Effect of some probiotic Lactobacillus spp. on serum lipids of rats

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Abstract

The main target of the present work is to screen three tested strains of Lactobacillus spp. for functional characteristics for probiotics. The potential probiotic characteristics of three Lactobacillus spp. strains were studied with regard to acid/bile tolerance and surviving in gastric/intestinal juices. Results obtained revealed that all tested lactobacilli strains showed much greater stability at different low pH values (1.5, 2 and 3), and normal growth at bile concentrations up to 1 % w/v, which recommended these cultures to use as probiotic bacteria. Moreover, data obtained declared that all tested Lactobacillus cultures were considered intrinsically tolerant to gastric and intestinal juices. The potential role of these probiotic Lactobacillus cultures on serum lipid of rats was studied. Twenty-five male albino rats were randomly and equally divided into five groups, five rats each. After an adaptation period of 7 days, the first group was fed on basal diet served as control I, the second group was offered basal diet + buffalo's milk plus one of the tested lactobacilli strains. At the end of the 28 days’ experimental period, the rats were killed. However, blood samples were collected at the beginning and the end of experiment. From results obtained it could be concluded that supplementation of diets with fermented milk culture with either L. casei or L. rhamnosus resulted in noticeable decreases in total cholesterol, LDL-cholesterol and triglyceride contents. Moreover, theorectic indexes 1, 2 and 1 LDL/HDL ratio were markedly reduced in rats received fermented milk as compared with control treatment I (dry diet). In conclusion, fermented milk can decrease in the faecal counts of either coliform or streptococci.

Keywords: Lactobacillus spp; LDL; HDL.

INTRODUCTION

The genus Lactobacillus represent one of the major members of the lactic acid bacteria. Also, during the last three decades Lactobacillus is considered one of most commonly bacteria used as probiotic. However, probiotics are live microorganisms, which when administered in adequate amounts, confer a health benefit on the host (Sanders et al., 2003). Recently, there has been increasing interest in the use of probiotics to prevent, to alleviate or to treat a variety of infectious and inflammatory conditions. These bacteria, may have several therapeutic functions, including antimicrobial activity, ability to assimilate cholesterol, improved lactose utilization and anti-carcinogenic activity (Chou and Weimer, 1999). Therefore, probiotics should meet criteria as identified by FAO/WHO such as safe for consumption and exposing to low pH and important criteria is the ability to confer a health benefit on a host. Therefore, the main target of the present work is to screen three tested strains of Lactobacillus spp. for functional characteristics for probiotics. An additional aim is to evaluate in vivo the impact of feeding rats on fermented milk cultured with different Lactobacillus spp. strains on serum lipids of rats and fecal microflora.

MATERIALS AND METHODS

Materials

Tested strains

Three identified Lactobacillus cultures were used in the present study, namely L. casei AZ1, and L. rhamnosus AZ1 isolated from feces of breast-fed infant, while L. gasseri AZ1 isolated from raw milk.

Bile acid

Bile salt was obtained from Difco Laboratories, Detroit, Michigan, USA.

Pepsin and pancreatin

Pepsin from Procine stomach mucosa and Pancreatin from porcine pancreas were delivered from Sigma Chemical Co. Missouri 63103, USA.

Albino rats

Twenty-five mature male albino rates, obtained from the Osman farm animal experiments, with mean body weights of 130 ± 5 gm, were used in the present study.

Basel diet

The chemical composition of basal or control diet was as follows: raw protein, 23%; raw fat, 6.40%; fibers, 3.60% and starch, 67%.
Buffalo's milk

The chemical composition of buffalo's milk obtained from the herd of Faculty of Agriculture, Al-Azhar Univ. Cairo, was as follows: fat, 6.1%; lactose, 4.3%; protein, 4.1%; solids not fat, 8.9% and salts, 0.5%.

Blood samples

At the beginning of this experiment and after adaptation period, blood samples were drawn from the retrobulber venous plexus of each rat through a capillary glass tube and left to clot at room temperature to obtain a clear serum. At the end of experiment, the rates were killed by withdrawing blood from the abdominal aorta under light diethyl ether anesthesia.

Faeces samples:

Rate faeces samples were collected every week in sterile Petri dishes transferred to laboratory in ice box and immediately subjected to microbiological analysis.

