Original Research Article

EFFECTS OF DIFFERENT ALCOHOL CONCENTRATIONS ON THE MORPHOMETRIC CHARACTERISTICS OF *Clariasgariepinus* and *Oreochromis niloticus*

Abstract

The effects of alcohol (90% and 95% concentration) preservation on the morphometric characteristics of *Clariasgariepinus* and *Oreochromisniloticus* was investigated. The morphometric characters observed were total length, standard length, head length, body depth, eye diameter, and total weight for the period of sixty-three (63) days. Samples were first euthanized before taking the morphometric characteristics after which the samples were individually preserved in separate bottles filled with respective concentrations (90% and 95%) for nine weeks (63days). Morphometric characteristics of the samples were later measured at the end of the 63 days to determine any possible changes. The results indicated that shrinkage was common in all the observed morphometric characters in both species even though they reacted differently to different concentration of alcohol. The results also revealed that the percentage shrinkage in all measured morphometric characters was higher in C. gariepinusthan in O. niloticus and also higher in 95% concentration than in 90% concentration.

showed that both *C. gariepinus* and *O. niloticus* reacted differently to the 90% and 95% alcohol preservation. The *C. gariepinus* recorded higher percentage shrinkage in all characters in both 90% and 95% concentration compared to that *O niloticus*.

In the 90% concentration, *C. gariepinus* had the lowest percentage shrinkage in the body depth (5.48) and followed by the total length (5.95), while the total weight had the highest percentage shrinkage (16.42) over the preservation period. Similarly, *O. niloticus* had the lowest percentage shrinkage in the total length (2.39) and followed by the standard length (2.89), while the highest percentage shrinkage was observed in the eye diameter (11.54), and followed by the total weight (10.96). In contrast to what was observed in the 90% preservation, the head length had the lowest percentage shrinkage (7.07) in *C. gariepinus* in the 95% preservation and followed by the total length (7.31) while the total weight had the highest percentage shrinkage (17.91) and followed by the eye diameter (14.29). *O. niloticus*,had the lowest percentage shrinkage (3.01) in the head length and followed by the standard length (3.18) while the highest percentage shrinkage was observed in total weight (14.91) and eye diameter (13.25) respectively.The observed variations in the two studied species in respective concentrations may be due to the species differentiation, which determines the variation in tissue water content and the ratio of white to red muscle. The presence of scales may also be a factor, which may influence the surface ratio of body exposed to the preservative agents in the studied fish. The study revealed that 95% concentration of alcohol have higher effects than 90% concentration but almost similar pattern on both *C. gariepinus* and *O. niloticus* species preserved for the period of sixty-three (63) days. However, more effects could have been observed if the preservation period is increased beyond 63 days, which may considerably affect subsequent and further biological analyses of the examined morphometric characters

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INTRODUCTION

Preservation methods are generally used to maintain the integrity of biological specimens for long-term storage (Berbel-Filho et al., 2013). Although, these biological samples are generally preserved under

varying conditions according to the purpose and further usage (Jawad et al., 2001; Jawad , (2003); Ghaly*et al*., 2010). For the identification of fish specimens, ichthyologists usually use formalin, alcohol, freezing and even chilling as a way to preserve morphological characteristics (Ghaly*et al*., 2010). However, several fields in fish biology like systematics, growth analyses and fishery stocks management use these morphological data extensively, and any interference that some preservation method may introduce, could directly influence the biological interpretation of the results. Haubrock*et al*., (2018) reported that storing fish samples in formalin and alcohol as a long-term measure may be reasonable, but the short-term storage of large quantities of such fish samples can be delicate and may not be the most efficient method of fish preservation. However, different short and long-term storage techniques have been shown to affect taxonomically important morphometric characteristics of fish, such as total length, head length, eye diameter, body depth and others (Al-Hassan and Shawafi, 2003). Inaccuracy or error in the morphometric measurement that do not reflect the real length of fish as a results of effects of preservation may considerably affect subsequent analyses (Porter *et al*., 2001)

Jawad *et al*., (2001), Jawad (2003) and Neave *et al*., (2006) have reported the effects of varying preservation methods on pigmentation and morphometric characteristics in different species of fish. These variations in morphology among different preserved species and samples were said to be as a result of several factors such as time elapsing until preservation, the applied preservation method, concentration of preservative, preservation duration and temperature, morphological variability among specimens, and species-specific factors (age, size, state, the osmoregulatory activity of the fish at the point of death) (Yeh and Hodson, 1975) The present work examined the effect of 90% concentrations of alcohol on selected morphological characteristics of a scale-less fish, *Clariasgaripienus* and scaled fish, *Oreochromisniloticus*

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MATERIALS AND METHODS

Collection of samples: Forty (40) individuals of *C. gariepinus* and forty (40) individual of *O. niloticus* of possible similar recruits were obtain from the Upper Benue River, Yola. The *C. gariepimus* ranges between 11.56cm-12.65cm and 12.83g-13.45g in total length and total weight respectively while the *O.niloticus* ranges between 11.95cm-12.25cm and 37.76g-38.27g in total length and total weight respectively.

