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Research article

THE EFFECTS OF PALM OIL ON THE PHYSICAL APPEARANCE OF *Clarias gariepinus* DURING TRANSPORTATION

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ABSTRACT: The study on the rate of water quality deterioration, bacterial load, survival percentage and physical appearance of transported adult *Clarias gariepinus* was carried out using palm oil as water additive and anti-stress at different concentrations, 904mgL^{-1} ,1808 mgL^{-1} and 2712 mgL^{-1} and compared to salt at 0.4% over a six hour transportation period. The adult fish were transported in a container at 2kg /litre of water in an open van while the water samples were at zero, second, fourth and sixth hours of transportation. Water quality, physical appearance and the survival rate of the fish within the various treatments were assessed at the end of the transportation exercise.
The pH of transport water containing oil at 904mgL^{-1}, 1808mgL^{-1} and 2712mgL^{-1} was maintained during the course of transportation in contrast to the treatment containing 0.4% salt and the control whose pH changed at the second hour of transportation but the dissolved oxygen (DO), temperature, ammonium (NH_4), Nitrate (NO_3), Nitrite (NO_2) and chlorine (CI) of all the treatments followed the same trend while the bicarbonate (HCO_3) concentration of transport water containing 2712mgL^{-1} palm oil were maintained till the second hour before it changed at the fourth and sixth hours of transportation. The plate count agar (PCA) of all the treatments containing oil recorded more organisms than the treatment containing 0.4% salt and the control; but, the fish in all the treatments containing palm oil have an appearance not different from when freshly harvested in contrast to the control that had bruises and scars on the skin and the survival percentage of fish in all the treatments was between 95% - 100%. It has been revealed that addition of palm oil at the varying concentrations kept the freshness of the fish during transportation thereby improving the market value of transported live catfish.
Key words: Dissolved Oxygen, pH, fish survival, physical appearance, market value transportation

INTRODUCTION

Harvesting, holding and transporting of market sized fish is a particularly important aspect of fish farming because the producer is dealing with his ultimate saleable product. However this phase of fish farming is frequently overlooked during the production management process (Dupree and Hurner, 1984), but the transportation of live fish is particularly important in aquaculture (Gupta and Gupta, 2006) The goal of fish transportation is to provide at the destination only healthy fish that will live and satisfy the criteria of the transporter but transportation of live fish involves the moving of large numbers or weights of fish in a small place (Dupree and Hurner, 1984) and the volume of water within the transport container is small relative to the mass of the fish thus the fish are subjected to stress (Crosby *et al.*, 2006)

Fish are easily stressed by handling, transport and stress resulting to immuno-suppression, physical injury or even death (Crosby *et al.*, 2006). The major concerns in transporting aquatic animals are the management of handling stress, mechanical shock, heat stress and water quality (Coyle *et al.*, 2004). Some water quality parameters of utmost importance during transportation include dissolved oxygen levels, changes in temperature, pH, carbon dioxide, ammonia and the salt balance of the fish's blood (Swann, 1993, Crosby *et al.*, 2006). Numerous chemical additives/anaesthetic can be added to the transport water to alleviate several problems associated with transporting fish (Swann, 1993), the reduction in these stress factors during transportation lowers mortality and improves appearance (Crosby *et al.*, 2006).

MATERIALS AND METHODS

Source of Fish**.** Adult catfish of average weight 550g were obtained from a commercial fish farm of known integrity in Ibadan, Oyo state, Nigeria

Source of Water**.** The water used was from a dug well located at Amzat Agro Allied Enterprises (IBZ-026308) farm complex, Ibadan and it was passed through series of cascades to aerate it, the aerated well water was later used to hold the fish for 15 minutes before the actual experiment started.

Loading of Fish**.** The fish was loaded at 2kg/litre of water in 35litre containers (20kg of fish was weighed into 35 litre plastic bowls containing 10 litres of water each). The top of the bowls was covered with a woven sack fasten to the bow's side to allow exchange of air as shown in plate 1.

Plate 1: Vehicle showing the fish being transported in bowls.

