PAT Dec, 2017; 13 (2): 162-168 ISSN: 0794-5213

Online copy available at *www.patnsukjournal.net/currentissue*

Publication of Nasarawa State University, Keffi

Effects of Garlic Hydro-Soluble Extracts on Weight Gain, Condition Factor and Survival Rate of *Clarias gariepinus* Fry

Okunsebor, S. A.

Faculty of Agriculture, Shabu-Lafia Campus, Nasarawa State University Keffi,
P.M.B. 135, Lafia, Nasarawa State, Nigeria
E-mail: okunseborsa@yahoo.com

Abstract

Low hatchlings survival rates has continued to slow down the success of aquaculture programs due to parasites and microbial infections. Garlic proves to be rich in antimicrobial properties and it was therefore investigated in the present study for towards ensuring successful hatchery operations. Rectangular glass aquaria of 40cm by 20cm by 20cm (water volume: 20 litres) were used in five treatments (GHSE01, GHSE02, GHSE03, GHSE04, and control - GHSE00) in three replicates stocked each with 200 fry of the fish (same age, parent and size) fed morning, afternoon and evening at 3% body weight/day. Garlic bulbs (70g) were peeled, washed, blended in electronic grinder and soaked in four litres of distilled water for 48 hours before the soluble fractions were strained through muslin cloth to obtain stock solution. The Treatments had the concentration of 0.25, 0.50, 0.75, 1.00 and 0.00ml of Garlic hydro-soluble extract stock solution per litre of water respectively. Feeding was adjusted weekly, water was changed twice a week and treatments' concentrations were renewed as data were collected. Water quality parameters (temperature (^oC), dissolved oxygen (mg/L), total alkalinity (mg/L) and free carbon dioxide (mg/L) of the source of water used were within acceptable level for fish production and were not significantly different ($p>0.05$) from each other. Treatments of Garlic hydro-soluble extracts enhanced growth, survival rate and condition factor significantly ($p<0.05$) more than the control. Treatment GHSE03 (0.75ml/L) improved significantly ($p<0.05$) survival rate (81.5%), condition factor (3.82), and percentage weight gain (4.19×10^3 %) of C. gariepinus fry more than other treatments and it is highly recommendable.

Key word: *Garlic, Hydro-soluble, Extract, fry, survival, condition factor.*

Introduction

African mud Catfish (*Clarias gariepinus*) is one of the most suitable fish species that has been considered to hold a great promise for fish farming in Nigeria because of its high growth rate, resistant to handling stress and high market value. One constraint to its culture is the limited availability of its quality fingerlings which serves as seed for fish farmers (Sahoo *et al*., 2007). *C. gariepinus* commands good commercial values in aquaculture but unfortunately, this fish will not readily spawn in captivity and hence the need for good success in its artificial fish seed production. It was reported that in fish culture, garlic promotes growth, enhances immunity, stimulates appetite, and strengthens the control of bacterial and fungal pathogens (Augusti, 1974). Garlic (*Allium sativum*) contains unique organosulphur compounds which provide its characteristic flavour, odour and most of its potent activities are useful biologically (Khattab *et al.,* 2004). Besides organosulphur compounds, garlic also contain carbohydrates (fructant), enzymes (allinase, catalase), proteins and free amino acid (aginine, lipids, polyphenols and phytosterols) (Khattab *et al.,* 2004). Reports have shown that garlic can effectively eliminate principal pathogenic bacteria such *as Pseudomonas fluorescenes,* and *Fibrobacter intestinalis* in fresh water fish (Augusti, 1974). These effects of garlic are due to the presence of various organosulphur compounds, including allicin (Augusti, 1974). Many scientific studies have shown that allicin can actively kill a wide range of pathogens like fungi, bacteria, and even viruses (Nya and Austin, 2009).

