Global Journal of Fisheries Science
Volume 7(3), pages 99-104, August 2025
Article Number: A8527EF25
ISSN: 2782-750X
https://doi.org/10.31248/GJFS2025.089
https://integrityresjournals.org/journal/GJFS

Full Length Research

Effect of commercial probiotics on growth performance, carcass quality and haematological profile of *Clarias gariepinus* (Burchell, 1822) juveniles cultured in concrete tanks

Lawal, B. M.*, Oke, A. I., Awonuga, A. A., Oyeniyi, O. V., Soboyejo, I. O., Shofu, Y. A., Ugbodu, F. O. and Akintayo, I. A.

Nigerian Institute for Oceanography and Marine Research, Lagos, Nigeria.

*Corresponding author. Email: bolalawal166@gmail.com; Tel: 07037805906.

Received 13th July 2025; Accepted 25th August 2025

ABSTRACT: Two thousand (2000) *Clarias gariepinus* fingerlings (5.25 g) were obtained from a reputable fish farm in Lagos and were transported to the grow-out section of the Aquaculture Department, Nigerian Institute for Oceanography and Marine Research, Badore, Lagos. Four concrete tanks (2 m x 6 m x 1 m) were thoroughly washed with saline water; two of the concrete tanks were used to culture fish without probiotics, while the other two tanks were used to culture fish with the application of probiotics. Each of the tanks was stocked with four hundred (400) juveniles. The experimental fish were fed twice daily (morning and evening) for ten (10) weeks with an appropriate size of the feed, and the size of the feed was later adjusted based on the size of the fish. The data generated on the fish weight fortnightly were used to calculate the growth performance of the fish. At the end of the 10-week experiment, two fish were randomly selected from each treatment and blood samples were taken by caudal puncture into heparinised capillary tubes for selected haematological analyses using standard methods adopted in fish haematology. The proximate (carcass) composition of the experimental fish was also determined. The experimental big fish without probiotics (C2) had the highest mean weight gain, while the experimental small fish (C1) had the least mean weight gain. The growth performance of the experimental fish also revealed that all the fish had a better food conversion rate (FCR) and a high survival rate. The result of the ten-week experimental period of *Clarias gariepinus* showed that probiotics can be incorporated into the feed and or the culture system without any adverse effect on the haematological profile of the fish, but the use of probiotics did not enhance the growth of the *Clarias gariepinus* in this study.

Keywords: Carcass quality, *Clarias gariepinus*, haematological profile, growth performance, probiotics.

INTRODUCTION

Clarias gariepinus has been described by Onyia *et al*. (2018) as an economically important freshwater fish that contributes immensely to Nigeria's fish production scheme. The fish is widely cultured in Nigeria under intensive, semi-intensive and extensive management practices (Adegbesan, 2018). *C. gariepinus* has also been described as a major tropical aquaculture species in Africa (Nguyen *et al*., 2021). The African catfish is very important in the commercial fisheries in Nigeria and is the most cultured because of its desirable qualities, which include: ability to tolerate low dissolved oxygen, ability to reproduce by artificial induction and fast rate of growth (Adegbesan, 2018). The farming of *C gariepinus* in Nigeria expanded rapidly due to the fish's trophic plasticity, rapid rate of growth, hardiness and resistance to fungi, viruses and bacteria diseases (Taukhid *et al*., 2015). The African

Catfish also has a very good commercial value to fish mongers in Nigeria (Adegbesan, 2018). According to Nwanna *et al.* (2017), there is a need in aquaculture to develop microbial control strategies to improve the growth of fish, and one of the alternatives reported is the use of probiotics. The use of probiotics in aquaculture has therefore been reported to reduce the use of harmful antimicrobial compounds, particularly antibiotics and also maintain the health of aquatic organisms (Schar *et al*., 2020).

Probiotics, which are live microorganisms or their product with health benefits to the host, have been reported to be used in aquaculture as dietary supplements and also as a means of disease control. According to Essa *et al*. (2010), probiotics are viable cell preparations that have beneficial effects on the health of a host by improving its feed value, enzymatic contribution to digestion, inhibition of pathogenic microorganisms, growth-promoting factors and increase in immune response. The use of probiotics has been reported extensively in pigs, and probiotics were originally reported to be incorporated into animal feed so as to increase animal growth and also improve their health by increasing their disease resistance (Ayoola *et al.,* 2013). According to Mocanu *et al*. (2022), the use of probiotics was reported to increase digestion process and feed conversion, improve health, increase disease resistance, decrease sensitivity to stress and improve the maintenance status of fish. In order to make aquaculture products safe for human consumption and also reduce the cost of production, this research was designed to investigate the effect of probiotics on the growth and haematological profile of *Clarias gariepinus* in Concrete Tanks.