Preparation of Treatment. The additive tested was palm oil and it was added at the following rates 2.5ml, 5.0ml and 7.5ml per litre of transport water. Non iodized salt was added at 4parts per thousand (ppt) to another treatment for comparisons and the fifth treatment did not have any additive so that it could serve as control.

Concentration of the Treatments

Treatment 1: Control (No additive)

Treatment 2: 4 grammes of non iodized salt was added per litre of water

$$\text{Concentration} = \frac{\text{Mass of solute}}{\text{Volume of solvent}}$$

$$= \frac{4}{1000} \times 100\%$$

$$= 0.004$$

$$= 0.4\% \quad = 4\text{ppt} \quad = 4000\text{ppm}$$

Treatment 3. An empty plastic syringe was used to weigh palm oil using 100grams capacity mini scale model HL-100, manufactured by A & D Company, Ltd. Korea. Care was taken to make sure air was expelled from the syringe before it was weighed.

Average weight of syringe + 2.5mls of palm oil 6.54g
Average weight of empty syringe 4.28g
Weight of oil = 2.26g
2.5mls of oil weigh 2.26g
Weight of solute = 2.26g
Volume of solute = 2.5ml

:. Concentration = $\frac{\text{weight of solute}}{\text{volume of solute}}$

= $\frac{2.26}{2.5}$

= 0.904grams

Concentration/Litre of water = $904mgL^{-1}$
i.e 904mg of palm oil per litre of water.
Treatment 4. 5.0mls of palm oil per litre of water was used
Since 2.5mls ……. $904mgL^{-1}$
:. 5mls …… $\frac{904 \times 5}{2.5}$

= $1808mgL^{-1}$

Treatment 5**.** 7.5mls of palm oil per litre of water was used
Since 2.5mls …….. $904mgL^{-1}$
:. 7.5mls ……. $\frac{904 \times 7.5}{2.5}$

= $2712mgL^{-1}$

Thus the treatment concentrations are
Treatment 1 – No additive
Treatment 2 – 0.4% salt solution
Treatment 3 – $904mgL^{-1}$ of palm oil
Treatment 4 – $1808mgL^{-1}$ of palm oil
Treatment 5 – $2712mgL^{-1}$ of palm oil
All the treatments were replicated thrice to give a total of fifteen replicates.
Collection of water sample for physico-chemical analysis. The temperature and pH of water samples was measured using a hand held pH meter (HANNA instruments, model no HI 98129- HI 98130). The water samples were collected into 500mls bottles and the dissolved oxygen was determined by azide – modification to winklers method of pond water analysis (Boyd, 1981) ammonium and nitrite was determined by distillation, nitrate was by brucine colorimetric method while chloride and bicarbonate was by volumetric method as described by Udo and Ogunwale (1986).
Collection of water samples for microbial analysis**.** Sample bottles that have been washed and autoclaved were used to collect the water samples before loading of the fish, two(2), four (4) and six(6) hours of transportation. A disposable glove was worn during the collection of the water samples to prevent contamination by hand and contamination from one experimental unit to the other. The isolation of bacteria was done using the pour plate method and Eosine methylene blue agar (EMB), MacConkey Agar (Mc) and Salmonella shigella agar (SSA) were used at three different dilutions i.e 10^{-2},10^{-4} and 10^{-6} colony forming unit per milliliter (cfu/ml) for coliform identification while the plate count agar (PCA) was used for total count .
Assessment of Physical appearance of Fish after transportation. A quality index method (QIM) of fish quality measurement (Huss, 1995) was adapted for assessing the physical appearance of the fish, the reason for adapting QIM was because of inaccessibility to literatures on assessment of live fish but abundance of literature on assessment of dead fish. At the expiration of six hours transportation period, two samples of fish were selected from each container to give a total of six fish per treatment for the QIM score and the scores were then recorded.
Survival of Fish (%) calculation.

$$SR = \frac{\text{Number of fish after transportation}}{\text{Number of fish before transportation}} \times 100$$

Statistical Analysis. Complete randomization was used in designing the experiment and data resulting from the experiment were analyzed using descriptive statistics.