Media

For propagation and maintenance of Lactobacillus strains MRS broth / medium was used as recommended by De Man Rogosa and Sharp (1960), while for enumeration of coliform count, violet red bile agar (VRBA) medium was adopted as recommended by Klein and Fung (1978). Whereas, the count of staphylococci was determined on Staph 110 media according to APHA, (1992).

Methods

Acid tolerance

Three tested strains were evaluated for their ability to grow in low pH values (1.5, 2 and 3) as described by Pereria and Gibson (2002) with some modifications: MRS broth previously adjusted to pH 1.5, 2 and 3 with HCl, were inoculated with 1% (v/v) of activated tested cultures, the tubes were maintained at 37°C for 3hours. One-milliliter of each samples were taken at various times (0, 60, 120, and 180 min) serially 10-fold diluted and plated into MRS agar, the plates were incubated at 37°C for 48 hours under anaerobic conditions by using double layer technique before enumeration.

Bile tolerance

Bile tolerance was estimated as described by Pereia and Gibson (2002). Overnight tested cultures (1% v/v) were added into MRS broth with concentrations (0.3, 0.5, and 1% w/v) of bile salts inoculated anaerobically at 37°C for 12h. One-milliliter of each samples were taken at the end of the experiment (12 h), serially diluted, into MRS agar. The plates were incubated at 37°C for 48 hours under anaerobic conditions.

Tolerance of artificial gastric and intestinal juices

Gastric and pancreatic juices were prepared freshly by dissolving pepsin (Sigma) from porcine stomach mucosa (3g/L) and pancreatin (Sigma) from porcin pancreas (1g/L) in sterile saline (5g/L) (Chateris et al. 1998). The pHs of the gastric and pancreatic preparations were adjusted to 2.0 and 8.0 with 5 M/L HCl or 1M/L NaOH, respectively.

One milliliter of each activated tested cultures was centrifuged 5000 x g for 10 min at 4°C and washed three time in sterile PBS. Of each washed cell washed cell suspension 0.2 ml was mixed with 1 ml of gastric or intestinal juice. After brief vortexing the mixtures were incubated at 37°C. When assaying gastric tolerance aliquots of 0.1 ml were removed after 60, 120 and 180 min for determination of total viable count, while for assaying intestinal tolerance, the sampling times were 60, 240 and 360 min.

Feeding Experiment

Rats were randomly and equally divided into five groups, five rats each. The animals were housed in cages at room temperature (25 ± 2°C) and relative humidity (about 55%) for 28 days. These rats were acclimatized on basal diet for one week before starting the experiment.

After an adaptation period for 7 days, the first group was fed on basal diet (80 g/rat.day⁻¹) and served as control I, while the second group was offered basal diet plus standardized buffalo's milk (40 mL/rat.day⁻¹) and served as control II. The other groups were fed on: 80 g basal diet plus 40 mL buffalo's milk and one of the tested Lactobacillus strains for each rat/day. The animals were weighed at the beginning and the end of the experimental period.

Determination of total cholesterol or triglycerides contents

The total cholesterol or triglycerides concentration were determined in the blood serum by using Spectrum diagnostic kits. The total cholesterol concentration was calculated by using the following equation:

Cholesterol (mg/dL) = (A of the tested sample/A of the standard solution) x200.

While, triglycerides concentration was calculated using the following formula:

Triglycerides (mg/dL) = (A of the tested sample/A of the standard solution) x200.
where: \( A \) = Absorbance at 546 nm.

**Determination of High density lipoproteins (HDL) cholesterol content**

HDL-cholesterol was determined in blood serum by using Genesis kit, and its concentration calculated by using equation:

\[
\text{Concentration of HDL-cholesterol (mg/dL)} = \frac{A}{570}
\]

where: \( A \) = Absorbance at 546 nm.

**Determination of Low density lipoproteins (LDL) cholesterol content**

The LDL-cholesterol was estimated according to the formula of Beena and Prasad (1997) as follows:

\[
\text{LDL-cholesterol (mg/dL)} = \text{Total cholesterol} - (\text{HDL} + \frac{\text{triglycerides}}{5})
\]

**Calculation of atherogenic indexes**

The atherogenic indexes were calculated as LDL-cholesterol / total cholesterol (index 1) and (total cholesterol – HDL)/HDL (index 2).