Experimental Set-up: A set of twenty individuals of C. gariepinus and O. niloticus were introduced to 90% alcohol preservation while the remaining set of twenty individuals of C. gariepinus and O. niloticuswere introduced to 95% alcohol preservations. Each samples were introduced into individual bottles, filled with respective concentration of alcohol after first been euthanized. Each of the samples were preserved and stored in a single glass bottle and labelled. Measurement of the morphometric characteristics were done on the fresh samples prior to preservation and after nine weeks (63 days) of preservation.

Morphometric Measurement: Morphometric characters like body weight (BW), total length (TL), standard length (SL), body depth (BD), head length (HL) and eye diameter (ED) were taken. The body weight was measured by electronic weighing balance to the nearest 0.01g, while the total length, standard length, body depth, head length and eye diameter were measured using digital veniercallipar

Data Analysis: The data generated were analyzed using Statistical Package for Social Sciences (SPSS 22.0). A simple descriptive analysis is used to determine the means and one way analysis of variance (ANOVA) was used to separate the means at (P= 0.05). The percentage shrinkage was also calculated to determine the decrease in the measured morphometrics characters in the fresh samples compared to the preserved samples.

$$\text{Percentage Shrinkage \%} = \frac{fresh\ sample\ -preserved\ \ sample}{\text{Fresh sample}} \times 100$$

RESULTS:

The effects of alcohol (90%) preservation on *C. gariepinus* and *O. niloticus* for the period of nine weeks (63 days) is presented in Table 1. The results showed varying degree of reduction in the morphometric characters of both studied species. *C. gariepinus* had the lowest percentage shrinkage in the body depth (5.48) and followed by the total length (5.95), while the total weight had the highest percentage shrinkage (16.42) over the preservation period. Similarly, *O. niloticus* had the lowest percentage shrinkage in the total length (2.39) and followed by the standard length (2.89), while the highest percentage shrinkage was observed in the eye diameter (11.54), and followed by the total weight (10.96). The results also revealed that *C.gariepinus*preserved in 90% alcohol showed higher percentage shrinkage in all the parameters measured compared to that of *O. niloticus*. However, there was no significant differences (p>0.05) in all the morphometric characters in both *C. gariepinus* and *O. niloticus* before preservation and after preservation except in the mean total weight.

The effects of alcohol (95%) preservation on *C. gariepinus* and *O. niloticus* for the period of nine weeks (63 days) is presented in Table2. The results also revealed varying degree of reduction in the morphometric characteristics of both fresh and preserved *C. gariepinus* and *O. niloticus*. The results revealed that C. gariepinus had lowest percentage shrinkage (7.07) in the head length and followed by the total length (7.31) while the total weight had the highest percentage shrinkage (17.91) and followed by the eye diameter (14.29). *O. niloticus*, had the lowest percentage shrinkage (3.01) in the head length and followed by the standard length (3.18) while the highest percentage shrinkage was observed in total weight (14.91) and eye diameter (13.25) respectively

However, there was no significance differences (p>0.05) between the measured characters in the fresh and preserved *C. gariepinus* and *O. niloticus*except in the total weight. The results also revealed that the *C. gariepinus* preserved in 95% alcohol had higher percentage shrinkage compared to *O. niloticus* that was exposed to the same concentration.The results also revealed significance differences (p>0.05) between morphometric characters of *C.gariepinus* and *O. niloticus* preserved in 90% and 95% alcohol. The results also revealed higher percentage shrinkage in all morphometric characters in *C.gariepinus* and *O. niloticus* stored in 95% alcohol and significantly different than that of 90% alcohol

Table 1: Effects of 90% ethanol preservation on Morphometric characters of Clariasgariepinus and Oreochromis niloticus for the period of sixty-three days (nine weeks)

90% alcohol preservation				
Morphologicsl character	**Before preservation in alcohol (cm)**	**After preservation in alcohol**	**Shrinkage (cm)**	**Percentage shrinkage**
Total length	11.76±1.24 [a]	11.06±1.23 [a]	0.70	5.95
Standard length	10.39±1.21	9.62±1.09 [a]	0.77	7.41
Head length	3.09±0.31 [a]	2.89±0.32 [a]	0.2	6.47
Body depth	1.64±0.16 [a]	1.55±0.14 [a]	0.09	5.48
Eye diameter	0.23±0.04 [a]	0.20±0.03 [a]	0.03	13.24
Total weight	12.91±3.34[a]	10..91±2.77[b]	2.12	16.42
O.niloticus				
Total length	12.09±1.47	11.81±1.43[a]	0.28	2.39
Standard length	9.67±1.18 [a]	9.39±1.12[a]	0.28	2.89
Head length	3.38±0.48[a]	3.28±0.39[a]	0.1	2.96
Body depth	4.10±0.33[a]	3.94±0.31[a]	0.16	3.90
Eye diameter	0.78±0.09[a]	0.69±1.00[a]	0.09	11.54
Total weight	38.04±9.92[a]	33.87±8.17[b]	4.17	10.96