RESULTS

The trend of changes in water quality parameters of the transported fish is presented in figures 1-8 while the total count of organisms observed on plate count agar (PCA) at three (3) different dilutions is presented in figure 9. The quality index method QIM was adapted to assess the physical appearance of the fish after transportation and is presented in figure 10 while the survival percentage of the fish after transportation is presented in figure 11.

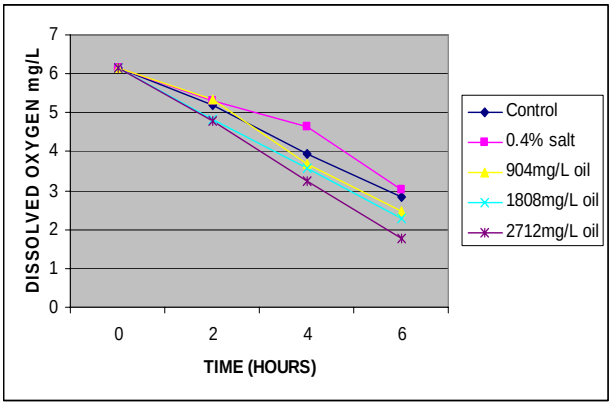

Fig1: Dissolved Oxygen content of water used in transporting live *Clarias gariepinus*

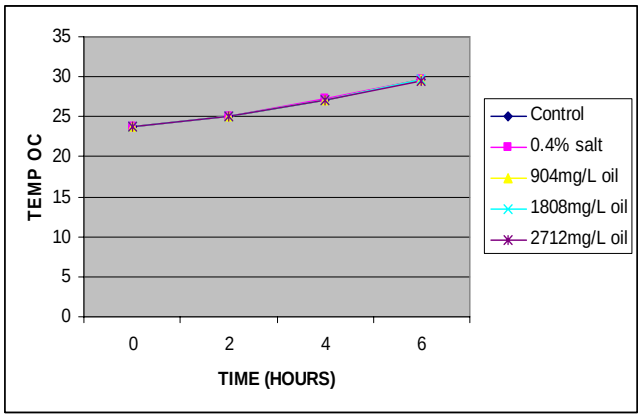

Fig.2: Temperature of water used in transporting live *Clarias gariepinus*

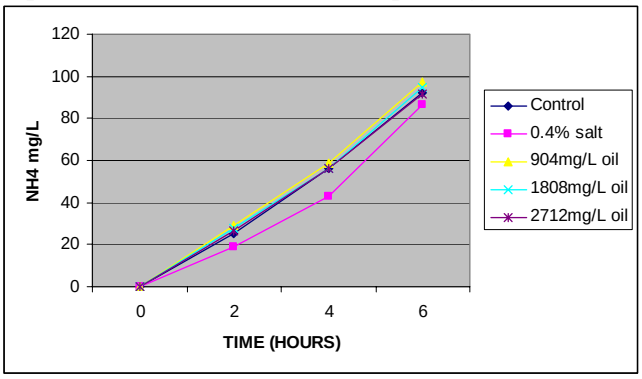

Fig.3: NH_4 content of water used in transporting live *Clarias gariepinus*

