

The Use of Probiotic Preparations on Basis of Bacteria of a Genus *Bacillus* During Intoxication of Lead and Zinc

A. Sizentcov, O. Kvan, A. Vishnyakov and E.E. Babushkina

FSEE HPE «Orenburg State University»,
Avenue Pobedy, 13, H. 16, R. 307, Orenburg, Russia, 460018

Abstract: this article gives the analysis of effectiveness of the use of probiotic preparations during intoxication of lead and zinc by means of estimation of its bioaccumulation out of different tissues of laboratory animals. *Annually*, the increasing level of technogenic load furthers the general accumulation of chemical pollutants. *Heavy metal* ranks as one of the main among the huge variety of substances polluting the environment. The study of this ability among microorganisms belonging to probiotic preparations especially among the bacteria of a genus *Bacillus* is of great interest. The important thing is that microorganisms of genus *Bacillus* belonging to probiotic preparations are self eliminating antagonists and they can have an antitoxic influence which is shown in active excretion of toxic elements from the organism especially heavy metals. *There* have been used three probiotic preparations: «Sporobacterin» (*B. subtilis* 534), «Biosporin» (*B. subtilis* 3 и *B. licheniformis*) и «Bactisubtil» (*B. cereus* IP 5832). *As* a toxicant there've been used zinc sulfate and lead nitrate. When choosing the metal we proceeded from the fact that it was the most widespread pollutant of the environment. *The* research on model of the groups-analogues of the laboratory rats took place in the experimental biological clinic (vivarium) of the Orenburg State University. *As* it comes from the above-stated *B. subtilis* 534 belonged to the preparation «Sporobacterin» has the highest accumulating ability, it reduces the concentration of lead ions on average to 58.9%, the similar index in groups O1 and O3 was 50.7% and 44.5%. *The* most effective preparation from the ones under study during poisoning of lead ions was «Sporobacterin», the least effective one-«Biosporin».

Key words: Probiotics • Lead • Zinc • Bioaccumulation • *Bacillus*

INTRODUCTION

This article gives the analysis of effectiveness of the use of probiotic preparations during intoxication of lead and zinc by means of estimation of its bioaccumulation out of different tissues of laboratory animals [1-3].

Annually, the increasing level of technogenic load furthers the general accumulation of chemical pollutants. Heavy metal ranks as one of the main among the huge variety of substances polluting the environment [4-6].

Metals, unlike organic polluting substances which are subject to the processes of decomposition, can only reassign between natural environments and further the pollution of foodstuffs causing pollution of the internal environment of human and animals.

The main difference of metals compared to other elements is their ability of bioaccumulation. It is well

known that ability to accumulate metals including heavy ones is widely spread in nature among different organisms [7-9]. The study of this ability among microorganisms belonging to probiotic preparations especially among the bacteria of a genus *Bacillus* is of great interest. The important thing is that microorganisms of genus *Bacillus* belonging to probiotic preparations are self eliminating antagonists and they can have an antitoxic influence which is shown in active excretion of toxic elements from the organism especially heavy metals [10-11].

MATERIALS AND METHODS

Based on the foregoing we have the following purpose: to study the efficiency of use of the probiotics on basis of spore-forming bacteria of a genus *Bacillus* during lead- and zinc-poisoning [12-15].

There have been used three probiotic preparations: «Sporobacterin» (*B. subtilis* 534), «Biosporin» (*B. subtilis* 3 и *B. licheniformis*) и «Bactisubtil» (*B. cereus* IP 5832).

As a toxicant there've been used zinc sulfate and lead nitrate. When choosing the metal we proceeded from the fact that it was the most widespread pollutant of the environment.

The research on model of the groups-analogues of the laboratory rats took place in the experimental biological clinic (vivarium) of the Orenburg State University.