Fish farmers are currently experiencing high mortality rate of fry in hatchery and as such facing

problem of undersupply and high cost of quality fish seeds for stocking farms. Standard treatment of fish fry culture to free them from diseases parasites, bacteria and worms so that the survival rate and growth can be enhanced in hatcheries by fish farmers has become indispensable factor in production. Therefore scientific documents that will help to improve quality *C. gariepinus* fry and survival in hatchery is highly needed in fish production cycle. Effects of garlic hydro-soluble extracts on fry growth, survival rates and condition may initiate information useful for sustainable *C. gariepinus* production by fish farmers.

Material and Methods

Experimental Procedures

The experiment was carried out in the Department of Aquaculture and Fisheries Management of Faculty of Agriculture Shabu-Lafia Campus, Nasarawa State University Keffi. Garlic bulbs were collected from Lafia Market in Nigeria, separated, peeled and washed with distilled water. About 70g of clean garlic bulbs were weight with a sensitive scale and crushed and blended with the help of electronic grinder. The blended garlic was soaked in 4 litres of distilled water for 48 hours. After the 48 hours, water soluble extracts was strained through muslin cloth to remove the water soluble fractions of the garlic to get a stock solution for this investigation. The experiments were carried out in rectangular aquaria glasses of 40cm by 20cm by 20cm with water volume maintained at 20 litres. Each aquarium was stocked with 200 fry of *C. gariepinus* of the same age and same parent with the same size. A total of five treatments (GHSE01, GHSE02, GHSE03, GHSE04, and control - GHSE00) in three replicates were used for this investigation. Treatments GHSE01, GHSE02, GHSE03, GHSE04, and control - GHSE00, had the concentration of 0.25, 0.50, 0.75, 1.00 and 0.00ml of Garlic Hydro-soluble Extract stock solution per litre of water respectively. The fry fish were fed morning, afternoon and evening at 3% body weight/day. The ration of fry was adjusted every week according to new mean weight of the fish fry obtained in the various experimental treatments. Faecal materials in each aquarium were siphoned out and the water in each aquarium was also change through the siphoning method twice a week. At the change of the water, the various treatments' concentrations were also renewed.

Data collection analysis

Data on fish growth characteristics were recorded every week, the weight of individual fish was determine with a sensitive scale of model 572, the standard length was determine with a measuring board. The experimental weight gain, condition factor and survival rate were determine as follows:

i) Percentage weight gain of *C. gariepinus* fry

Percentage weight gain (PWG) = $(W_2-W_1/ W_1) \times 100$

W_2= Final mean body weight (g)

W_1= Initial mean body weight (g)

ii) Condition factor

The condition factor of the *C. gariepinus* fingerlings fish after the experiment

$CF = \text{weight (g)} / [\text{length (cm)}]^3$

iii) Survival rate = (Final No. of survived fry/Initial No. of fry) x 100

Procedure for the water quality analysis

The temperature of the water was determined by dipping the automatic temperature compensation digital thermometer into the water and suspended it at about 2cm to 4cm in the water column for about 1-3 minutes and the temperature readings were taken (Agarwal, 1999).

Water pH was determined at the course of this experiment through the use of a digital pH meter.

The pH meter was dipped into the water column in the aquarium for 4 minutes to stabilize before the readings were taken (Agarwal, 1999). Dissolved Oxygen (mg/l), Total Alkalinity (mg/l) and Water carbon dioxide (mg/l), during the experiment were monitored by water testing kits.

Statistical analysis of data

Data collected in this experiment were analysed by one way randomized block of variance (ANOVA) and significant mean were separated at 0.05 probability level as described by (Steel *et al*., 1997). All statistics were carried out using Genstat Statistical Analysis program.