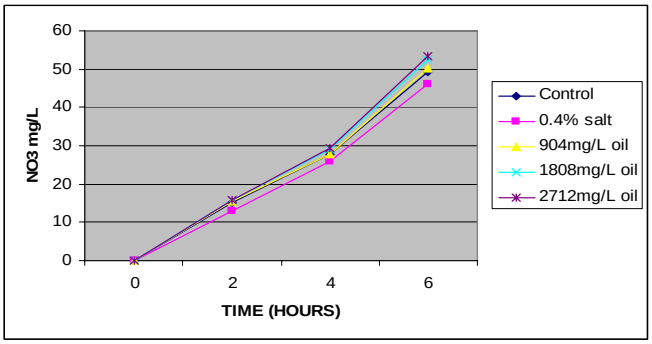

Fig.4: NO_3 content of water used in transporting live *Clarias gariepinus*

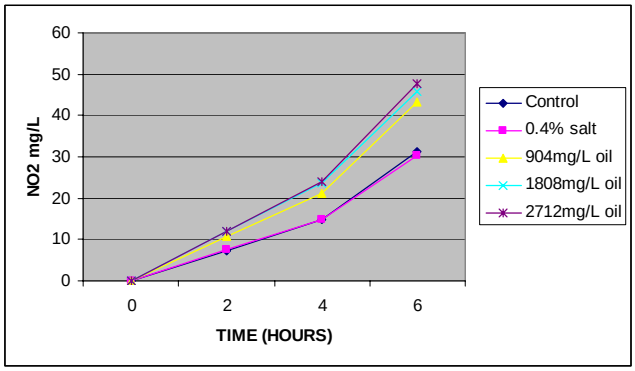

Fig.5: NO_2 content of water used in transporting live *Clarias gariepinus*

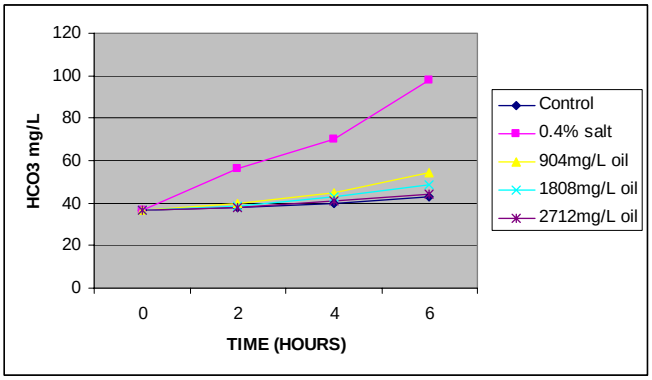

Fig.6: HCO_3 content of water used in transporting live *Clarias gariepinus*

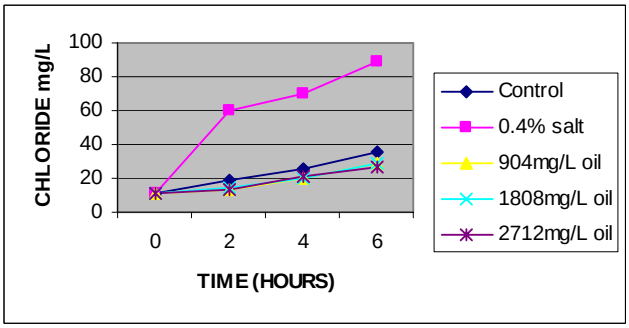

Fig.7: Chloride content of water used in transporting live *Clarias gariepinus*

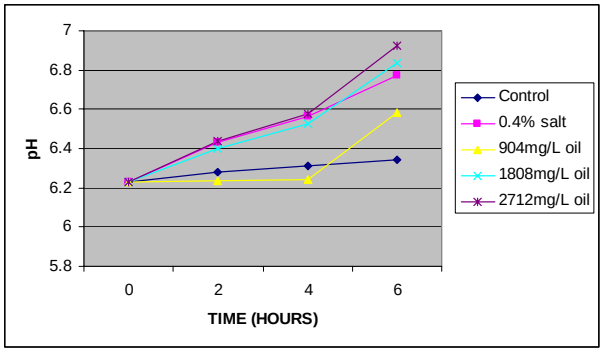

Fig.8: pH of water used in transporting live *Clarias gariepinus*

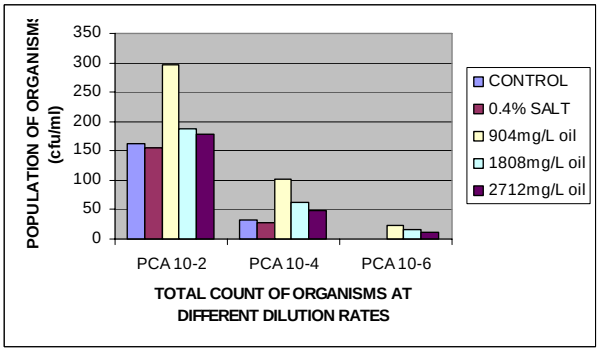

Fig. 9: Plate Count Agar (PCA) of the water used in transporting live *Clarias gariepinus* after six hours transportation period.

