INTRODUCTION

The incidence of non-insulin dependent diabetes mellitus (NIDDM), also known as type 2 diabetes, is increasing throughout the world, especially among young people [1]. The disease is characterized by high blood glucose due to insulin resistance. Delipidemia and decrease antioxidant defense are also features of the disease. Diabetes-related complications (such as cardiovascular diseases), represent the fifth worldwide leading cause of death [2] and the World Health Organization estimates that, in 2030, the number of diabetics will double [3]. Because the available therapeutic strategies are not completely efficient, there is a growing interest in the search of new compounds for treatment and also prevention of diabetes type 2.

Salvia officinalis (common sage) extracts and constituents are known for their antioxidant and anti-inflammatory properties [4] and also for their beneficial effects on age-related memory loss and depression [5]. Recent experimental studies have shown that a water extract of S. officinalis reduces liver glucose production and fasting plasma glucose levels in normal rats, suggesting an antidiabetic potential [6]. Here we report the result of a pilot trial performed in healthy humans. Parameters such as haemoglobin, erythrocyte antioxidant enzymes activities (SOD and CAT) as well as aminotransferases activities (AST and ALT), total cholesterol, LDL, HLD and glucose were measured.

EXPERIMENTAL OUTLINE

RESULTS AND DISCUSSION

The presence of the enzymes alanine aminotransferase (ALT) and aspartate aminotransferase (AST) in the plasma is considered an indicator of liver injury. The results of this study indicate that below of the indicating level of hepatotoxicity.

Table I: Enzymatic activities of ALT and AST in the plasma, quantified throughout the different phases of the assay.

<table>
<thead>
<tr>
<th>Study stages</th>
<th>Enzymatic activities</th>
<th>Reference values (IU/L)</th>
<th>ALT</th>
<th>AST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline (B)</td>
<td>Control 1</td>
<td>96 ± 11</td>
<td>10.0 ± 1.6</td>
<td>8.0 ± 1.5</td>
</tr>
<tr>
<td>Treatment 2</td>
<td>Control 2</td>
<td>10.0 ± 2.0</td>
<td>8.0 ± 1.5</td>
<td>6.0 ± 1.5</td>
</tr>
<tr>
<td>Treatment 4</td>
<td>Control 3</td>
<td>10.0 ± 3.0</td>
<td>6.0 ± 1.5</td>
<td>2.0 ± 1.5</td>
</tr>
</tbody>
</table>

Values are mean ± SEM (n = 6). Statistical differences were assessed by One-way ANOVA followed by a Student-Newman-Keuls test. * P ≤ 0.05 when compared with baseline values.

Antioxidant enzymes

The significant increase in erythrocytes activities of superoxide dismutase (SOD) and catalase (CAT) suggests that sage tea has an effect on the improvement of antioxidant defences (Fig. 3). These enzymes play an important role in organism oxidative stress protection which is involved in aging and is associated to the development of different diseases, such as diabetes mellitus and its complications.

Lipid profile

The results indicate that Salvia officinalis (sage) tea did not have adverse effects on any measured parameters including blood pressure, heart rate at rest and body weight.

Glycaemia

Considering that fasting and postprandial glucose levels in blood and plasma did not change during the different phases of the trial, we believe that there is no reason to fear undesirable hypoglycæmies associated to S. officinalis in healthy and/or diabetic patients (Table II).

Table II: Fasting and postprandial glucose levels in blood and plasma quantified throughout the different phases of the assay.

<table>
<thead>
<tr>
<th>Glucose levels (mg/dl)</th>
<th>Fasting 1</th>
<th>Postprandial 1</th>
<th>Fasting 2</th>
<th>Postprandial 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline (B)</td>
<td>96 ± 11</td>
<td>200 ± 17</td>
<td>96 ± 11</td>
<td>200 ± 17</td>
</tr>
<tr>
<td>Treatment 2 (T2)</td>
<td>96 ± 11</td>
<td>200 ± 17</td>
<td>96 ± 11</td>
<td>200 ± 17</td>
</tr>
<tr>
<td>Treatment 4 (T4)</td>
<td>96 ± 11</td>
<td>200 ± 17</td>
<td>96 ± 11</td>
<td>200 ± 17</td>
</tr>
</tbody>
</table>

Values are mean ± SEM (n = 6). Statistical differences were assessed by One-way ANOVA followed by a Student-Newman-Keuls test. * P ≤ 0.05 when compared with the second week of treatment.

Haemoglobin

We also found that two weeks of sage treatment increased blood haemoglobin levels (Fig. 4). This could reflect an undesirable increase of blood pressure. This was, however, not the case, blood pressure values remained well below of the indicating level of hypertension.

Neurocognitive tests

In the present study a battery of neurocognitive tests (Rao et al., 1998) was carried to each volunteer in two moments: the first one during the treatment with sage tea and the second one during wash-out. This battery of tests allowed, beyond a test-retest, the exclusion of the following aptitudes: memory, visico-spatial capacity, verbal fluency, attention and executive functions. The used tests were: Selective Reminding Test (SRT), Paired Auditory Serial Addition Test (PASAT), Spatial Recall Test (7/24), STROOP test and Controlled Oral Word Association Test.

The regular intake of sage tea by a period of four weeks didn’t affect negatively the neurocognitive processes of the volunteers. There seems to be an improvement on the performance in test results such as SRT and PASAT which is correlated with the increase of SOD antioxidant activity, allowing a better performance in those tests (Statistical differences were assessed by Spearman correlations and Wilcoxon signed rank test). In particular, sage tea seems to be associated with an improvement of memory and attentional capacities.

References


Acknowledgements

The results support the popular belief that drinking S. officinalis (sage) tea is safe and can contribute for an improvement of diabetic patient health conditions. This pilot trial showed no adverse effects associated with sage tea drinking. The effects on antioxidant as well as on plasma lipid profile are of use in diabetes management but may have broader applications.