Lysozyme-Producing Activity of Bacteria of Genus *Lactobacillus* Isolated from the Human Intestine in Dysbacteriosis of the Northern Residents

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Abstract: The research activity of lysozyme of bacteria of the genus Lactobacillus, isolated from human intestinal dysbiosis which was found that in all age groups, pre-possessed lactobacillus with low and medium activity of lysozyme (from 53.0 to 57.0% of cases). Lysozyme activity had the greatest representatives of the species of L. and L. jensenii fermentum. The lowest lysozyme activity was observed in lacto-bacteria species L. cellulosus and L. coryniformis. The absence of lysozyme activity was observed among members of the species L. lactis. The most lysozyme activity in the group of children younger than 1 year was observed in members of the species L. Fermentum, L. plantarum and L. rhamnosus in the group of children 2-15 years of L. and L. jensenii fermentum in the group aged 16 and older in L. sasei, L. delbrueskii and L. rhamnosus.

Key words: *Lactobacillus* • Lysozyme activity • The residents of the North

INTRODUCTION

Bacteria of the genus *Lactobacillus* are one of the important components of the microflora of the gastrointestinal tract [1-4]. These microorganisms in human organism are involved into metabolism, protection from external infection [5-7] and reveal the lysozyme-synthesized activity, suppressing the activity of a large number of pathogenic and conditionally pathogenic microorganisms [8, 9].

Majority of conditionally pathogenic bacteria can reduce the concentration of lysozyme by products anti-lysozyme factor [10, 11]. Therefore, the compensation of the deficit of lysozyme is important during the treatment and prevention of numerous diseases, including dysbacteriosis, closely related with secondary immunodeficiency conditions, reducing the colonization resistance of open cavities of the host organism.

Lactobacilli causing the dysfunction of the intestine biocenosis in the Northern residents were not identified. Our study was aimed at the research of phenotypic activity of lactobacilli at the intestinal dysbacteriosis of the inhabitants of the urban Northern territories.

MATERIALS AND METHODS

The residents of the Northern territories with the intestine dysbacteriosis were undergone the clinical and laboratory examination. There were following age groups allocated: children up to 1 year (group 1; \( n = 53 \)), children from 2 to 15 years (group 2; \( n = 52 \)), the third group was composed of young people from 16 to 29 years (\( n = 52 \)), living in the North longer 15 years.

The studies were conducted in the laboratory of Clinical and Experimental Pathology (headed by Professor A.V. Kuyarov, Doctor of Medical Science) of Medical Institute at Surgut State University, bacteriological laboratory of the Surgut Regional Clinical Hospital (headed by O.E. Khoreva), Day Surgery Hospital of the City Clinic # 4, Department of Clinical Immunology and...
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Identification of species was performed by digestion of 13 carbohydrates: glucose, maltose, mannitol, lactose, sucrose, rhamnose, arabinose, sorbitol, trehalose, salicin, raphinose, fructose and cellobiose. The bacterial inoculations were incubated at 37°C for 2–7 days. The results were evaluated by change of a color of the medium using the table “Digestion of carbohydrates by species of the genus Lactobacillus” according to the Bergey’s Key to Identification of Microorganisms.

RESULTS AND DISCUSSION

The identification of the species of the genus Lactobacillus isolated in patients with the intestine dysbacteriosis (Fig. 1) has shown that the species L. delbrueksii (20.8% of cases), L. casei (20.7%), L. rhamnosus (14.6%) and L. plantarum (12.5%) were mostly allocated in children of first life year. L. trichodes, L. brevis, L. fermentum, L. cellobiosus were phenotypically scarce (from 4.1 to 8.3% of cases) and L. corynoformis, L. acidophilus and L. jensenii were identified only in a few cases. The species composition of lactobacilli in children of preschool and school age was insignificantly different from the previous age group.

The intestine dysbacteriosis in people over the 16 years old proceeded with a significant reduction in the lactobacilli species composition. In a few cases, there were no L. trichodes, L. plantarum, L. acidophilus, L. cellobiosus, L. jensenii and L. lactis isolated.

Determination of lysozyme activity of lactobacilli isolated from the human intestine (Table 1) has showed that the maximum lysozyme activity of lactobacilli was 1.13 µg/ml in the group of children up to 1 year old. A decrease of lysozyme activity of lactobacilli with the concentration of lysozyme – 0.97 µg/ml \((P_{1.2} < 0.05)\) was observed in a group of 2-15 years old children. In the group of 16-29 years old young people, the lysozyme activity of lactobacilli was 1.02 µ/ml in average that is significantly higher than in the second group, but lower than in the first studied group \((P_{1.3} < 0.05)\). Lactobacilli with low and medium lysozyme activity are dominated in all age groups (Fig. 1) in 53.0-57.0% of cases.