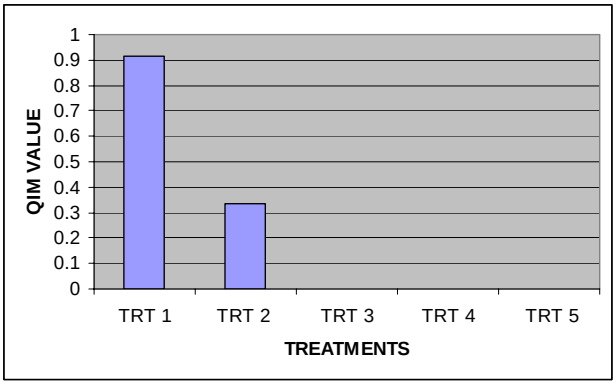

Fig.10: Adapted Quality Index Method (QIM) scale showing the physical appearance of *Clarias gariepinus* after six hours transportation exercise.
NB: The lower the value, the better the appearance of the fish

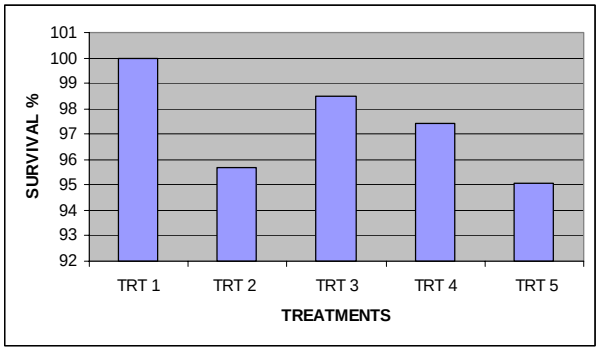

Fig. 11: Survival percentage of *Clarias gariepinus* after transporting for six hours

DISCUSSION

The results obtained from water quality parameters in this study is in accord with the works of Crosby *et al.,* (2006) who reported that as the duration of transportation increases, the dissolved oxygen content of the water decreases and also reported that addition of salt aids osmoregulation and that dissolved oxygen concentration in the transport container changes greatly during transport of fish. The transport water containing 0.4% salt had the highest dissolved oxygen throughout the transport exercise while the transport water containing 2712mgL^{-1} oil had the least dissolved oxygen till the end of transportation. The differing rates of oxygen depletion can be adduced to difference in physiological states of the fish kept in different anaesthetic media (Crosby et al., 2006) but in this case, palm oil.

The temperature of all different transport media followed the same trend increasing with duration of transport. The Ammonium (NH_4), Nitrate (NO_3) and Nitrite (NO_2) content of the transport water increased with duration of transportation and this is in agreement with the reports of Wedemeyer and Yasutake (1977) and Crosby *et al.*, (2006). Treatment containing 904mgL^{-1} of palm oil had the highest concentration of NH_4 at six hrs while 0.4% salt had the lowest concentration of NH_4 at six hours of transportation. The transport medium containing 2712mgL^{-1} of palm oil had the highest nitrate (NO_3) concentration throughout the transport period while the medium with 0.4% salt had the least concentration of nitrate during the period of transportation. Nitrite concentration of the transport medium containing 2712mgL^{-1} of palm oil was highest during the period of transportation while the nitrite concentration of the medium with 0.4% salt had the least concentration of nitrite during the period of transportation.

The bicarbonate (HCO_3) content of the transport medium containing 0.4% salt had the highest rate of increase followed by that containing 904mgL^{-1} of palm oil while the transport medium with no additive (i.e control) had the lowest rate of increase in bicarbonate. The chloride content of the transport medium with 0.4% salt increased sharply at the commencement of the exercise due to the addition of salt to the medium and the rate of chloride concentration increase was followed by the medium with no additive (i.e. control) but all the treatments containing palm oil showed a slower rate of increase in chloride concentration. The pH values of the transport medium containing no additive and 0.4% salt increased sharply from the beginning of the transportation exercise till the second hour when it stabilized till the sixth hour whereas there was no significant difference in the pH values of the all transport water containing palm oil from the commencement of transportation till end of a transportation. This is contrary to Crosby *et al*., (2006) that reported a decrease in pH of water during transportation of fish which was adduced to increase in CO_2 Production.

