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## BIOPHYSICS AND BIOCHEMISTRY

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# Free-Radical Lipid Oxidation in Intergeneric and Interspecific Sturgeon Hybrids at Early Stages of Ontogeny

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The intensity of free-radical lipid oxidation was evaluated in total homogenates of intergeneric (great sturgeon with barbel sturgeon) and interspecific (Russian sturgeon with barbel sturgeon) hybrid fry and their parental species. Activity of the antioxidant defense system in intergeneric fry was higher than in interspecific fry, which should be taken into consideration during selection of objects for intensive aquaculture.

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**Key Words:** *acipenseridae; remote hybridization; fry; free-radical oxidation*

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The maintenance of high resistance to unfavorable biotic and abiotic factors in fishes is an important problem of fish breeding. A promising way is adequate adaptation to damaging factors of different nature. In aquaculture, like in nature, the population is regulated mainly at the early stages of ontogeny (embryos, fry, and young fishes) [4]. Violation of temperature and gaseous regimens [9] and intoxication [8] during these periods lead to activation of free-radical oxidation of membrane lipids, which results in their dysfunction and development of pathological processes. The regularities of free-radical lipid oxidation during the early ontogeny of sturgeons were extensively studied [2,7], but the peculiarities of these processes in hybrid forms, the promising objects of commercial sturgeon breeding, remain little known.

Here we evaluated the intensity of free-radical lipid oxidation in some intergeneric sturgeon hybrids at the early stages of ontogeny.

### MATERIALS AND METHODS

The objects of investigation were fry of intergeneric hybrid Russian sturgeon+barbel sturgeon (RB), inter-

specific hybrid great sturgeon+barbel sturgeon (GB), and their parental species. The quality of sex product (eggs and semen) was evaluated before fertilization [5] at stage 14 (early gastrula), embryonal development at stages 26-27 (formation of heart primordium), and survival of fry at stage 45 (transition to active nutrition) [1].

Sturgeon fry were fed starting from the moment of melanin plug release from the intestine. Live fodder was given *ad libitum* every 2 h for 1 month.

For evaluation of the activity of the antioxidant defense system, the rate of MDA accumulation in total homogenates was measured using the iron (II)-ascorbate system with and without incubation. In the former case the maximum level of free-radical lipid oxidation products reacting with thiobarbituric acid (TBA) can be measured, while in the latter weak induction of oxidation can be recorded.

The content of total lipids in homogenates was evaluated by color reaction [3] and MDA content was measured by the reaction with TBA [6]. Homogenates from fry fed two types of fodder (*Artemia salina* L. nauplia and *Enchytraeus albidus* Henle) were studied.

### RESULTS

The quality of sex products used in sturgeon hybridization was satisfactory, the development of embryos

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**TABLE 1.** Biological Characteristics of Sturgeons at Early Stages of Ontogeny

Parameter	Russian sturgeon	White sturgeon	Sturgeon	RB	GB
Number of fish eggs per gram	44.0	36.0	91.0	49.0	36.0
Percentage of fertilized eggs at stage 14	96.0	89.0	85.0	91.5	97.0
Percentage of typically developing embryos at stages 26-27	94.5	88.5	87.0	86.0	81.5
Survival at stage 45, %	78.3	70.8	94.6	80.9	80.0

**TABLE 2.** Intensity of Free-Radical Lipid Oxidation (nmol MDA/g Lipids) in Fry of Russian Sturgeon, Great Sturgeon, Barbel Sturgeon, and Hybrids ( $M \pm m$ )

LPO; fodder		Russian sturgeon	Great sturgeon	Barbel sturgeon	RB	GB
Initial	artemia	0.72±0.02	1.43±0.01	1.46±0.12	0.83±0.03	1.16±0.09 <sup>++</sup>
	oligochaete	4.67±0.54	1.23±0.09	1.46±0.09	1.17±0.06	2.46±0.07 <sup>**</sup>
Spontaneous	artemia	6.26±0.04	8.66±0.07	8.36±0.81	4.35±0.04	4.85±0.05
	oligochaete	50.15±1.02	9.19±0.06	7.26±0.75	7.32±0.09 <sup>**</sup>	15.73±1.02 <sup>**</sup>
Ascorbate-dependent	artemia	7.95±0.67	13.13±1.05	12.26±1.09	4.72±0.03	7.04±0.07 <sup>+++</sup>
	oligochaete	51.08±3.03	9.80±0.15	8.48±0.02	11.45±0.09 <sup>*</sup>	15.91±0.08 <sup>+++</sup>

**Note.** \* $p < 0.001$ , \*\* $p < 0.01$  compared to the corresponding parameter in fry fed artemia; \* $p < 0.001$ , \*\* $p < 0.01$ , \*\*\* $p < 0.05$  compared to RB fed the same fodder.

and survival of fry during transition to active nutrition was normal (Table 1).

The lowest initial LPO intensity was found in RB hybrid fry fed both types of live fodder and the highest in Russian sturgeon fry fed oligochaete. In fry fed artemia nauplia the initial LPO intensity in GB hybrids was lower than in parental species, while in RB hybrids it was intermediate (Table 2). The intensity of initial free-radical oxidation was maximum in great sturgeon and barbel sturgeon and minimum in hybrids. Feeding with oligochaete increased this parameter in Russian sturgeon fry and hybrids. A similar picture was observed in evaluation of ascorbate-dependent LPO (Table 2). Hence, in fry fed artemia nauplia the intensity of initial and ascorbate-dependent LPO was higher in intergeneric hybrids compared to interspecific hybrids. The use of finely chopped oligochaete fodder increased the intensity of initial, ascorbate-dependent, and spontaneous LPO in intergeneric hybrids compared to interspecific hybrids. Activation of free-radical lipid oxidation in sturgeon fry was observed after changes in the ration, except the initial LPO in RB (Table 2).

The results indicate that activity of the antioxidant defense system in fry of interspecific sturgeon hybrids

is higher than in intergeneric hybrids. This fact should be taken into consideration when selecting the objects for intensive aquaculture. The use of artemia nauplia for feeding Russian sturgeon and the studied hybrid fry is preferable.

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