![Fig. 1: The comparative characteristic of bacteria of the genus Lactobacillus isolated from the human intestines in different age groups](image1)

![Fig. 2: The degree of lysozyme activity of lactobacilli in different age groups](image2)

<table>
<thead>
<tr>
<th>Age group</th>
<th>(n)</th>
<th>(\bar{a} \pm m)</th>
<th>(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children up to 1 years old</td>
<td>53</td>
<td>1.13 ± 0.03</td>
<td>-</td>
</tr>
<tr>
<td>Children, 2-15 years old</td>
<td>52</td>
<td>0.97 ± 0.01</td>
<td>(P_{1.2} &lt; 0.05)</td>
</tr>
<tr>
<td>16 years old and older</td>
<td>52</td>
<td>1.02 ± 0.02</td>
<td>(P_{1.2} &lt; 0.05)</td>
</tr>
</tbody>
</table>

Note: \(^*\) - data reliability.
Fig. 3: Lysozyme activity of single species of lactobacilli in different age groups, µg/ml

Assessment of the lysozyme activity of single species of lactobacilli in different age groups (Fig. 3) has determined that L. jensenii and L. fermentum possessed the highest lysozyme activity in all studied groups. The lowest lysozyme activity was noted in species L. celllobiosus and L. corynoformis. The lack of lysozyme activity was observed in members of species L. lactis.

The maximum lysozyme activity (1,87 µg/ml) was identified in the members of species L. fermentum in the group of children up to 1 year old. The lowest lysozyme activity in this group was noted for L. plantarum (1,66 µg/ml) and L. rhamnosus (1,56 µg/ml). The members of Lactobacillus species L. jensenii (1,47 µg/ml), L. delbrueksii (1,24 µg/ml) and L. casei (1,14 µg/ml) had revealed the moderate lysozyme activity.

L. brevis (0,88 µg/ml), L. acidophilus (of 0.63 µg/ml) and L. trichodes (0,56 µg/ml) revealed low lysozyme activity while there were no activity in L. corynoformis, L. celllobiosus and L. lactis.

Maximum lysozyme activity revealed L. jensenii and L. fermentum (2,13 µg/ml) in the group of 2–15 years old children that is identified as high lysozyme activity. L. delbrueksii (1,24 µg/ml) showed the moderate lysozyme activity in this group and gradually followed by L. acidophilus (0,95 µg/ml), L. rhamnosus (0,9 µg/ml), L. casei (0,83 µg/ml), L. plantarum (0,73 µg/ml), L. celllobiosus (0,66 µg/ml), L. brevis (0,56 µg/ml) and L. trichodes (0,39 µg/ml). L. corynoformis and L. lactis were not identified in this age group.

In the group aged 16 and older, the maximum lysozyme activity was identified for L. casei (1,17 µg/ml), L. delbrueksii (1,11 µg/ml) and L. rhamnosus (1,06 µg/ml). These species are characterized by moderate lysozyme activity. L. brevis (0,79 µg/ml), L. fermentum (0,71 µg/ml) and L. corynoformis (0,52 µg/ml) characterized by low lysozyme activity. L. jensenii, L. plantarum, L. acidophilus, L. trichodes, L. celllobiosus and L. lactis, were not identified in this age group.

Thus, the study of lysozyme activity of bacteria of the genus Lactobacillus isolated from the intestine of the people with dysbacteriosis, revealed the range of lysozyme activity from 0,59 to 1,41 µg/ml. Lactobacilli with moderate and low degree of lysozyme activity identified in 53,0–57,0% of cases dominated in all age groups. Maximum lysozyme activity was noted for L. jensenii and L. fermentum.

The minimal lysozyme activity was observed for L. celllobiosus and L. corynoformis. The lack of lysozyme activity was determined for L. lactis. In the group of children up to 1 year old, the highest lysozyme activity was determined for L. fermentum with average for the group ~ 1,87 µg/ml followed with less degree by L. plantarum (1,66 µg/ml) and L. rhamnosus (1,56 µg/ml). In the group of 2-15 years old children, the maximum lysozyme activity was noted for L. casei (1,17 µg/ml), L. delbrueksii (1,11 µg/ml) and L. rhamnosus (1,06 µg/ml).

REFERENCES