MATERIALS AND METHODS

Experimental fish

Two thousand (2000) *Clarias gariepinus* fingerlings (5.25 g) were obtained from a reputable fish farm in Lagos and were transported to the grow-out section of the Aquaculture Department, Nigerian Institute for Oceanography and Marine Research, Badore, Lagos. The fish were randomly distributed into two concrete tanks and were left to acclimatise for a period of two weeks prior to exposure to experimental feeding and probiotics. During the period of acclimatisation, the fish were fed on 2 mm Blue Crown feed three times per day. This ensured that the experimental fish had a uniform nutritional status before exposure to experimental treatment

Experimental design and feeding

Four concrete tanks (2m x 6mx 1m) were thoroughly washed with saline water; two of the concrete tanks were used to culture fish without probiotics, while the other two tanks were used to culture fish with the application of probiotics. The two concrete tanks that were used for probiotics were first layered with one (1) inch sharp sand and then filled with freshwater up to one meter (1 m). Three probiotics were used at different stages, and the first commercial probiotic used was Bioclean Aqua Plus*. Sixteen grams (16 g) of Bioclean Aqua Plus* was poured into a clean bowl and then mixed thoroughly in ten (10) litres of water before spreading sparingly into the experimental tanks, and it was then left for five (5) days. The Bioclean Aqua Plus* was added to disinfect and balance the tanks physically, chemically and biologically. The second stage of the probiotics used was Biofish Aqua*, one (1) sachet of Biofish Aqua was added into twenty (20) litres of water and then mixed thoroughly to avoid lumps and bubbles. The bucket was covered halfway and was kept in a cool and safe place to avoid contamination from dirt and rodents. The inoculated water was kept for five days in order to activate the beneficial bacteria. After the fifth day of inoculation, the inoculated probiotics were poured carefully into the tanks. This ensured that the probiotics touched the wall of the tank while others settled into the sand at the bottom and then attached themselves so as to multiply.

After the introduction of the inoculated probiotics. The acclimated fish were then introduced into the tanks. The fish were sorted into two different sizes before stocking: small and big. Each of the tanks was stocked with four hundred (400) juvenile fish. The third stage was the application of Biogut* commercial probiotics to their feed. Five (5) grams of Biogut* was added to 15 kg of commercial feed (Blue Crown) and was mixed thoroughly. The experimental fish were fed twice daily (morning and evening) for ten (10) weeks with an appropriate size of the feed, and the size of the feed was later adjusted based on the size of the fish.

Fish growth performance evaluation

On weighing days, the fish weights were measured using a top-loading Mettler balance (Model ME1002E). Data collection started from the first day of stocking of the fish juveniles and ended after the 10-week culture period. The quantity of feed consumed and the growth performance data were generated from the collected fish weight data as appropriate:

$$\text{TFI (g)} = \frac{\text{Total Weight of feed fed (g)}}{\text{No of fish per tank}}$$

$$\text{MWG (g)} = \text{Wf} - \text{Wi}$$

Wf = Final Mean Weight (g) and Wi = Initial Mean Weight (g)

