



Original article

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Morphological variations of common carp (*Cyprinus carpio*) by fixation and preservation in 10% formalin

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ABSTRACT

Objective: To determine the effects of morphological characteristics of common carp (*Cyprinus carpio*) by fixation and preservation in 10% formalin.

Methods: Fish samples were collected from the Research Center of Aquaculture of Barabadi Fazli martyr, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran. After initial assay on morphological characters such as total length, standard length and head length, samples were fixed in 10% formalin for 12 weeks. After this period, samples were taken away from the formalin and the morphological characteristics and evaluation of color features were assayed once again.

Results: The results indicated that shrinkage was usual in all the specimens and changes in body and fins color were clear and their color was opaque. Formalin preservation is usually causing a reduction in the length of fishes.

Conclusions: Different rates of change in body length and color of preserved sample are observed after a standard period of preservation in different preservatives and it can be suggested that the decrease of color intensity in fixed samples in formalin does not have inhibition effects in color identification keys.

1. Introduction

The common carp [*Cyprinus carpio* (*C. carpio*)] is a widespread freshwater fish of eutrophic waters in lakes and large rivers in Europe and Asia. *C. carpio* is the number one fish of aquaculture. Classical taxonomic analysis divides the currently existing common carp forms into three categories: (1) European (*Cyprinus carpio carpio*), (2) Far Eastern (*Cyprinus carpio haematopterus*) and (3) South-East Asian (*Cyprinus carpio viridiviolaceus*) (Kirpitchenkov, 1999). The wild populations are considered vulnerable to extinction, but the species has also been domesticated and introduced into environments, being included in the list of the world's 100 worst invasive species.

Ichthyologists have used freezing, formalin or alcohol for preserving fish specimens. Morphological characters are essential for taxonomic and population studies[1-3].

Identification keys are often based on morphological characteristics and pigment of fixed samples. Because of the variability in the process of fixing and maintaining, and also different fixation methods on the color pattern of fixed samples, the morphological characters in live fresh samples are different from fixed samples.

Various preservatives and preservation techniques are used to

preserve fish specimens for further studies, e.g. biosystematics work. Formalin, alcohol and freezing are the standard ichthyologic preservatives. Body proportions of preserved fish showed variable degrees of change after a standard period of preservation in various preservatives. Most authors have reported a decrease in length[4-6], but Billy[7], Al-Hassan and Abdullah[8] and Al-Hassan *et al.*[9] reported a slight increase in length or at least no shrinkage in preserved specimens of *Sarotherodon mosambicus*, *Barbus luteus* and *Rastrelliger kanagurta*, respectively.

In this study, the effect of fixation and preservation in formalin on the morphological characters of common carp (*C. carpio*) was investigated.

2. Materials and methods

To perform this experiment, 40 samples were collected from the Research Center of Aquaculture of Barabadi Fazli Martyr, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran. To identify fishes, samples were studied by usual morphometric, meristic and descriptive methods. The morphological characters measured were total length (TL), standard length (SL) and head length (HL). Measurement was conducted by using a graded caliper with an accuracy of 1 mm. After measuring TL, SL and HL, color pattern of skin and fins in samples were studied. Tagging or marking was done. Then, samples were fixed in 10% formalin. Samples were removed from formalin after 12 weeks and measurement of TL, SL and HL and evaluation of color pattern were performed once again. At the end, the results of the two steps were recorded.

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3. Results

Effects of formalin on morphometric characters of *C. carpio* were presented in Table 1 and the average of morphometric characters were presented in Table 2. Also, changes in body color were clear. Fresh fish had a silver color but after removing from 10% formalin, the body color became opaque.

Table 1

Effect of formalin on morphometric characters of the 40 tested *C. carpio* (mm).

Serial No.	Before preservation in formalin			After preservation in formalin			Amount of shrinkage		
	TL	SL	HL	TL	SL	HL	TL	SL	HL
1	60	50	11	58	49	10	2	1	1
2	65	52	13	62	50	12	3	2	1
3	70	55	15	68	54	14	2	1	1
4	72	56	15	69	55	13	3	1	2
5	62	53	10	59	51	9	3	2	1
6	67	55	14	65	54	13	2	1	1
7	75	60	16	72	59	14	3	1	2
8	75	60	16	72	59	14	3	1	2
9	65	55	13	62	53	12	3	2	1
10	65	50	12	62	49	10	3	1	2
11	65	55	13	62	54	11	2	1	1
12	60	50	11	58	49	10	5	2	3
13	63	50	11	58	48	8	5	4	1
14	62	50	10	57	46	9	4	3	1
15	65	52	11	61	49	10	2	1	1
16	72	60	15	70	59	14	4	1	3
17	66	53	14	62	52	11	2	1	1
18	60	50	10	58	49	9	2	1	1
19	70	55	14	66	54	11	4	1	3
20	60	50	10	58	49	9	2	1	1
21	60	50	10	58	49	9	2	1	1
22	66	55	12	61	52	10	5	3	2
23	70	60	14	68	59	13	2	1	1
24	67	55	13	64	54	11	3	1	2
25	65	55	12	61	53	10	4	2	2
26	65	55	12	63	54	11	2	1	1
27	70	55	14	66	52	13	4	3	1
28	60	50	10	57	48	9	3	2	1
29	75	60	15	71	58	13	4	2	2
30	75	60	15	72	59	13	3	1	2
31	65	55	10	61	53	8	4	2	2
32	65	55	11	60	53	8	5	2	3
33	60	53	8	59	48	8	4	2	2
34	60	50	10	57	59	13	3	1	2
35	70	60	15	56	49	6	4	1	3
36	60	50	9	58	49	9	2	1	1
37	60	50	10	64	55	11	3	1	2
38	67	56	13	61	51	11	4	3	1
39	65	54	12	67	57	13	3	2	1
40	65	55	11	60	52	10	5	3	2

Table 2

Average of TL, SL and HL before and after preserving in formalin (mm).

Morphometric characters	Before preservation in formalin	After preservation in formalin
Average of TL	66.12821	62.61538
Average of SL	54.35897	52.74359
Average of HL	12.46154	10.82051

4. Discussion

Results of this study have demonstrated length reductions that probably due to wrinkle and shrinkage of the body during preservation in 10% formalin. This result agrees with several other studies[4,6]. While Al-Hassan and Abdullah have showed length increase or no shrinkage in storage of *Sarotherodon mosambicus* and *Barbus luteus*[8]. Also Al-Hassan indicated that freezing, storage in alcohol and 10% formalin increases the TL, SL and HL[9].

The effects of fixation materials on body lengths depend on different factors including size, age and species of fish, and the osmoregulatory state of the fish at death[7], style of preservation such as fixation and freezing, concentration and kind of chemical preservation agents, period of preservation, temperature and salinity of preservative and measurement error among workers. Larger fish have been reported to shrink proportionally less than smaller fish[4,6]. Different materials with different concentrations have different effects on morphological properties of stored samples. Many researchers have recommended the use of geographically specific correction equations as preservation effects can vary among stocks and location within the same species[3,7]. Thus they behave differently when they were been kept in different preservative concentrations. The differences observed on the effect of preservation might be due to genitival factors that determine the ratio of white to red muscles[2].

In this study, changes in body color were also clear after preservation, but colors were distinguished and color intensity were changed. Different rates of change in body length and color of preserved sample were observed after a standard period of preservation in different preservatives, also it can be suggested that decrease of color intensity in fixed samples in formalin does not have inhibition effects in color identification keys.

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Conflict of interest statement

We declare that we have no conflict of interest.

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