Results and Discussion

Water Quality Parameters from Source of Water for the Treatment

The pH values, temperature (^{0}C), total alkalinity (mg/L), dissolved oxygen (mg/L) and Free carbon dioxide (mg/L) of each of the treatments (GHSE00, GHSE01, GHSE02, GHSE03 and GHSE04) of this research work are presented in Table 1. The result shows that all the water quality parameters from source of water supplied for the treatments were not significantly different ($P>0.05$) from each other and they were within the acceptable range according to WHO, (2010). Therefore the variations in the results of this investigation were not from the water parameters.

Effect of Hydro-Soluble Garlic Extracts on Condition Factor of *C. gariepinus* fry

The effect of hydro-soluble garlic extracts on condition factor of *C. gariepinus* fry presented in Figure 1. The results show that all the treatments were significantly different ($p < 0.05$) from each other. Treatment GHSE03 had the highest condition factor (3.82±0.02), followed by treatment GHSE04 (3.68±0.01), Treatment GHSE02 (3.64±0.01) and treatment GHSE01 (3.04±0.01) while treatment GHSE00 (the control) had the lowest score (2.70±0.02). As condition factor shows the well-being of the fish in a given environment so an improved condition factor of the fry treated with garlic hydro-soluble extracts is indicator of good culture environment where the fry were protected against parasites and nutritional problems. Golam and Fahad (2013) reported that condition factor studies consider the health and the general wellbeing of a fish as related to its environment while Araneda *et al.* (2008) considered condition factor as important parameter for management of cultured system as it provides basic information for organism assessment in order to evaluate growing condition. The high values of condition factor (k) in this study indicated the rapid growing rates of the fish fry and the highest k-value was found in treatment GHSE03. Benson and Ayaobu-cookey (2014) revealed in their study that fish is said to be in good condition when the (k-value is higher than one and that k-value is highest in small fish due to active growth process of young fish. The findings of Ndong and Fall (2007); Nya and Austin (2009); Aly (2010), suggested that garlic improved the immune response of fish and increased protection against an immediate health challenge by its anti-infection properties.

Effects of Garlic Hydro-Soluble Extracts on Survival Rate of *C. gariepinus* Fry

The result of the effects of garlic hydro-soluble extracts on survival rate of *C. gariepinus* fry of this study is presented in Figure 2. The results show that all the treatments were significantly different ($p<0.05$) from each other. GHSE03 significantly had the highest survival rate scores (81.5%), followed by treatment GHSE02 (73%), treatment GHSE01 (71.5%) and treatment GHSE04 (67.5%) while treatment GHSE00 which was the control recorded the least score (63.5%).Generally, causes of mortality among fry are attributed to poor water quality, food, culture environment and disease parasites. The food, water quality and culture environment were constant but the only

source of variation in the experiment was the concentration of garlic hydro-soluble extract added to the culture medium. These variation led to improvement of the survival rate of the fry in all the treatments more than the control. The treatment GHSE03 among all the treatments is most likely be the best acceptable concentration for *C. gariepinus* fry production. Alder and Holup (2009) reported that garlic promotes growth and enhances immunity, stimulates appetite, and strengthens the control of bacterial and fungal pathogens in aquaculture. Many scientific studies have shown that allicin from fresh garlic can actively kill a wide range of pathogens like fungi, bacteria, and even viruses (Nya and Austin, 2009). This effects of garlic on pathogenic diseases must have contributed to the good survival rate of the fry.

Table 1: Water Quality Parameters from Source of Water Supplied for this Study

Treatments	**GHSE00**	**GHSE01**	**GHSE02**	**GHSE03**	**GHSE04**
GHSE (ml/ L)	**0.00**	**0.25**	**0.50**	**0.75**	**1.00**
Water Parameter					
Temperature (°C)	27.41±0.04	27.43±0.06	27.42±0.02	27.43±0.05	27.41±0.06
pH	7.25±0.02	7.26±0.03	7.27±0.03	7.26±0.03	7.26±0.03
Total alkalinity (mg^{-1})	15.21±0.03	15.21±0.01	15.21±0.02	15.21±0.03	15.21±0.01
Dissolved oxygen (mg^{-1})	8.22±0.03	8.21±0.03	8.22±0.03	8.21±0.01	8.21±0.03
Carbon dioxide (mg^{-1})	4.21±0.01	4.20±0.03	4.21±0.02	4.20±0.03	4.21±0.03

