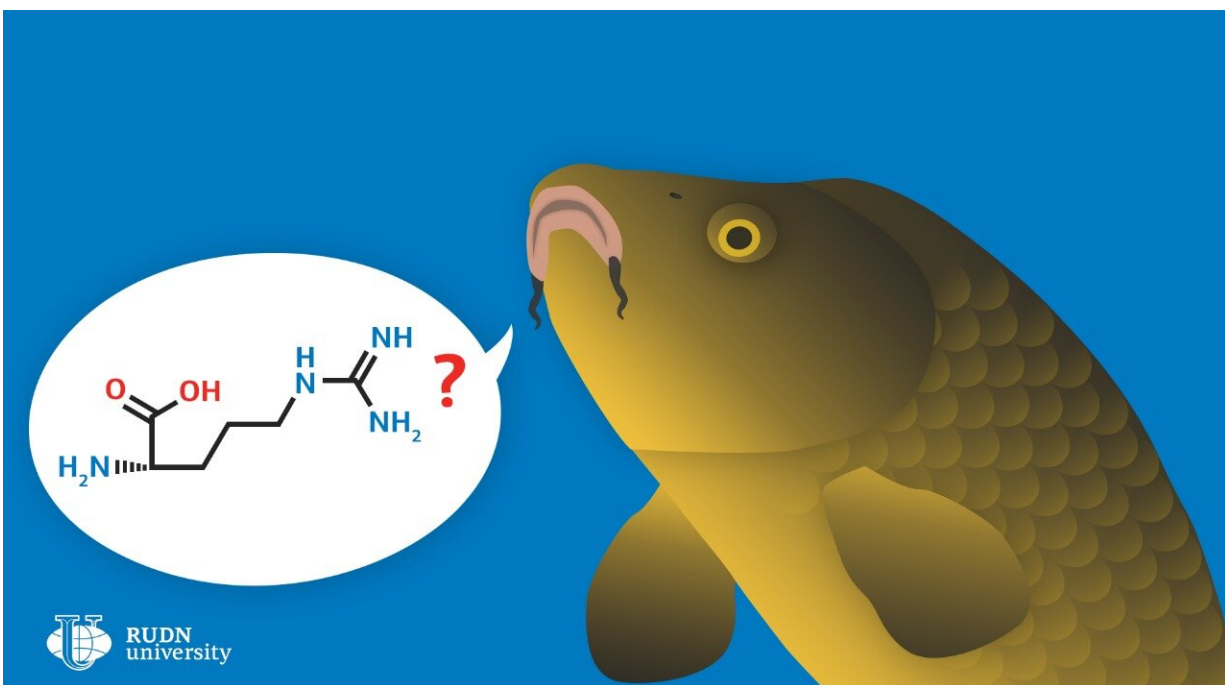


Method to protect carp from the harmful effects of ammonia

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Credit: RUDN University

Veterinarians from RUDN University have developed a way to increase the resistance of carp, the most common fish in fish farms, to the harmful effects of ammonia, which is found in almost all water bodies. The researchers found that the amino acid arginine added to fish food can be helpful. The results are published in the journal *Aquaculture*.

One of the main problems of fish farms is the pollution of water with [ammonia](#) (NH₃). The compound gets into [water bodies](#) via human activities, from [wastewater treatment plants](#), and runoff from livestock farms and fields where nitrogen fertilizers are used. Ammonia reduces the ability of hemoglobin to bind oxygen, acts on the nervous system, affects red blood cells, and can lead to fish death.

Director of the Department of Veterinary Medicine of RUDN University Yuri Vatnikov and his colleagues have developed a way to use food additives to increase the resistance to ammonia in common carp, a species of great economic importance—fish farms sell about 4 million tons of carp per year, according to the U.N. Food Organisation (FAO).

The veterinarians conducted two experiments in which they examined the effect of arginine, an amino acid that stimulates the release of growth hormone. In the first experiment, 600 carp were distributed over four tanks and kept there for 10 days, so that the fish adapted to new conditions.

After that, for two weeks, the fish in each tank were fed following one of four feeding options: with the addition of arginine in the proportion of 0.25 percent, 0.5 percent, or 1 percent by weight of the food, and without the addition of arginine (control group). Then the fish from each tank were distributed over 15 30-liter aquariums with 10 animals each. An ammonia solution was added to the water for three hours in concentrations of 0.7, 0.8, 0.9, 1.1, and 1.3 mg per liter. And finally, the water was vented and the condition of the fish assessed.

In the second experiment, 60 carp were distributed over six aquariums. After two weeks of acclimatisation, for the next 14 days, half of the specimens were fed with food to which no arginine was added, and another half was on a diet that included 0.5 percent arginine. Then an ammonia solution concentration of 0.7 mg per liter was added to all

tanks. After three hours of exposure to ammonia, the researchers took blood samples for analysis.

In the first experiment, the fish exposed to an aqueous solution concentration of 0.7 mg per liter ammonia survived regardless of the type of diet. An increase in the dose of ammonia led to the death of some specimens, and with the maximum ammonia concentration of 1.3 mg per liter, all fish died. In the group where arginine supplementation was 0.25 percent, mortality was 5 to 10 percent lower. With an increase in the dose of arginine to 0.5 percent, mortality decreased even more significantly, by about 35 percent.

The purpose of the second experiment was to study fish blood samples. Exposure to ammonia reduces the content of [amino acids](#), which play an important role in the formation of urea, in particular, the amino acids ornithine and citrulline. The addition of arginine increased the production of amino acids, which enhanced the processing of ammonia into urea. Thus, excess ammonia was excreted from the body.

The problem of the toxic effects of ammonia is of great importance in aquaculture. Fish farmers are interested in suppressing the side effects of ammonia. The new study offers a working method based on dietary manipulations—addition of just 0.5 percent arginine to the carp food reduces the [fish](#) mortality from exposure to ammonia by 35 percent. The additive activates detoxification, i.e., turning ammonia into urea, and suppresses oxidative stress caused by exposure to ammonia.

More information: Seyyed Morteza Hoseini et al. Effects of dietary arginine supplementation on ureagenesis and amino acid metabolism in common carp (*Cyprinus carpio*) exposed to ambient ammonia, *Aquaculture* (2019). [DOI: 10.1016/j.aquaculture.2019.734209](https://doi.org/10.1016/j.aquaculture.2019.734209)

Provided by RUDN University

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