**Biological Evolution of rat diets**

Biological evolution of the different diets was carried out according to Carthew et al. (2001) by using the following equations:

- Body weight gain = final weight – initial weight
- Food efficiency ratio = Daily growth rate/Daily food intake
- Growth rate, g/day = Body weight gain, g / Experimental period long, day.

**Fecal bacterial population**

Appropriate dilution of each fecal sample was plated on either violet red bile agar (VRBA) or staph.110media, plated were either incubated at 37°C for 24 or 48h coliform and staphylococcus, respectively (APHA, 1992).

**Statistical analysis**

Analysis of variance was computed using the General Linear Model procedure of statistical analysis system (SPSS, 2011). Variable means for treatments indicating significant differences in the ANOVA were compared.

**RESULTS AND DISCUSSION**

**Screening of Lactobacillus strains for their probiotic characteristics**

**Tolerance to acid and bile salts**

In the present study, all the tested Lactobacillus spp. were successfully survival in different low pH values (Table 1). They retained varying levels of viability ranged from 100.62 % to 109.04 %. However, pH 1.5 seemed to be more damaging to the tested strains. In this respect, Maffei and Nobrega (1975) stated that the bactericidal effect of acid is evident at pH values below 2.5. Among the tested Lactobacillus strains, *L. gasseri* AZ1 was the most acid tolerant, while the least survival was observed for *L. rhamnosus* AZ1 strain.

| Table 1. Effect of low pH values on viability of tested Lactobacillus spp. strain. |
|-----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Strains                          | PH          | Incubation time (min) | Log Cfu/mL | % increase | Log Cfu/mL | % increase | Log Cfu/mL | % increase |
|                                  |             | 0          | 60          | 120         | 180         | 60          | 180         | 60          |
| *L. casei* AZ1 KY123805          | 1.5         | 12.76     | 12.89       | 1.07        | 12.96       | 12.89       | 1.07        | 12.96       | 12.89       |
|                                  | 2           | 13.92     | 14.27       | 2.53        | 14.27       | 14.27       | 2.53        | 14.27       | 14.27       |
| *L. gasseri* AZ1 KY123806        | 1.5         | 12.97     | 13.22       | 1.92        | 13.06       | 13.22       | 1.92        | 13.06       | 13.22       |
| *L. rhamnosus* AZ1 KY123789      | 1.5         | 12.82     | 12.90       | 0.62        | 12.93       | 12.90       | 0.62        | 12.93       | 12.90       |
|                                  | 2           | 13.89     | 14.16       | 1.93        | 14.30       | 14.16       | 1.93        | 14.30       | 14.16       |

cfu: colony forming unit.
Fig. 1. Bile tolerance of *L. casei* AZ1 KY123805 on different bile salt concentrations.

Fig. 2. Bile tolerance of *L. gasseri* AZ1 KY123806 on different bile salt concentrations.

Fig. 3. Bile tolerance of *L. rhamnosus* AZ1 KY123789 on different bile salt concentrations.
Tolerance to bile salts is a prerequisite for colonization and metabolic activity of bacteria in small intestine of the host (Havenaar et al., 1992). Once the bacteria reach the intestinal tract, bile entering the duodenal section of small intestine has been found to reduce survival of bacteria. Therefore, probiotics must have an ability to tolerate bile (Kimoto et al., 2000).

In agreement with literate recordings, all tested Lactobacillus strains exhibited excellent bile tolerance (Figures 1, 2 and 3). In this regard, Oh et al., (2000) mentioned that Lactobacillus was capable of surviving in the presence of bile due to its ability to deconjugate bile acids bile acids. Also, it was of interest to notice that all tested Lactobacillus strains showed varying response toward different bile salt concentrations. In this connection, Gopal et al., (1996) reported that the observed differences in tolerance to bile may partly due to the natural differences in growth of individual strains.