$$\text{DFI (g)} = \frac{\text{TFI}}{\text{D}}$$

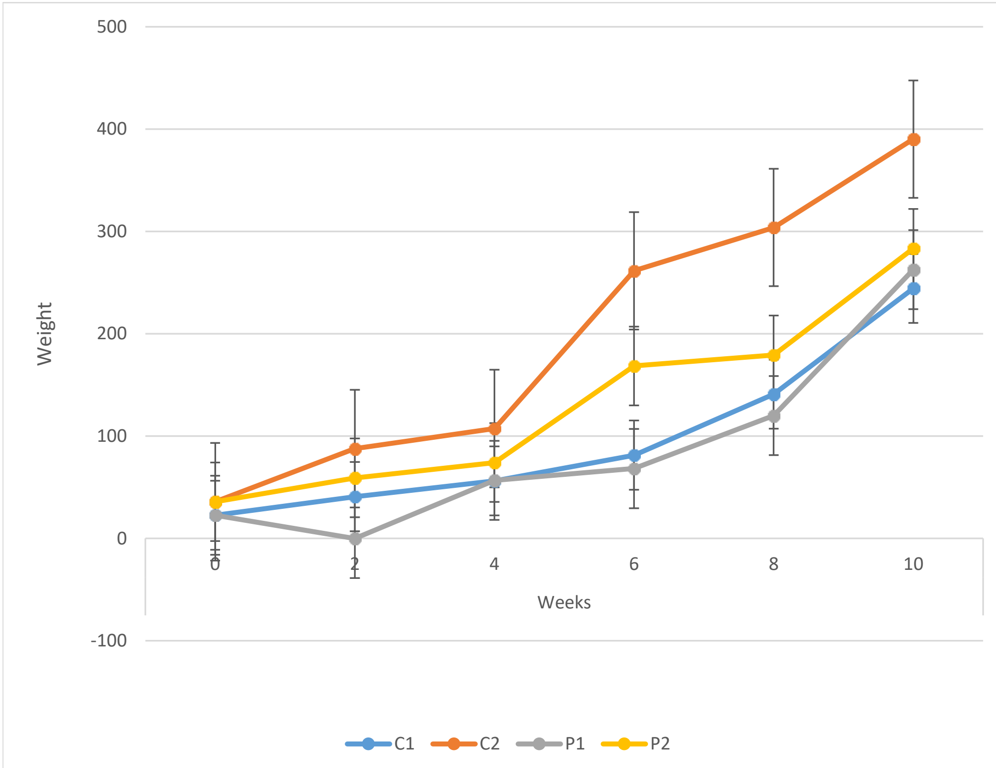

Figure 1. Fortnight weight gained by *Clarias gariepinus* juveniles fed the experimental diets during the period of study.

Where D = Rearing periods (days) and TFI = Total Feed Intake

$$SGR = \frac{LogWf - LogWi}{T} x100$$

$$FCR = \frac{\text{Total Feed Intake (g)}}{\text{Total Wet Weight Gain (g)}}$$

$$\text{Survival (\%)} = \frac{Nf}{Ni} x100$$

Haematological studies

At the end of the 10-week experiment, two fish were randomly selected from each treatment and blood samples were taken by caudal puncture following the procedure described by Adegbesan (2018) into heparinised capillary tubes for selected haematological analyses using standard methods adopted in fish haematology. The selected haematological parameters determined were: packed cell volume (PCV), haemoglobin count (Hb) and red blood cell count (RBC), mean cell haemoglobin (MCH), mean cell volume (MCV), mean cell haemoglobin concentrations (MCHC), white blood cell (WBC) and differential counts (neutrophils and lymphocytes).

Proximate analysis

The proximate (carcass) composition of the experimental fish was determined at the Department of Biochemistry, Lagos State Teaching Hospital. The determinations were carried out using standard methods described by the Association of Official Analytical Chemists (AOAC, 2011) as adopted by Babale (2016).

Statistical analysis

All the data obtained on body composition and haematological profiles were subjected to one-way ANOVA, and the differences in their means were compared using Duncan Multiple Range Test (DMRT).

RESULTS

The weight gained fortnightly by the experimental fish is shown in Figure 1. Table 1 showed that there was a variation in the initial mean weight of *Clarias gariepinus* juveniles subjected to the experiment. Growth performances in the experimental fish showed that they all supported growth to various degrees. The experimental big-sized fish without probiotics (C2) had the highest mean

Table 1. Growth performance of the experimental fish.

Parameter	Treatments			
	C1	C2	P1	P2
Initial Weight (g)	22.7	35.80	22.70	35.80
Final Weight (g)	244.30	390.2	262.6	283.36
Mean Weight Gain (g)	221.60	354.4	239.9	247.56
Total Feed Intake (TFI) (g)	153.85	208.33	141.89	181.94
FCR	0.69	0.59	0.59	0.74
SGR	3.41	3.69	3.45	3.50
Survival rate (%)	90.0	90.0	95.0	95.0

Keys: P1 = Small fish with probiotic, P2 = Big fish with probiotic, C1 = Small fish without probiotic, C2 = Big fish without probiotic.

