Antioxidant Effect of Lactobacillus acidophilus as a Probiotic at Different Time Intervals

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Abstract

Background: Probiotics are survival microorganisms that, when administered in sufficient amounts, confer health benefits to the host and can be used in an antioxidative role.

Objectives: The antioxidative effect of whole cells and intracellular cell-free extracts of the lactic acid bacteria Lactobacillus acidophilus (PTCC 1643) as a probiotic at three different time intervals was investigated.

Materials and Methods: Antioxidant biomarkers, such as total antioxidant power (TAP), measured with the FRAP (ferric-reducing ability of plasma) method, were evaluated at 24, 48, and 72 hours.

Results: The results showed that extracts and bacteria of L. acidophilus were able to significantly increase TAP after 24 and 72 hours.

Conclusions: The results showed that the effect of L. acidophilus is time-dependent.

Keywords: Antioxidants, Probiotics, Lactobacillus acidophilus

1. Background

Probiotics are microbially derived factors that stimulate the growth of other organisms. Currently, probiotics are selected from the strains most favorable for the most intestinal bacteria, which belong to the yeast genera and to Bifidobacterium and Lactobacillus (1, 2), which are the most commonly used. The major target of the probiotic Lactobacillus is the human gastrointestinal tract. The benefits of probiotics, due to their antimicrobial and antioxidative properties, are predicted to increase the popularity of their use in humans (3). Various authors have reported the defense in opposition to the capability to reduce the risk for gathering of reactive oxygen species (ROS) and oxidative toxic stress (4, 5). The antioxidant properties of probiotics could be due to metal ion chelation, enzyme inhibition, reduction of ascorbate autoxidation, and ROS scavenging (6). The causes of this decline have been suggested to be increased oxidative stress and disorders in energy metabolism, which might participate in important functions (7, 8). Oxidative stress arises when there is a marked imbalance between the production and the elimination of ROS. It has been shown that exposure of living systems to various chemicals results in the urgent formation of free radicals that last for a matter of millisecond...
The TAP level was significantly lower (P < 0.05) among the extract samples in comparison to the bacterial samples after 72 hours (Table 2). The mean ± SE values for extracts and bacterial solutions were 95.32 ± 9.5 and 119 ± 11.1 Umol/mL, respectively (Table 2). No significant difference was observed in TAP between the groups after 48 hours (Table 3).

### Table 1. Total Antioxidant Power of Probiotics After 24 Hours of Incubation

<table>
<thead>
<tr>
<th>Group A (After 24 Hours)</th>
<th>TAP, Umol/mL&lt;sup&gt;a&lt;/sup&gt;</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extract</td>
<td>95.32 ± 9.5</td>
<td>0.04</td>
</tr>
<tr>
<td>Bacteria</td>
<td>119 ± 11.1</td>
<td>0.04</td>
</tr>
</tbody>
</table>

<sup>a</sup>Values are expressed as mean ± SD.

### Table 2. Total Antioxidant Power of Probiotics After 72 Hours of Incubation

<table>
<thead>
<tr>
<th>Group C (After 72 Hours)</th>
<th>TAP, Umol/mL&lt;sup&gt;a&lt;/sup&gt;</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extract</td>
<td>91.32 ± 8.6</td>
<td>0.04</td>
</tr>
<tr>
<td>Bacteria</td>
<td>125 ± 12.9</td>
<td>0.04</td>
</tr>
</tbody>
</table>

<sup>a</sup>Values are expressed as mean ± SD.

### Table 3. Total Antioxidant Power of Probiotics After 48 Hours of Incubation

<table>
<thead>
<tr>
<th>Group B (After 48 Hours)</th>
<th>TAP, Umol/mL&lt;sup&gt;a&lt;/sup&gt;</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extract</td>
<td>260 ± 13.6</td>
<td>0.65</td>
</tr>
<tr>
<td>Bacteria</td>
<td>295 ± 75</td>
<td>0.65</td>
</tr>
</tbody>
</table>

<sup>a</sup>Values are expressed as mean ± SD.

### 5. Discussion

In the present study, our purpose was to investigate novel activity of *L. acidophilus* as a probiotic at different time intervals (24, 48, and 72 hours) in extracts and bacterial samples in an in vitro study. Collectively, the results established that a significant increase in TAP was observed in extracts and bacterial samples after 24 and 72 hours, as shown in Tables 1-3. There has been increasing interest in the role and use of probiotics as a means of preventing oxidative damage in diseases due to high oxidative stress (15). ROS generation overwhelms antioxidant defenses, and ROS can interact with endogenous macromolecules and change cellular functions (16). A high level of ROS may also result in protein oxidation (PO) and lipid peroxidation (LPO). Consequently, PO and LPO levels can be used as biomarkers of ROS-induced tissue damage in various diseases (17, 18). Accumulating research has suggested that certain probiotics play various biological roles through several mechanisms, one of the most-debated of these being antioxidant activity (19). In fact, among the useful effects of probiotics in humans, protection against oxidative stress has been reported in several studies (20, 21). In this experimental study, specific strains of *L. acidophilus* showed...
antioxidant properties after different time intervals. Therefore, the results indicate that probiotic bacteria have antioxidant properties, calculated according to the FRAP method, which is used in many studies (22, 23). In every microbial collection, irrespective of the method used, broad dispersion of the values for antioxidant parameters was observed in different concentrations, and for TAP with the FRAP method. In this survey, the probiotic formulations were chosen from within the genera Lactobacillus and Bifidobacterium, the most commonly used probiotic bacteria. The special probiotic strains acted in concert to neutralize the oxidative stress induced in animal and human models (24). Some authors theorize that probiotics exert their protective effects against oxidative stress by restoring the gut microbiota (25). Acting in this way, antioxidant probiotic strains can be chosen and investigated as promising candidates for the prevention and control of several free radical-related disorders (26-28). Finally, L. acidophilus as a probiotic plays an important role in the alteration of oxidative injuries through TAP.

Footnote

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References


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