FCR the average DO value must be above 3.5 mg L^{-1} (Boyd & Hanson 2010). Likewise with rohu fingerling, giving aeration can reduce FCR from an average of 5.78 to 4.25 (Pawar et al 2014). The improved FCR value due to aeration can spur photosynthetic activity in the maintenance tank, creating optimum environmental conditions for fish. Although some types of aeration fish have a positive effect, in turbot fish there is no significant FCR difference due to DO increase from 100% saturation to 147% saturation, even with higher saturation, which is 224% saturated (super saturation) on cultivation media (Person-Le-Ruyet et al 2002).

Conclusions. Based on the results of the research that has been presented, it can be concluded that the use of water aeration in the rearing of tinfoil barb fingerling can increase dissolved oxygen, oxygen consumption levels, nitrogen and energy retention, weight gain and decrease the feed conversion ratio. The best aeration level for rearing of tinfoil barb fingerling in 40 L of water is 10 L min^{-1}. The prospect of this research for the future is the need for in-depth studies on the implementation of optimum aeration levels in commercial-scale aquaculture.

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