Table 2. Proximate composition (carcass of the experimental fish)

Treatment	Nutrient (%)					
	Crude protein	NFE	Lipid	Ash	Crude fibre	Moisture content
P1	57.10 ± 0.49^{a}	12.00 ± 0.00^{a}	9.82 ± 0.23^{a}	7.42 ± 0.20^{a}	8.29 ± 0.17^{a}	30.08 ± 1.02^{a}
P2	64.23 ± 0.11^{b}	12.46 ± 0.00^{a}	10.00 ± 0.13^{b}	7.21 ± 0.00^{a}	8.23 ± 0.15^{a}	30.11 ± 0.94^{a}
C1	60.11 ± 0.09^{b}	12.83 ± 0.03^{b}	9.22 ± 0.04^{a}	7.99 ± 0.01^{b}	8.15 ± 0.10^{a}	30.00 ± 1.00^{a}
C2	69.22 ± 0.21^{b}	13.50 ± 0.01^{a}	10.06 ± 0.02^{b}	8.11 ± 0.03^{b}	8.07 ± 0.05^{a}	30.10 ± 0.56^{a}

*Values are means of two determinations. **Keys:** P1= Small fish with probiotic, P2= Big fish with probiotic, C1= Small fish without probiotic, C2= Big fish without probiotic.

Table 3. Haematological parameters (Means±S.D) of the experimental fish.

Parameter	Treatment			
	C1	C2	P1	P2
PCV (%)	29.60 ± 9.97^{a}	32.05 ± 6.24^{a}	32.90 ± 0.67^{a}	32.60 ± 2.96^{a}
RBC ($x10^{6}$/l)	2.94 ± 0.14^{a}	2.72 ± 0.08^{a}	3.23 ± 0.74^{b}	3.70 ± 0.79^{b}
WBC ($x10^{3}$)	55.05 ± 2.28^{a}	58.95 ± 10.40^{a}	56.83 ± 3.11^{a}	55.50 ± 14.14^{a}
HB (g/dl)	13.40 ± 4.12^{a}	12.90 ± 0.96^{a}	13.60 ± 0.84^{a}	12.50 ± 1.21^{a}
MCV (fl)	129.60 ± 19.4^{a}	126.20 ± 15.42^{a}	123.42 ± 19.80^{a}	124.44 ± 12.34^{a}
MCH (pg)	40.10 ± 4.31^{a}	43.00 ± 0.21^{a}	41.30 ± 8.41^{a}	41.80 ± 2.50^{a}
MCHC (g/dl)	29.50 ± 3.90^{a}	28.20 ± 3.25^{a}	29.50 ± 5.43^{a}	32.70 ± 1.41^{a}

Values are means of two determinations. **Keys:** P1= Small fish with probiotic, P2= Big fish with probiotic, C1= Small fish without probiotic, C2 = Big fish without probiotic.

weight gain, while the experimental small-sized fish (C1) had the least mean weight gain. The growth performance of the experimental fish in Table 1 also revealed that all the fish had a better food conversion rate (FCR) and a high survival rate.

The proximate composition of the experimental fish is shown in Table 2. The highest crude protein value was recorded in the big fish (C2) without the probiotic, while the small fish (P1) with the probiotic had the lowest crude protein value, and there was a significant difference between them. The big fish with the probiotic (P2) had the lowest lipid content and was significantly different from other treatments. The highest crude fibre was recorded in small fish with probiotics (P1), while the least value was recorded in big fish without probiotics (C2). Although there were no significant differences among ($p > 0.05$) all the treatment.

The haematological profile of the experimental fish is shown in Table 3. The highest packed cell volume (PCV) level was recorded in the small size of fish with probiotics (P1), and the lowest level was recorded in the small size of fish (C1) without probiotics. Although there were no significant differences ($p > 0.05$) among all the treatments. The red blood cells (RBC) recorded in the two groups of fish without the probiotics were significantly lower ($p < 0.05$) than the values recorded in the two groups of fish with probiotics. The values recorded for white blood cells (WBC), haemoglobin (HB), mean corpuscular volume

(MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration were not significantly different ($p > 0.05$) from each other.