**Tolerant to simulated gastric and small intestinal juices:**

About 2.5 L. of gastric juice and 0.7 L. of pancreatic juice are secreted each day, these secretions present a pH and enzymatic barrier and act in concert with bile to ensure the survival of ingested microorganisms during digestion. Therefore, surviving gastrointestinal transit was found to be an important functional property of tested probiotic bacteria (Succi et al., 2005 and Vizoso et al., 2006).

As shown from Table 2 gastric juice exerted variable influence on the growth of examined cultures. In general, L. casei AZ1 strain exhibited more gastric juice resistance than other tested cultures. However, variation in the tolerance to gastric juice was previously reported by Mathara et al. (2008) and Kershah (2014). In generally, the three tested Lactobacillus cultures exhibited acceptable levels of survivability and considered intrinsically tolerant to gastric juice, since at least ≥10⁶ cfu/ml of each strain survived after 180 min of exposure, as previously concluded by Guerra et al., (2007).

From the foregoing results, it could be pointed out that all tested strains could be successfully transit the human stomach and reaching the intestinal tract and functioning effectively there.

It was obvious, as the data in Figure 4, that all tested cultures retained viability during growth in simulated intestinal juice and considered intrinsically tolerant to intestinal transit. In this respect, Charteris et al., (1998) stated that the majority of probiotic strains were intrinsically resistant to simulated pancreatic juice and showed no reduction in viability up to 4 hours.

According to the obtained results, it might be deduced that L. gasseri AZ1 was markedly with regard to intestinal juice tolerance followed by L. casei AZ1 strain. However, several authors previously concluded that variations and degree of response to intestinal juice may be strain dependent (Sultana et al., 2000; Guerra et al., 2007; Kim et al., 2008). According to the foregoing results, it could be concluded that the three tested lactobacilli strains may be promising candidate strains for use as probiotics.

**Feeding Experiment:**

An extensive investigation concerning the potential role of probiotic lactobacilli strains was carried out. Data obtained were summarized in Tables 3, 4 and 5.

The effect of different diets on growth parameters of rats is presented in Table 3. At the end of the experiment (28 days), significant differences in final body weights of all rats were detected, but rats received fermented milk products gained higher body weights than those fed only dry diet (cont. I). Anon (1997) concluded that fermentation of milk by lactic acid bacteria was reported to increased its protein availability and its nutritional value. However, our findings are in agreement with those previously reported by Abd El-Gawad et al. (2005), Zommara et al. (2006) and Mohamed (2009). Also, as seen from the same table, rats received milk cultured with L. casei gained the highest final body weight, being 259.3 g.

In addition, the present results revealed that there were no considerable variations between growth rate or food efficiency among different treatments. This statement is consistent with previous finding of Zommara (2002). Moreover, significant differences were detected among dietary groups in food intake (g/ day), while no-significant differences were observed in body weight gain (g). This finding is in contrary to those reported by Abd El-Gawad et al. (2005) and Mohamed (2009).

In order to assess the potential hypcholesterolamic properties of fermented milk made with different Lactobacillus strains albino rats were used as an animal model. Results of determination blood serum lipids of rats were presented in Tables 4 and 5.

The results obtained indicated that serum cholesterol level in control II was significantly higher than in control I, by 24.07 % at the end of the experiment. Compared with control group (cont.I), the total serum cholesterol were lowered by 21.39% and 15.74% in rats fed on L. casei and L. rhamnosus, respectively. However, our results are consistent
with previous reports of Zommara et al. (2006), Mohamed (2009), Ying et al. (2010), Chuan et al. (2014), Song et al. (2015) and Bobae et al. (2016).

In contrast, *L. gasseri* achieved an opposite trend, in which their final total cholesterol level was markedly increased by 13.27% as compared with control I.

Also, it could be noticed from obtained results that there were significant differences in HDL-cholesterol level between different treatments at the end of the experiment. However, the levels of serum HDL-cholesterol were increased throughout experiment period and the increases values ranged from 4.02% to 29.44%, as compared with their corresponding initial values. Zilva and Mayne (1991) stated that HDL-cholesterol levels are "anti-atherogenic", where their reduced level are associated with increased risk of coronary artery disease.

Since a high blood LDL-cholesterol is associated with increased risk of atherosclerosis and cardiovascular disease, any product that lower this level is of potential value. Therefore, the effect of feeding rats on different lactobacilli strains on LDL-cholesterol level was carried out, results obtained presented in Table (4).