For the purpose of the research there have been formed eight groups: 5 control ones and 3 experimental ones out of 96 individuals. K0- the main ration, K1- the main ration with the supplement of zinc sulfate on the basis of 100 ml/kg of the body weight, K2- the main ration with the supplement of "Sporobacterin", K3-the main ration with supplement of "Biosporin", K4-the main ration with the supplement of "Bactisubtil". Three experimental groups were getting the main ration with the supplement of zinc sulfate and probiotics- "Biosporin"(O1), "Sporobacterin"(O2), "Bactisubtil"(O3). Dosage of the probiotics corresponded to the annotations of the preparations. Experimental animals have been kept in the same conditions. Zinc sulfate was used on the first day of the experiment and probiotics from the first to the 7th day. Material taking was done on the 7th, 14th, 21st days.

We have analysed the ability of the bacilli to the accumulation of zinc ions in a tissues with help of atomic absorptive spectrometry (for that we took biological materials such as bones, muscles and skin of the laboratory animals).

Preparation of samples was done by the following method: the biomaterial of 5g weight was subjected to the ignition, then lime precipitations dissolved in a 10% nitric acid.

During the experiment it was determined that bone tissue has the most accumulating ability regarding zinc ions. There was the same situation as on the experiment studying the efficiency of use of the probiotics during the intoxication of lead ions.

RESULTS

The highest indices of accumulation of zinc ions were registered in the experimental group O3 (supplement of zinc and "Sporobacterin") which shows that under conditions of "in vivo" using zinc the most effective probiotic is "Sporobacterin" on basis of bacteria *B. subtilis* 534. The concentration of zinc ions in the tissue of this experimental group was on average 60.5% lower than the

control value, while the similar index in the groups where "Biosporin" and "Bactisubtil" were used was 47.1% and 47.9% (($p < 0,5$; $p < 0,01$).

Lead nitrate was taken on the first day of experiment and probiotics from the 1st to the 7th day. Material taking was done on the 7th, 14th, 21st days.

During the experiment it was determined that bone tissue has the most accumulating ability regarding lead ions (table 1), a reduction of the concentrations of lead ions was shown in both control and experimental groups on the 14th and 21st days of the experiment ($p < 0,01$).

However, in all the experimental groups there is a general tendency to reduction as compared to the control group, in which there was used only introduction of lead salt in the body. So, on the 7th day of experiment the quantity of ions in experimental animals' skin in the experimental group was 29.4% lower in group O1 (supplement of lead and "Biosporin"), 37.2% lower in group O2 (supplement of lead and "Sporobacterin") and 20% lower on group O3 (supplement of lead and "Bactisubtil"). In a muscular tissue the difference was 27,1 %, 38,0 %, 19,7 % and bone tissue- 25,2 %, 30,9 %, 7,4 % accordingly ($p < 0,5$; $p < 0,01$).

On the 14th and 21st days the concentration of lead ions in the experimental groups was lower regarding the control group, 40,3 % and 56,5 % lower in group O₁, 58,0 % и 67,9 % lower in group O₂, 33,7 % и 47,6 % in group O₃, in a muscular tissue 36,4 % and 41,2 %, 42,7 % and 47,1 %, 31,8% and 35,8 % lower accordingly, in a bone tissue 34,8 % and 53,5 %, 47,1 % and 61,5 %, 27,5 % and 48,4 %, accordingly. ($p < 0,5$; $p < 0,01$; $p < 0,001$).

As it comes from the above-stated *B. subtilis* 534 belonged to the preparation "Sporobacterin" has the highest accumulating ability, it reduces the concentration of lead ions on average to 58.9%, the similar index in groups O1 and O3 was 50.7% and 44.5%.

DISCUSSION

As we defined that bacteria of a genus *Bacillus* belonged to the probiotics under study have the ability to the accumulation of lead ions by defining their concentration in the tissue of the laboratory animals we also revealed that preparation help to reduce the toxic influence of lead ions in the tissues. Bone tissue has the most accumulating ability regarding lead ions. To the accumulation of zinc ions by defining their concentrations in the tissue of the laboratory animals we revealed that preparations help to reduce the toxic influence of zinc ions in the tissues. Bone tissue has the most accumulating ability regarding zinc ions.

The most effective preparation from the ones under study during poisoning of lead ions was “Sporobacterin”, the least effective one- “Biosporin”.

ACKNOWLEDGEMENTS

This work was supported by the President of the Russian Federation, the scholarship for young scientists and graduate students (SP-2012 competition, SP-102.2012.4).

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