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Determination of some heavy metals levels in common carp fingerlings fed with yeast

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Abstract

This study was carried out at fish laboratory of Animal Production Department, Faculty of Agricultural Sciences, University of Sulaimaniya using commercial dry yeast in three concentration (0%, 3%, and 5%) for 12 weeks to study their effects on concentration of some heavy metals (namely Cr, Cd, Co, Pb, Cu, Fe, Zn, and Mg) of common carp fingerlings (*Cyprinus carpio*). The experiment was included three treatments each in three replicates (plastic tanks) in which 10 fingerlings common carp of the same size and average weight (3.5 gram) were stocked in each aquarium. The actual experimental feeding trials lasted three months. Results indicated that the concentrations of heavy metals differ among the treatments.

Keywords: Carp; Yeast; Heavy metals.
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تقدير مستويات بعض العناصر الثقيلة في اصبعيات اسماك الكارب العادى المغذاة على الخميرة

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الخلاصة

أجريت هذه الدراسة في مختبر الأسماك من قسم الإنتاج الحيواني، فاكلتى العلوم الزراعية، جامعة السليمانية باستخدام الخميرة الجافة التجارية في ثلاث تركيز (٠٪، ٣٪، و ٥٪) لمدة ١٢ اسبوع لدراسة تأثيرها على تركيز بعض المعادن الثقيلة (الكروم، الكادميوم، الكوبلت، الرصاص، النحاس، الحديد، الزنك، والمغنيسيوم) لإصبعيات اسماك الكارب الشائع (*Cyprinus carpio*). تضمنت هذه التجربة ثلاثة معاملات لكل منها ثلاث مكررات (أحواض بلاستيكية) التي كانت مخزنة فيها ١٠ إصبعيات من نفس الحجم وبمعدل وزن (٣,٥ غرام) في كل حوض. استمرت التجربة مدة ثلاثة أشهر. وأشارت النتائج أن تراكيز المعادن الثقيلة إختلفت بين المعاملات المختلفة.

Introduction

The role of heavy metals in aquatic environments is increasingly becoming an issue of global concern at private and governmental levels with heavy metals biomagnifying and increasing their toxicity; high concentrations of heavy metals in surface water could lead to health hazards in man, either through drinking of the water and/or consumption of fish and other aquatic life forms (1). Many aquatic organisms have the ability to accumulate and bio-magnify contaminants like heavy metals, polycyclic aromatic hydrocarbons that are mutagenic and carcinogenic (2). The ingestion of these contaminants may affect not only the productivity and reproductive capabilities of these organisms, but ultimately affect the health of man (3).

Accumulation of trace elements in the tissues of fish living in aquatic environment depends on many factors (4). These factors include metal contents in water and food organisms, exposure time, environment conditions (e.g., pH, alkalinity, salinity), feed habit, age, and size of fish (5-8). The metals entering the aquatic ecosystem may not directly cause damage to organism but they can be

deposited in aquatic organisms through the effect of bioconcentration, bioaccumulation and other food chain processes, thus gets to man in concentrations that pose threats to human health via consumption of seafoods (9).

The differences in metal contents between localities are pronounced in muscle of chub, although muscle usually shows low levels of accumulation of trace elements and is recognized as a poor indicator of the pollution status of water environments (10,11). Similarly, other authors (8,12) also found differences in trace element concentrations in chub muscle in various polluted sections of the river. Thus, the purpose of the study was to determine the effect of different levels of dry yeast on some heavy metals level in common carp fingerlings.

Material and methods

The experiment was conducted for 12 weeks, using common carp (*Cyprinus carpio*, 3.5 g average weight) fingerlings obtained from Dukan hatchery. The experimental system was in 100 L plastic tanks.

Experimental diets and design

Commercial dry yeast was used to study their effects on some heavy metal concentrations in common carp (*Cyprinus carpio* fingerlings meat. The animals were allowed to adapt to the experimental system for a week and fed with a conventional diet after that time the different treatments (control treatment without any addition, first treatment addition of 3% of the dry yeast, second treatment the addition of 5% of the dry yeast) were randomly assigned to the tanks with three replicates per treatment, each with 6 fish. Feed was manually administered (3% of fish weight) ad libitum 2 times a day manually for 12 weeks. The water of the tanks was changed daily.

Heavy metal analysis

Chemical elements (Chromium (Cr), Cadmium (Cd), Cobalt (Co), Lead (Pb), Copper (Cu), Iron (Fe), Zinc (Zn), and Magnesium (Mg)) were estimated in the samples using Atomic Absorption after incineration of samples at 600 ºC by muffle furnace. Electrical blender homogenized fish meat specimens, 2 grams of fish (wet weight) were weighed and placed into 40 ml Pyrex conical centrifuge tubes fitted with poly– seal screw cap. The sample was shaken vigorously by hand with 25 ml aliquots acetone. The mixture was centrifuged for 3 minutes at 1500 rpm, and the acetone was removed by aspiration. 5 ml of acid bromide and 10ml (HNO_{3+} 4N H_2So_4) solution was then added to the residue, and the mixture was shaken gently by hand. Then 10 ml of toluene was added and the tube was shaken by hand for 1 min, and then centrifuged for 10 minutes at 1500 rpm. The solution was prepared for analysis in atomic absorption spectrophotometer by preparing 0.5ml of toluene extract and 0.5 ml of 10% dithizone into glass-stoppered tube on vortex mixture.

Results

The concentrations of heavy metals determined in fish muscles were in the following order in the control group as shown in table (1): Zn > Mg > Fe > Pb > Cr > Cu > Cd > Co. In the second treatment, group (3% yeast) the arrangement was in the pattern of Zn > Fe > Mg > Pb > Cr > Cu > Co > Cd and in the third group it was Fe > Mg > Zn > Pb > Cr > Cu >Cd > Co.

Table 1: The effect of two levels of dry yeast on some heavy metals concentrations (ppm).

Treatment	Cr	Cd	Co	Pb	Cu	Fe	Zn	Mg
T1 (0%)	0.21	0.05	0.04	1.99	0.18	3.01	4.32	4.01
T2 (3%)	0.22	0.03	0.02	1.54	0.09	3.18	4.22	2.69
T3 (5%)	0.43	0.08	0.02	1.01	0.11	2.98	1.56	2.54

Discussion

Studies from the field and the laboratory experiments reveal that accumulation of heavy metals in fish is mainly dependent upon metals concentration in ambient water and exposure period, although some other factors such as water salinity, pH, hardness and temperature, ecological needs, size and age, life cycle, capture season and feeding habits of fish also play significant role in metal accumulation (13,14**)**. Zinc concentration was high compared to other elements because it is essential in maintaining the gonads and to protect aquatic environment from the effects of cadmium toxic and this deliberately fish to absorb large amounts of this element (15). The concentration of selenium was high in the muscles of the three categories of fish examined and the evidence of the accumulation of this element from water into the bodies of living organisms, including fish and this is clear evidence on the grounds of fish as a vital indicator to the presence of contamination of these hazardous heavy elements (16).

The fish through different metabolic processes and the level of accumulations usually is independent of ambient concentration actively control accumulation of bioactive metals. Environmental concentrations affect the

accumulation of non-essential toxic elements (17,18). Bioactive metals are important in metabolism, thus in physiology and pathology of fish; metals like Zn, Cu, or Mn function as a cofactor in several enzyme systems (19). Iron is directly involved with hemoglobin formation in fish blood, however, when in excessively high concentrations, these bioactive metals may pose serious threats to normal metabolic processes (20,21).

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