<table>
<thead>
<tr>
<th>Table 2. Effect of simulated gastric juice on viability of tested Lactobacillus spp. strains.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strains</td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td><em>L. gasseri</em> AZ1 KY123806</td>
</tr>
<tr>
<td><em>L. rhamnosus</em> AZ1 KY123789</td>
</tr>
</tbody>
</table>

*cfu*: colony forming unit.

![Fig. 4. Viability of tested Lactobacillus spp. at simulated intestinal juice.](image-url)


Table 3. Growth parameters of rats fed on some fermented milk products cultured with *Lactobacillus* spp.

<table>
<thead>
<tr>
<th>Treatments Parameters</th>
<th>Control I dry diet</th>
<th>Control II B.M. (6.1% fat)</th>
<th><em>L. casei</em> AZ1 KY123805</th>
<th><em>L. gasseri</em> AZ1 KY123806</th>
<th><em>L. rhamnosus</em> AZ1 KY123789</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial body weight (g)</td>
<td>140.8</td>
<td>141.3</td>
<td>142.2</td>
<td>141.4</td>
<td>139</td>
<td>-</td>
</tr>
<tr>
<td>Final body weight (g)</td>
<td>245</td>
<td>256.3</td>
<td>259.3</td>
<td>256.3</td>
<td>257</td>
<td>0.008*</td>
</tr>
<tr>
<td>% change to normal control</td>
<td>-</td>
<td>4.61</td>
<td>5.84</td>
<td>4.61</td>
<td>4.90</td>
<td>-</td>
</tr>
<tr>
<td>Food intake (g/day)</td>
<td>22.3</td>
<td>21.9</td>
<td>22.7</td>
<td>21.4</td>
<td>22.9</td>
<td>0.030*</td>
</tr>
<tr>
<td>Body weight gain (g)</td>
<td>104.2</td>
<td>115.3</td>
<td>117.1</td>
<td>114.9</td>
<td>118.4</td>
<td>0.0483 (n.s)</td>
</tr>
<tr>
<td>Growth rate (g/day)</td>
<td>3.72</td>
<td>4.11</td>
<td>4.18</td>
<td>4.10</td>
<td>4.21</td>
<td>-</td>
</tr>
<tr>
<td>Food efficiency</td>
<td>0.169</td>
<td>0.188</td>
<td>0.184</td>
<td>0.192</td>
<td>0.184</td>
<td>-</td>
</tr>
</tbody>
</table>

B.M: Buffalo’s milk; n.s: non-significant; *: significant.

Table 4. Levels of serum total cholesterol and HDL-cholesterol in rats fed on some fermented milk products cultured with *Lactobacillus* spp.

<table>
<thead>
<tr>
<th>Item</th>
<th>Treatments</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameters</td>
<td>Control I dry diet</td>
<td>Control II B.M. (6.1% fat)</td>
</tr>
<tr>
<td>Initial LDL cholesterol (mg/dL)</td>
<td>24.27</td>
<td>25.62</td>
</tr>
<tr>
<td>Final LDL-cholesterol (mg/dL)</td>
<td>14.69</td>
<td>33.40</td>
</tr>
<tr>
<td>% Change to normal control</td>
<td>-</td>
<td>(+) 127.13</td>
</tr>
<tr>
<td>Initial triglycerides (mg/dL)</td>
<td>93.43</td>
<td>95.22</td>
</tr>
<tr>
<td>Final triglycerides (mg/dL)</td>
<td>97.48</td>
<td>172.53</td>
</tr>
<tr>
<td>% change to normal control</td>
<td>-</td>
<td>(+) 76.99</td>
</tr>
</tbody>
</table>

B.M: Buffalo’s; *: significant; **: high significant; HDL: high-density lipoprotein; (+): increase; (-): decrease.

Table 5. Levels of LDL-cholesterol and serum triglycerides in rats fed on some fermented milk products with *Lactobacillus* spp.

