DIABETES is a disease caused by loss of control of glucose homeostasis, that also involves imbalances in the internal metabolic environment that can lead to oxidative stress and damage in some cell populations. Decreased antioxidant defences and dislipidemia are also features of diabetes, the latter being one of the major causes for type 2 diabetes-related complications, such as cardiovascular diseases.

Salvia officinalis (common sage) is a medicinal plant to which antioxidant, anti-inflammatory and antimutagenic properties have been attributed [1]. Recent results from our laboratory showed cellular and in vivo antioxidant effects of sage (2,3) as well as mitoerin-like effects at the rat liver level, suggesting an antiabetic potential for sage [4]. In order to test these effects in humans, we performed a pilot trial with six healthy female volunteers. We investigated the protective effect of the regular intake of sage infusion (tea) on the DNA damage of human peripheral blood lymphocytes (PBLs) challenged with H2O2. We also assessed effects on Hsp70 expression levels in PBLs because a therapeutical role for Hsp70 induction in diabetes has been suggested [5]. The mechanisms of cellular protection conferred by sage tea drinking to human blood cells were further explored by estimating antioxidant enzymes activities (SOD and CAT) in erythrocytes. Parameters such as anti-inflammatory activities (AST and ALT), total cholesterol, LDL, HDL and glucose were measured as well.

**RESULTS**

1. **Plasma transaminases and other blood parameters**
   - Both plasma transaminases activities (AST and ALT) did not change during the 3 phases of the experimental period. 
   - Furthermore, S. officinalis tea did not have adverse effects on blood pressure, heart rate at rest and body weight. 
   - No changes in glucose clearance were observed in the oral glucose tolerance tests at the end of treatment period.

2. **Lipid profile in plasma**
   - Sage tea treatment reduced total cholesterol levels and the effect seemed to be present even two weeks after sage treatment (Fig. 2A).
   - This beneficial effect is supported by the lipoproteins levels, where a gradual reduction of LDL levels (Fig 2B) and a gradual increase of HDL levels in plasma (Fig. 2C) was observed.
   - No effect was obtained for the triglycerides levels on plasma.

3. **Antioxidant enzymes in erythrocytes**
   - Both SOD and CAT activities increased significantly after 2 weeks of sage treatment, and decrease to normal values afterwards.

4. **DNA damage in lymphocytes**
   - There is a significant reduction of DNA damage induced by H2O2 after two weeks of treatment, this effect was maintained after the wash-out period.

5. **Hsp70 expression in lymphocytes**
   - The intake of sage tea induced more than 2 fold increase in the expression of Hsp70, when compared with the baseline period.

**REFERENCES**


**FINAL REMARKS**

The results of this pilot study shows that drinking sage tea:
- Does not lead to hypertrophy and shows no adverse effects on blood pressure, heart rate at rest and body weight, therefore it is safe; 
- Improves erythrocyte antioxidant status by increase of SOD and CAT activities; 
- Gradually decreases total cholesterol and LDL levels and gradually increases HDL levels in plasma, which is accountable for an improvement of the lipid profile; 
- Has a protective effect against oxidative DNA damage in lymphocytes; 
- Increases Hsp70 levels during treatment, which may be at least in part responsible for the improved cellular response to induced oxidative damage.

All the observed effects certainly contribute for an improvement of the individual health condition. Furthermore, the positive effect of Salvia officinalis on the induction of molecular chaperones, emphasises the value of this plant as a promising source of compounds with pharmacological potential.