DISCUSSION

At the end of the experimental period, the group of big fish (Control 2) without probiotics grew better than the group of fish with probiotics. The highest mean weight gain, specific growth rate (SGR) and feed conversion ratio (FCR) recorded in the group of fish fed without inclusion of probiotics could be attributed to the high intake of feed by the fish. This suggests that the probiotics added to the feed and water did not enhance growth in this study. This agrees with the findings of Efthimiou (1996), who reported that there was no effect of probiotics on growth performance observed in Atlantic salmon fry. In contrast, Mohamed *et al*. (2007) and Lara-Flores *et al.* (2003) reported that Nile tilapia (*O. niloticus*) fed diets supplemented with probiotics exhibit greater growth. The low growth performance in the group of fish with probiotics could be attributed to the fact that the culture system was not exposed to direct sunlight, and the fish did not feed well at the beginning of the experiment because of polluted water. Mohammed *et al.* (2025) reported that probiotics improved the growth performance, feed utilisation, disease resistance and water quality management in aquaculture systems. The chemical analysis of the whole fish body showed that the highest protein and lipid content were recorded in a group of big fish fed with and without probiotics, while the least values were recorded for the group of small fish with and without probiotics. The high protein and lipid content in the whole body of the experimental fish with and without the probiotics could probably be as a result of the nutrient intake by the fish. Nakhei Rad *et al.* (2023) also reported that probiotics could improve the resistance and the survival of fish against all types of stresses, improving the health and the growth of fish.

Haematological characteristics have been reported to be widely used in clinical diagnosis of disease and pathologies of domestic animals (Ayoola *et al.,* 2013). Haematological parameters are routinely used for the evaluation of physiological environments and husbandry stressors in fishes (Akintade *et al*., 2018). The packed cell volume (PCV) in the experimental fish with and without probiotics in this study ranged from 29.60- 32.90 %. The values of PCV recorded during the study were within the range reported by Ayoola *et al*. (2013) when fed *Clarias gariepinus* juveniles with probiotics. The increased red blood cell (RBC) and Haemoglobin (HB) recorded in the group of fish with probiotics could probably be attributed to the abundance of oxygen molecules required for the production of more red blood cells (Marzouk *et al.,* 2008). The white blood cell count (WBC) of fish or any animal is a function of immunity and the animal's resistance to vulnerable illness or disease. The white blood cell count (WBC) recorded in the experimental fish with and without the probiotics was not different from each other; this could probably mean the fish were not subjected to any disease or infection. The variation in some haematological parameters in this study could be attributed to the size and inclusion of probiotics into the feed and the culture system. Nakhei Rad *et al.* (2023) reported an increase in hematocrit, haemoglobin, red blood cells, mean corpuscular haemoglobin and mean corpuscular haemoglobin concentration in rainbow trout when the diet was supplemented with probiotics. According to Osuigwe *et al*. (2005), the haematological parameters of fish are affected by a range of factors, which include size, age, physiological status, environmental conditions and dietary regime (quality and quantity of feeds, protein, vitamins and probiotics).

Conclusion

The result of the ten-week experimental period of *Clarias gariepinus* showed that probiotics can be incorporated into the feed and or the culture system without any adverse effect on the haematological profile of the fish, but the use of probiotics did not enhance the growth of the *Clarias gariepinus* in this study. However, a further study on the effect of probiotics on the growth performance of *C. gariepinus* should be carried out under direct sunlight.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

REFERENCES

Adegbesan, S. I. (2018). Effects of dietary supplementation with phytobiotics on growth, metabolism and biochemistry in broodstock and fingerlings of African mud catfish (*Clariasgariepinus*). Ph.D. Thesis, Department of Aquaculture and Fisheries Management, Federal University of Agriculture, Abeokuta, Nigeria, 273p.

AOAC (2011). Association of International Official Analytic Chemists, AOAC, International 18th Edition, Arlington, Virginia.

Ayoola, S. O., Ajani, E. K., & Fashae, O. F. (2013). Effect of probiotics (*Lactobacillus* and *Bifidobacterium*) on growth performance and heamatological profile of Clarias gariepinus, *World Journal of Fish and Marine Sciences*, *5*(1), 1-8.

Babale, M. Y. (2016). Growth performance at various growth stages of *Clarias gariepinus* (Burchell, 1822) fed various inclusion levels of processed water melon (*Citrullus lanatus*) seed cake diets. Ph.D. Thesis, Department of Biological Sciences, Ahmadu Bello University, Zaria.144p

Efthimiou, S. (1996). Dietary intake of β-1, 3/1, 6 glucans in juvenile dentex (Dentex dentex), Sparidae: effects on growth performance, mortalities and non-specific defense mechanisms. *Journal of Applied Ichthyology*, *12*(1), 1-7.