<table>
<thead>
<tr>
<th>Item</th>
<th>Treatments</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameters</td>
<td>Control I dry diet</td>
<td>Control II B.M. (6.1% fat)</td>
</tr>
<tr>
<td>Initial total cholesterol (mg/dL)</td>
<td>111.36</td>
<td>114.77</td>
</tr>
<tr>
<td>Final total cholesterol (mg/dL)</td>
<td>122.73</td>
<td>152.27</td>
</tr>
<tr>
<td>% change to normal control</td>
<td>-</td>
<td>(+) 24.07</td>
</tr>
<tr>
<td>Initial HDL-cholesterol (mg/dL)</td>
<td>68.40</td>
<td>70.11</td>
</tr>
<tr>
<td>Final HDL-cholesterol (mg/dL)</td>
<td>88.54</td>
<td>84.63</td>
</tr>
<tr>
<td>% change to normal control</td>
<td>-</td>
<td>(-) 4.42</td>
</tr>
</tbody>
</table>

B.M: Buffalo’s Milk; n.s: non-significant; **: high significant; LDL: low-density lipoprotein; (+): increase; (-): decrease.

It might be gathered from the data obtained that buffalo’s milk supplementation to dry diet had markedly increase on level of LDL-cholesterol by 127.3%. Also, it is noteworthy from the same table the rats fed on by fermented milk cultured by either *L. rhamnosus AZ1* or *L. casei AZ1* possessed the lowest serum LDL-cholesterol concentrations, actually 8.95 mg/dL with the highest reduction.
level, actually 39.07%, while the corresponding figures were 11.42 mg/dL and 22.27%, respectively for L. casei. These results might be considered as promising, because 1% reduction in cholesterol can reduce the risk of cardiovascular disease for 2 – 3% (Kourelis et al., 2010). In agreement with our finding, previous studies showed that receiving fermented milk products reduce LDL-cholesterol concentration (Abd El-Gawad et al., 2005; Zommara et al., 2006; Ying Huang et al., 2013 and Song et al., 2015).

Furthermore, alternation in triglycerides content was studied and data obtained presented in Table 4. From these results it could be noticed that addition of buffalo’s milk to the normal diet (cont. II) markedly increased serum triglycerides by 76.99% as compared to dry diet (cont. I). In addition, rats received fermented milk cultured by either L. casei or L. Rhamnosus ranked noticeable decreases in serum triglycerides content, actually 16.49% and 21.99%, respectively as compared to dry diet (cont. I). Recently, several investigators confirmed the reduction of triglycerides concentrations in rats fed different fermented milk products (Ying Huang et al., 2013; Xu et al., 2013 and Bobae et al., 2016).

As a matter of fact, the atherogenic index is an indication for the susceptibility for atherosclerosis. Therefore, the atherogenic indices were calculated and results illustrated in Table 5. Buffalo’s milk supplementation to basal diet (cont. II) led to obvious increases in atherogenic indexes 1, 2 and LDL / HDL ratio by mean values of 82.5%, 51.69% and 137.91% respectively as compared with control treatment I. The same trend of result was previously reported by Zommara et al. (2006) and Mohamed (2009).

Table 6. Levels of atherogenic indices in rats fed on some fermented milk products cultured with Lactobacillus spp.

<table>
<thead>
<tr>
<th>Item</th>
<th>Control I dry diet</th>
<th>Control II B.M. (6.1% fat)</th>
<th>L. casei AZ1 KY123805</th>
<th>L. gasseri AZ1 KY123806</th>
<th>L. rhamnosus AZ1 KY123789</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameters</td>
<td>0.721</td>
<td>0.556</td>
<td>0.713</td>
<td>0.595</td>
<td>0.770</td>
<td>0.018*</td>
</tr>
<tr>
<td>Final HDL/total cholesterol (mg/dL)</td>
<td>0.120</td>
<td>0.219</td>
<td>0.118</td>
<td>0.223</td>
<td>0.087</td>
<td>0.330 (n.s)</td>
</tr>
<tr>
<td>Atherogenic index 1</td>
<td>0.386</td>
<td>0.799</td>
<td>0.403</td>
<td>0.682</td>
<td>0.299</td>
<td>0.018*</td>
</tr>
<tr>
<td>Atherogenic index 2</td>
<td>16.59</td>
<td>39.47</td>
<td>16.60</td>
<td>37.47</td>
<td>11.24</td>
<td>0.202 (n.s)</td>
</tr>
<tr>
<td>% LDL/HDL ratio</td>
<td>0.721</td>
<td>0.556</td>
<td>0.713</td>
<td>0.595</td>
<td>0.770</td>
<td>0.018*</td>
</tr>
</tbody>
</table>

B.M: Buffalo’s; n.s: non-significant; *: significant; atherogenic index 1: (LDL/total cholesterol); atherogenic index 2: (Total cholesterol-HDL)/HDL.