GHSE= Garlic Hydro-soluble Extract

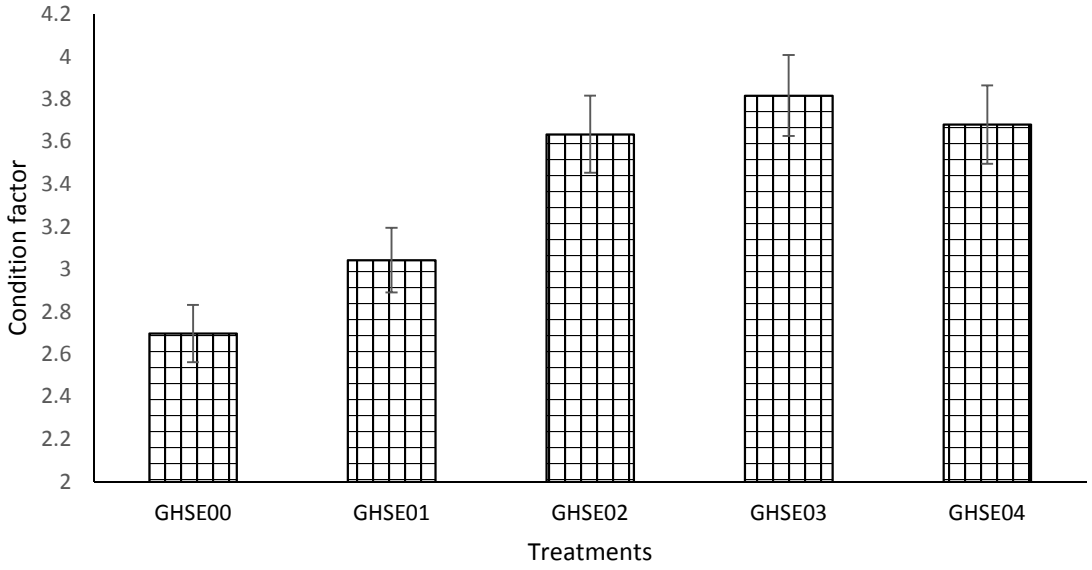

Fig. 1: Effects of Garlic Hydro-soluble Extract on Condition Factor of C. *gariepinus* fry

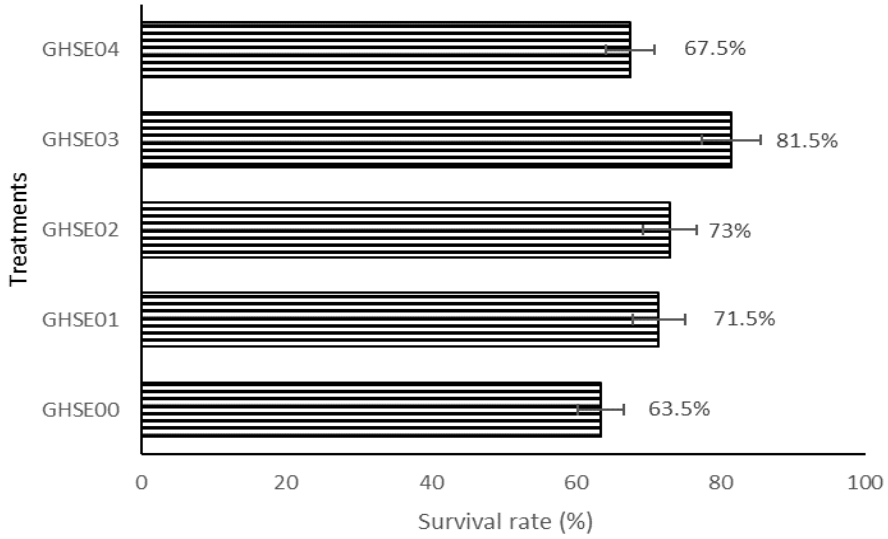

Fig. 2: Effects of Garlic Hydro-soluble Extract on Percentage Survival Rate of *C. gariepinus* fry