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Table 2: Effects of 95% ethanol preservation on Morphometric characters of Clariasgariepinus and Oreochromis niloticus for the period of sixty-three days (nine weeks)

95% alcohol preservation				
Morphologicsl character	**Before preservation in alcohol (cm)**	**After preservation in alcohol**	**Shrinkage (cm)**	**Percentage shrinkage**
Total length	11.77±1.29[a]	10.91±1.06[a]	0.86	7.31
Standard length	10.46±1.29	9.53±0.96[a]	0.93	8.89
Head length	3.11±0.32[a]	2.89±0.28[a]	0.22	7.07
Body depth	1.55±0.29 [a]	1.41±0.19 [a]	0.14	9.0
Eye diameter	0.21±0.04 [a]	0.18±0.03 [a]	0.03	14.29
Total weight	13.01±4.65[a]	10.68±3.82[b]	2.33	17.91
O.niloticus				
Total length	11.83±1.41 [a]	11.42±1.38[a]	0.41	3.47
Standard length	9.44±1.05 [a]	9.14±1.03[a]	0.30	3.18
Head length	3.32±0.43[a]	3.22±0.40[a]	0.10	3.01
Body depth	3.89±0.44[a]	3.71±0.38	0.18	4.63
Eye diameter	0.83±0.05[a]	0.72±0.06	0.11	13.25
Total weight	34.01±10.03 [a]	28.94±8.65[b]	5.07	14.91

DISCUSSION

The use of different preservatives have been reported to cause change in the body proportion of the fish. In this research, decrease in length in most of the characters measured was an evident of shrinkage of the morphometric characters and exit of interstitial fluid as reported by Hossaini, *et al*. (2016). The shrinkage observed over the preservation period is in accordance with the results of Jawad *et al*. (2001); Jawad (2003) and Hossaini, *et al*.(2016) who all revealed that different concentrations of alcohol causes various degrees of shrinkage in total length, standard length and head length. The higher percentage shrinkage observed in total weight, eye diameter and body depth in both species and in both concentration also corroborate with the work of Berbel*et al*. (2013) who reported higher percentage shrinkage in body depth and eye diameter. However, the result obtained from this study is not in agreement with the work of Scott *et al.*, (2016) who reported length gain in bluegill larvae preserved in 90% alcohol for the period of twenty-six (26) days while Jawad (2003) also reported no effect of alcohol preservations on the head length of *Alepesdjeddaba*preserved at 70% concentration. The differences observed in this study and that of Scott et al., (2016) may be attributed to differences in age and sizes of the samples used as Hossaini, *et al* 2016 already reported them as factors that influence changes in morphometric characteristics. Differences in this present study and the report of Jawad (2003) on *Alepesdjeddaba* may be attributed to differences in fish species and concentration of alcohol used. This present study is also in accordance with the study of Sotola*et al*. (2019) who reported larger changes in eye diameter and body depth of cyprinids preserved for a period of less than 1 year

Changes in morphometric characters of preserved species has been reported to be influenced by various factors such as method of preservation, concentration and type of chemical preservation agents, length of preservation period, salinity and temperature of the preservative (Macdonald et al. 1997; Jawad, 2003; and Hossaini, *et al* 2016). The type of species, age, size and developmental state of the preserved fish are all factors that determine changes in morphometric characters of a preserved fish. The two studied fish species reacted to the 90% and 95% alcohol concentration differently in which the *C. gareipinus* recorded higher percentage shrinkage compared to that *O niloticus*may be because of species differentiation, which determines the variation in tissue water content and the ratio of white to red muscle. The presence of scales may also be a factor, which may influence the surface ratio of the studied fish exposed to the preservative agent. The higher percentage shrinkage observed in the 95% alcohol compared to 90% alcohol in both fish species may be influence by the concentration of the preservatives as already been reported as a factor that determines rate of changes in the morphometric characteristics of fish

Comment [MOU6]: This cannot be acceptable and this is because of the dehydration of the tissues.

Conclusion

The study revealed that 90% and 95% alcohol concentration have different effects but similar pattern on both *C. gariepinus* and *O. niloticus* fish species preserved for the period of sixty-three (63) days. However, effects that are more significant could have been observed had it been that the preservation period is increased beyond 63 days, which may considerably affect subsequent and further biological analyses of the examined morphometric characters.

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