The coliform count of water before transportation showed that the water is free of coliforms but the water samples collected during the fish transportation for two, four and six hours showed that treatments containing palm oil recorded more coliforms than the control and the treatment containing 0.4% salt. The presence of coliforms may be from the transport containers and from the body of the fish, vomited feed and feaces. The organisms identified in all the different agar are similar and they include coliforms, Enterobacter, *Eschericha coli,* shigella and salmonella. The plate count agar (PCA) done to ascertain the total count also had the treatments containing palm oil having the highest population of organisms at the different dilutions 10^{-2}, 10^{-4} and 10^{-6}. The organisms identified on the PCA are basically *Bacillus sp.*

The treatments containing palm oil have a QIM score of zero, while treatment containing 0.4% salt have a QIM value greater than 0.3 with the control (no additive) having a QIM score of (0.9 -1). It is worthy to note that the lower the QIM score the better the appearance of the fish and vice versa. Thus, fish in all the treatments containing palm oil had a better physical appearance than the control and treatment containing 0.4% salt. This is in agreement with Iwu (1993) who reported that palm oil is administered as poison antedote and used externally as lotion for skin diseases.

The survival rate of fish in all the treatments was very high, indicating that application of palm oil in water used for transporting catfish does not have a negative effect on fish survival.

CONCLUSION

In conclusion, this study has shown that application of palm oil at 904mgL^{-1}, 1808mgL^{-1} and 2712mgL^{-1} to water used in transporting live catfish showed a similar trend with no significant difference in water quality parameters but in terms of cost and quantity used, it is advisable to use 904mgL^{-1}, for transporting live catfish because it maintains the water pH, fish appearance and does not have a negative effect on fish survival. Thus, the knowledge of the minimum concentration of palm oil to be added to transport water for transporting live adult catfish will go a long way in reducing fish loss between the farm and the market as well as to command a higher market value and consumer preference; hence, it has a corresponding increase in the income and profit that will be accrued to the farmer.

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REFERENCES

Boyd C.E. 1981. Water quality in warm water fish ponds. Auburn University Agricultural Experiment Station. (2nd Edition) 359p.

Coyle S.D, Durborow R.M and J.H. Jidwell, 2004. Anesthetics in Aquaculture. Southern Regional Aquaculture Centre. Publication no 3900

Crosby T.C, Hill J.E, Martinez C.V, Watson C.A and R.P.E. Yanong, 2006. On-farm transport of Ornamental fish. (FA – 119) University of Florida IFAS Extension http://edis.ifas.uf/.edu.

Dupree H.K. and J.V. Hurner, 1984. Transportation of live fish. Page 165-176 in H.K. Dupree and V.Hurner, (ed) Third report to fish farmers. U.S. fish and wildlife services, Washington, D.C.

Gupta S.K and P.C. Gupta. 2006. Pure and Applied Ichthyology. Chand co Ltd, 1133pHurner J.V, Dupree H.K and D.C. Greenland, 1984. Harvesting, Grading and Holding fish pages

158-164 in H.K Dupee and J.V. Huner (eds). Third report to fish farmers U.S. fish and Wildlife service, washington, D.C.

Huss H.H.1995. Quality and quality changes in fresh fish. FAO Fisheries technical paper 348. Rome.Iwu, M.M. 1993. Handbook of African Medicinal Plants. CRC Press.LLC

Swann, L.1993. Transportation of fish in Bags. North Central Regional Aquaculture Centre also in University of Missouri Extension Live and Learn MX 392.

Udo E.J & J.A. Ogunwale, 1986. Laboratory manual for soil, plant and water samples. 2nd Edition. 174pp.

Wedemeyer G.A and W.T. Yasutake, 1977. Clinical methods for the assessment of the effects of environmental stress on fish health. Technical papers of the US fish and wildlife service no 89. Washington, DC, US Dept of the Interior, Fish and Wildlife service.180p.