Table 2: Effects of Garlic Hydro-soluble Extract on Weight Gain of *Clarias gariepinus* fry

Treatments	**GHSE00**	**GHSE01**	**GHSE02**	**GHSE03**	**GHSE04**
GHSE (ml/L.)	**0.00**	**0.25**	**0.50**	**0.75**	**1.00**
Parameters					
Final weight (g)	6.60±0.002	6.70±0.001	8.00±0.002	8.40±0.002	8.10±0.001
Initial weight (g)	0.02	0.02	0.02	0.02	0.02
Weight gain (g)	6.58±0.001	6.68±0.003	7.98±0.001	8.38±0.002	8.08±0.002
Percentage weight gain	$3.29x10^3$	$3.34x10^3$	$3.99x10^3$	$4.19x10^3$	$4.04x10^3$

GHSE= Garlic Hydro soluble Extract

Effects of Garlic Hydro-soluble Extracts on Percentage Weight Gain of *C. gariepinus* Fry

Results of garlic hydro-soluble extract on percentage weight gain of *C. gariepinus* fry as obtained in the experiment is presented in Table 2. The result shows that there was significant difference ($p>0.05$) between all the treatments with treatment GHSE03 recording the highest percentage weight gain ($4.19x10^3$ %), followed by treatment GHSE02 ($3.99x10^3$ %), treatment GHSE01 ($3.34x10^3$ %), treatment GHSE04 with ($4.04x10^3$ %) and treatment GHSE00 ($3.29x10^3$ %) which was the control. GHSE03 which shown the highest percentage weight gain must have been the optimal concentration of garlic hydro-soluble extract for the fry. The control group shows the lowest percentage score while treatment with garlic hydro-soluble extracts steadily improved in percentage weight gain. The result of this investigation indicated that the garlic hydro-soluble extracts on percentage weight gain of *C. gariepinus* fry was achieved in all the inclusion of garlic concentration. In aquaculture, garlic promotes growth and enhances immunity and stimulates appetite (Alder and Holup, 2009). Garlic (*Allium sativum*) has been used to improve the growth and disease resistance of a number of livestock and fish significance gain in weight, protein efficiency ratio (PER) and specific growth rate (Megbowon *et al.*, 2013). Diab *et al.* (2002), reported that feed containing 2.5% garlic resulted in the highest growth performance in Nile tilapia (*Oreochromis niloticus*).

Conclusion and Recommendations

Garlic Hydro-soluble Extracts of treatment GHSEO3 (0.75ml/L of water from stock solution 17.5g/L of water of fresh garlic) improved survival rate of *C. gariepinus* fry up to 81.5% , condition factor (3.82), and percentage weight gain ($4.19x10^3$ %) of *C. gariepinus* fry within 6 weeks. The use of Garlic Hydro-soluble Extracts (0.75ml/L of water from stock solution 17.5g/L of water of fresh garlic) in the hatchery for the production of fry is highly recommendable. Further study on Garlic Hydro-soluble Extracts of fresh garlic on different fry disease parasites and its effect on haematology is needful.

Acknowledgment

The author appreciates the Department of Aquaculture and Fisheries Management, Faculty of Agriculture, Nasarawa State University Keffi, for providing hatchery complex for this investigation.

References

Agarwal, V.P. (1999). Recent trends in aquaculture. Agarwal Printers, 1174, P. Sharma Road, Meerut. 550- 556.