Continuously, the examined Lactobacillus spp. showed different results towards atherogenic indices, were rats received fermented product cultured with L. rhamnosus AZ1, reduced markedly the atherogenic indexes I, 2 and LDL / HDL ratio by a mean values of 27.5%, 22.54% and 32.25%, respectively, as compared with control treatment I. In contrast, fermented product cultured with L. gasseri showed an opposite trend.

The effect of fermented milk culture products cultured with Lactobacillus spp. on rats’ intestinal pathogenic microflora had been studied. Data obtained graphically plotted in Figures 5 and 6. Faeces of rats received dry diet or dry diet plus buffalo’s milk showed increases in the counts of coliform by 4.5% and 6.65% respectively, and in staphylococci counts by 7.12% and 7.29% respectively.

In contrast, rats fed on fermented products exhibited highly decreases in the populations of either coliform or staphylococci in their faeces. However, the decrease in coliform counts varied from 3.6% to 30.65%, while, the reduction values for staphylococci ranged from 7.95% to 15.88%. This finding may be due to the double effect of developing acidity and the production of antimicrobial agents which suppress the growth of both pathogens (Kebary, 1995 and Badawi & El-Sonbaty, 1997).

Generally, the obtained results strongly suggest that both L. casei and L. rhamnosus are promising candidate as they exhibited pronounced hypolipidemic effect and greater antagonistic effect against either coliforms of staphylococci strains.
CONCLUSION
The total serum cholesterol levels were lowered by 21.39 % and 15.74 % in the group fed L. casei KY123805 and L. rhamnosus KY123789, respectively. Contrarily, to L. casei and L. rhamnosus, L. gasseri KY123806 achieved opposite trend. Plasma HDL-cholesterol levels were increased at the end of the experiment as compared with control I.

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تأثير بعض المدعمات الحيوية على ليبيدات الدم في الفئران

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المصلح العربي

انطلق في هذا الدراسة البحث إلى دراسة قدرة سلالة لباصكيلاس Lactobacillus spp. على تحميل الحمض والأحماض الصفراء والبقاء على قيد الحياة في المعدة المعوية. تم استخدام بعض المدعمات الحيوية لاجتماعات الليبيدات في الفئران. وتم استخدام حبوب التغذية المعوية لاحتضان الفئران. حيث تم تقسيم الفئران إلى خمسة مجموعات، كل مجموعة تحتوي على خمسة فئران. تم تغذية الفئران المعوية لباصكيلاس Lactobacillus في اليوم الأول، وتم تغذية الفئران المعوية لباصكيلاس Lactobacillus في اليوم الثاني، وتم تغذية الفئران المعوية لباصكيلاس Lactobacillus في اليوم الثالث، وتم تغذية الفئران المعوية لباصكيلاس Lactobacillus في اليوم الرابع، وتم تغذية الفئران المعوية لباصكيلاس Lactobacillus في اليوم الخامس.

النتائج:

1. انخفض مستوى الكوليسترول الكلي (LDL) والمجهرات الثلاثية في الفئران التي تناولت الحبوب المعوية لباصكيلاس Lactobacillus بشكل ملحوظ بشكل ملحوظ.
2. انخفض مستوى أول ال hạiات في الفئران التي تناولت الحبوب المعوية لباصكيلاس Lactobacillus بشكل ملحوظ بشكل ملحوظ.
3. انخفض مستوى الحمض والأحماض الصفراء في الفئران التي تناولت الحبوب المعوية لباصكيلاس Lactobacillus بشكل ملحوظ بشكل ملحوظ.

الخلاصة:

نتيجة الدراسة أن بعض المدعمات الحيوية لها تأثيرات إيجابية على تحميل الحمض والأحماض الصفراء والبقاء على قيد الحياة في الفئران.