Mocanu, E. E., Savin, V., Popa, M. D., & Dima, F. M. (2022). The effect of probiotics on growth performance, haematological and biochemical profiles in Siberian sturgeon (Acipenser baerii Brandt, 1869). *Fishes*, *7*(5), 239.

Mohammed, E. A. H., Ahmed, A. E. M., Kovács, B., & Pál, K. (2025). The significance of probiotics in aquaculture: A review of research trend and latest scientific findings. *Antibiotics*, *14*(3), 242.

Lara-Flores, M., Olvera-Novoa, M. A., Guzmán-Méndez, B. E., & López-Madrid, W. (2003). Use of the bacteria Streptococcus faecium and Lactobacillus acidophilus, and the yeast Saccharomyces cerevisiae as growth promoters in Nile tilapia (*Oreochromis niloticus*). *Aquaculture*, *216*(1-4), 193-201.

Marzouk, M. S., Moustafa, M. M., & Mohamed, N. (2008). The influence of some probiotics on the growth performance and intestinal microbial flora of O. niloticus. In *Proceeding of the 8th International Symposium on Tilapia in Aquaculture* (pp. 1059-1071).

Mohamed, K. A., Fattah, B. A., & Eid, A. M. S. (2007). Evaluation of using some feed additives on growth performance and feed utilization of monosex Nile tilapia (Oreochromis niloticus) fingerlings. *Agricultural Research Journal, Suez Canal University*, *7*(3), 49-54.

Nakhei Rad, M. H., Haghighi Khiabanian ASl, A., Azari Takami, G., Razavilar, V., & Tehrani Sharif, M. (2023). The effects of probiotics and prebiotics on growth, stress reponses, blood and immune parameters of rainbow trout. *Iranian Journal of Fisheries Sciences*, *22*(2), 278-302.

Essa, M. A., El-Serafy, S. S., El-Ezabi, M. M., Daboor, S. M., Esmael, N. A., & Lall, S. P. (2010). Effect of different dietary probiotics on growth, feed utilization and digestive enzymes activities of Nile tilapia, Oreochromis niloticus. *Journal of the Arabian Aquaculture Society*, *5*(2), 143-162.

Nguyen, D. H. M., Panthum, T., Ponjarat, J., Laopichienpong, N., Kraichak, E., Singchat, W., Ahmad, S.F., Muangmai, N., Peyachoknagul, S., Na-Nakorn, U., & Srikulnath, K. (2021). An Investigation of ZZ/ZW and XX/XY Sex Determination Systems in North African Catfish (*Clarias gariepinus*,). *Frontiers in Genetics*, *11*, 562856.

Nwanna, L. C., & Tope-Jegede, H. (2017). Effects of dietary *Lactobicillus plantarum* on the growth, carcass quality, and immune response of African catfish (*Clarias gariepinus*) challenged with Salmonella typhi. *Journal of Applied Aquaculture*, *29*(1), 62-80.

Onyia, U. L., Philip, B., & Jegede, O. I. (2018). Evaluation of reproductive indices and growth of normal, albino Clarias gariepinus and their reciprocals in hatchery conditions. *Journal of Natural Sciences Research*, *8*(16), 7-14.

Osuigwe, D. I., Obiekezie, A. I., & Onuoha, G. C. (2005). Some haematological changes in hybrid catfish (*Heterobranchus longifilis* x *Clarias gariepinus*) fed different dietary levels of raw and boiled jackbean (*Canavalia ensiformis*) seed meal. *African journal of Biotechnology*, *4*(9), 1017-1021.

Schar, D., Klein, E. Y., Laxminarayan, R., Gilbert, M., & Van Boeckel, T. P. (2020). Global trends in antimicrobial use in aquaculture. *Scientific reports*, *10*(1), 21878.

Taukhid, P. U., Sugiani, D., Sumiati, T., & Lusiastuti, A. M. (2015). Efficacious of in-active bacterial vaccines: Aeromonas hydrophila-AHL0905-2 (Hydrovac) and Streptococcus agalactiae-N14G (Streptovac) for prevention of bacterial diseases on freshwater aquaculture. *Journal of Research Akuakultur*, *10*, 541-551.