Adler, A. J. and Holup, B. J. (1997). Effect of garlic and fish-oil supplementation on serum lipid and lipoprotein concentrations in hypercholesterolemia. *The American Journal of Clinical Nutrition*: 65: 445-450.

Aly, S. M. and Mohammed. M. F. (2010). *Echinacea purpurea* and *Allium sativum* as immunostimulants in fish culture using Nile tilapia (*Oreochromis niloticus*). *Journal of Animal Physiology and Animal Nutrition* 94: 31-39.

Araneda, M., Perez, E.P. and Gasca-Leyva, E. (2008). White Shrimp *Penaeus vannmei* Cultured in freshwater at three densities: condition state based on length and weight. *Aquaculture* 283:13-18.

Augusti, K. T. and Matthew. P. T. (1974). Lipid lowering effect of allicin (daily disulphide-oxide) on long term feeding to normal rats *Experientia 30*:468-470

Benson, L.B. and Ayaobu-cockey, I.K. (2014). Length-weight relationship, condition factor and sex ratio of *Liza falcipiniis* collected from Lagos Lagoon. *Proceedings of the 29th Annual Conference of Fisheries Society of Nigeria (FISON).* 175-181.

Diab, A.S. (2002). Antibacterial and antifungal effects of *Allium sativa* (garlic), *Hibiscus sabdariffa* (karkade) and *Nigella sativa* (black seeds) extract on some bacterial and fungal isolates from Abbassa hatchery in *Veterinary Medicine Zagazig Conference, 6*, Zagazig University, Hurghada, Egypt. 467-467.

Golam, M. and Fahad, A.A. (2013). Length weight, Condition factor and sex ratio of Nile Tilapia, *Oreochromis niloticus* in Wadi Hanifah, Riyadh, Saudi Arabia. World of *Journal of Zoology* 8(1): 106-109.

Khattab, Y.A., Shalaby, A. M.E., Sharaf, S.M., El-Markby, H.J. and Rizallaeh, E.H. (2004). The physiological Changes and growth performance of Nile tilapia *Oreochromis niloticus* after feeding with Biogen as growth promoter. *Egyptian Journal of Aquatic Biology and Fisheries* 8: 145-158.

Metwally, M. A. A. (2009). Effects of garlic on some antioxidant activities in *Tilapia nilotica. World Journal of fish and marine sciences,* 1: 56-64.

Megbowon, L., Adejonwo, O.A., Adeyemi, Y.B., Kolade, O.Y., Adetoye, A.A.A., Edah, C.A.B., Okunade, O.A. and Adedeji, A.K. (2013). Effect of Garlic on Growth Performance, Nutrient Utilization and Survival of an Ecotype Cichild, "Wesaf" *IOSR Journal of*

Agriculture and Veterinary Science (IOSR-JAVS) e-ISSN: 2319-2372. 3: 10-13.

Ndong, D. and Fall, J. (2007). The effect of garlic (*Allium sativum*) on growth and immune responses of hybrid tilapia (*Oreochromis niloticusx Oreochromis aureus*) *Asfa Fisheries Biology,* 5: 3-11.

Nya, E. J. and Augusti B. (2009). Use of garlic, *Allium sativum*, to control Aeromonas hydrophila infections in rainbow trout, *Oncorhynchus mykiss*(Walbaum). *Journal of Fish Diseases 1986,* 32: 963-970.

Sahoo, S.K., Giri, S .S., Chandra, S. and Sahu, A .K. (2007). Spawning performance and egg quality of Asian catfish *Clarias batrachus* at various doses of HCG injection and latency periods during spawning induction. *Aquaculture,* 266: 289-292.

Steel, R. G. D., Torrie, J.H. and Dickie, D. A. (1997). Principles and Procedures of Statistics- A biometric approach.3rd ed. McGraw- Hill Book Publishing Company, Toronto, Canada.

WHO (2010). International Standard for Drinking Water Guidelines for Water Quality, Geneva.