THE EFFECT OF TRANSPORTATION STRESS ON HAEMATOCRIT LEVEL OF *Oreochromis niloticus* LINNAEUS

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ABSTRACT

Transportation stress was investigated in Oreochromis niloticus (Linnaeus) by transporting samples in open rectangular iron tanks from Panyam fish farm, Plateau State of Nigeria to University of Jos, Nigeria. All fish appeared more stressed with higher densities and increasing media salt employed in transportation. There was a significant difference between mean haematocrit values of control (before transportation) and those of low, medium and high densities (p < 0.05). Transportation under different saline concentrations showed significant difference between means haematocrit value of control and varying media saline levels (p < 0.05) except 1% saline. There were immediate and delayed mortalities, lasting up to three days after transportation except in aerated samples.

Keywords: Transportation stress, Haematocrit, *Oreochromis niloticus*, Salinity, Oxygen.

INTRODUCTION

Prior studies on problems of handling and transportation of fresh water fishes indicated that severe physiological disturbances accompany capture and transportation. The transportation of live fish from hatchery to the waters in which they are to be stocked is an extremely important aspect of fish culture and fish farm management, (Mc-Craren, 1978; Beraka, 1986). Transportation usually involves handling large numbers of fish in a small amount of water, which, depending on the time involved can result in considerable deterioration of water quality. Sometimes, fish arrive at the stocking site in poor condition due to handling and transportation stress and some may die at the stocking site or shortly there after stocking (shreck and Lorz 1978).

Conditions that alleviate harmful handling and transportation stress have become the focus of research in recent times. Carmichael (1984) observed that when fish were transported at higher densities, the level of cortisol and glucose in the plasma increased. Orji (1998) pointed out that transportation of *O. niloticus* led to decreased hepatic glycogen. Sharp et al (1998), working on effects of routine handling and tagging procedures on the physiological stress response to juvenile Chinook salmon, observed that cortisol increased from resting level of 2 mg/ml by 1 hour post stress and returned to near resting level about 8 hour post stress. Also, Orji (2003), observed that transportation of *O. niloticus* led to increase in interrenal cell nuclear height. Similarly, Specker and Shreck (1979), on stress induced by transportation of Coho Salmon – *Oncorhynchus kitsutch* reported thus: - transportation caused an increase in glucose and cortisol circulation. Acclimated coho salmon are more likely to survive a second stress than unacclimated coho salmon. The stress of transportation occurs during loading and first few hours enroute.

The aim of this paper was to investigate the level of fish mortality as well as some stress reactions of transported fish from a fry production centre – Panyam Fish Farm, Plateau state Nigeria, to the stocking site, - Fisheries Laboratory experimental pond, Zoology department, University of Jos, Nigeria. The transportation covered a measured distance of about 80 kilometres. It also attempted to identify conditions that could heighten or alleviate transportation and handling stress in fish.

MATERIALS AND METHODS

Fish were caught with fish net and kept in acclimation tank for one week after which they were transported in open rectangular iron tanks, measuring (98 x 76 cm), coated with aluminium paint inside. After transportation, they were stocked in three experimental holding ponds each measuring (31.6 x 25.5 cm). Each pond was partitioned into three, so that fish with similar transportation treatments were stocked in the same apartment. Sampling of fish was carried out before and immediately after transportation. Sampling of fish involved taking total length measurements, caudal severance and collection of blood into heparinized capillary micro tubes and sealing them with plasticine. Blood samples collected before transportation served as controls.

Table 1: Mean haematocrit values of *O. niloticus* transported under different densities

Treatment	Mean total length (cm)	Mean heamatocrit value (%)
Control	12.00 ± 1.2	32.82 ± 1.5
Low Density (40 fry/96)	11.35 ± 2.44	22.00 ± 2.69
Medium density (40 fry/72)	11.22 ± 0.88	19.97 ± 2.84
High Density (40 fry/48)	11.30 ± 2.70	15.45 ± 2.97

Table 2: Mean haematocrit values of *O. niloticus* transported under different saline concentrations, with and without aeration

Treatment	Mean total length (cm)	Mean heamatocrit value (%)
Control	12.29 ± 0.77	32.80 ± 1.20
0% Saline + 0_2	12.28 ± 1.43	28.90 ± 2.34
0.Saline + 0_2	13.17 ± 1.56	28.90 ± 2.91
1% Saline + 0^2	13.10 ± 1.46	31.90 ± 1.90
0% Saline - 0_2	12.81 ± 1.80	24.81 ± 1.90
0.6% Saline + 0_2	15.10 ± 1.56	25.50 ± 2.10
1% saline - 0_2	12.20 ± 1.21	26.20 ± 3.02

Table 3: Instant and delayed mortalities of *O. niloticus* transported under different saline concentrations with and without aerations

Date	No	% mortality	Treatments
1st Day	8	8.8	0 Saline without 0_2
“	5	5.5	1 Saline without 0_2
“	3	3.3	0.6 Saline without 0_2
2nd Day	17	18.8	1 Saline without 0_2
“	19	21.1	0 Saline without 0_2
“	7	7.7	0.6 Saline without 0_2
3rd Day	2	2.2	0 Saline without 0_2
“	1	1.1	0.6 Saline without 0_2
“	1	1.1	1 Saline without 0_2

Transportation under Different Densities: The following densities of Tilapia fry were maintained per group (A-C).
A – 40 fry per 48L, for high density; B – 40 fry per 72L, for medium density and C – 40 fry per 96L for low density, each group was replicated thrice.

Transportation under Different Saline Conditions: Sodium chloride (NaCl) levels of 0.6% (25.29g/72L) 1% (113.22g/72L) and 0% (water without addition of saline) were obtained by preparing slurry of the appropriate weights of salt in 200 mls of water thus,
A – 40 fry in 0% saline (water without saline); B – 40 fry in 0.6% saline and C – 40 fry in 1% saline.

Blood Haematocrit Value: Blood was collected into heparinized micro haematocrit tubes from a severed caudal peduncle vessel, centrifuged under standard conditions at 2500 rpm for five minutes. The packed red blood cell volume was measured directly and expressed as percentage of the total blood volume with a microhaematocrit meter according to Wedemeyer and Yasutake (1977).

Determination of Dissolved Oxygen: Water samples were collected with sampling bottles and analysed for dissolved oxygen (DO), using Hach Fish Farmer's water quality test kit (Model FFIA). Two way analysis of variance (ANOVA) was employed to test the significant levels of deviation means from control values. The analysis of variance was extended by use of LSD Test, for evaluating treatment means.

RESULTS

Transportation of *O. niloticus* under different densities (Table 1) showed that there was significant differences between the control mean and those of low, medium, and high densities ($P<0.05$) There were decreases in the haematocrit value from 32.82± 1.5% in control to 22.0± 2.69% in low, 19.97± 2.84% in medium and 15.45± 2.97% in the high densities respectively. This implies that increase in density accentuates stress in *O. niloticus.*

Transportation under different saline concentrations (Table 2) showed significant difference between the mean haematocrit value of control and varying media saline levels ($P<0.05$), except 1% saline. However, there was sequential trend of increased values correlated with increase in salinity. This phenomenon could be ascribed to haemoconcentration as opposed to haemodilution, which characterized the previous result. With the application of aeration into samples transported in various saline concentrations there was also evidence of stress in all the transported samples from the results of the haematocrit values, again repeating the effect of haemoconcentration. The haematocrit values increased towards increasing saline concentrations. However, aerated samples had higher haematocrit values than the non-aerated.

Mortality was high during the first day, increasing on the second day and decreased on the third day, after transportation (Table 3). During pilot transportations, there was drastic reduction of dissolved oxygen content of the water samples from 10.99mls per litre to 2.4 mls per litre and from 7.62 mls per litre to 2.69 mls per litre respectively on two transportations. This drastic reduction in dissolved oxygen (DO) necessitated the use of aerator in subsequent transportations, which yielded better results in terms of higher haematocrit value and lower mortality.

DISCUSSION

The overall results obtained so far on the physiological indices of stress reveal that transportation of *Oreochromis niloticus* let to decreased haematocrit. This decrease in the value of haematocrit caused by stress conforms to results obtained by (Soivio and Oikari 1976, Madden 1977, Hattingh 1976, Nomura and Kawatsum 1977 and Sikoki, *et al* 1989), but differed from that of (Casillas and Smith 1977). The later observed an increase in haematocrit value of fish when stressed. A possible explanation of this variation could be that haematocrit value increases within the first 20-30 minutes after stress inducement and later starts to decrease. This proposition is based on the fact that Casillas and Smith sampled their fish blood within 20 minutes after stress inducement. Alternatively, it could be argued that Casillas and Smith sampled their fish blood in an aerobic environment. Since (Soivio and Nybols 1973) stated that haematocrit of Rainbow trout could be changed invitro by placing the blood in an aerobic or anaerobic environments. An anaerobic environment could cause a decline of greater than 10% of the original haematocrit value, whereas an aerobic condition could cause an increase of10-30% and this was the range recorded by Casillas and Smith. Be that as it may, it will be useful to carry out a time-course study of the pattern of the haematocrit stress response under varying media conditions in fish.

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