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EFECTOS NEURO Y HEPATOPROTECTOR DEL SILICIO Y SU APLICACIÓN COMO INGREDIENTE FUNCIONAL

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3. Results

3.1. α-Glucosidase activity

Si significantly reduced the *in vitro* α-glucosidase activity from minute 45 to 90 (**Table 1**), and 15% less glucose was raised compared to control at 45 min ($p < 0.001$). A linear adjustment of glucose formation-time was found in the two samples ($p < 0.001$). Si showed 17% lower slope than control.

3.2. Hypoglycaemic effect of Si

Figure 1A shows plasma glucose concentration profile corresponding to the acute administration. Si administration changed the postprandial curve of glucose respect to control ($p < 0.001$, repeated measures). Si significantly decreased glucose concentration by 10-18% at 3h and 4h ($p = 0.020$ and $p = 0.005$, respectively).

After 1-week of Si administration (**Fig. 1B**), postprandial glucose was significantly reduced respect to control group ($p < 0.001$, repeated measures), starting at 1h and keeping it until the end of the study ($p < 0.005$, unpaired Student's *t* test). In this postprandial experiment the 4h determination was not performed, as anaesthesia has been suggested to affect glycaemia (Zuurbier et al., 2008).

The comparison of 0-3h period between both studies did not show any significantly difference in the control group. On the other hand, significant differences were found in Si-group at 0, 1, 2 and 3 h between the acute and subchronic administration ($p \leq 0.001$, unpaired Student's *t* test).

3.3. SGLT-1 levels

Compared to control, Si treatment decreased SGLT-1 levels in duodenum and jejunum portions ($p < 0.01$) by 20 % (**Fig. 2A, B**).

3.4. Effect of Si on triglycerides levels

Acute administration of Si (**Fig. 3A**) significantly reduced the postprandial triglyceridaemia respect to control ($p < 0.001$, repeated measures), specifically at time 2 and 3h ($p < 0.001$, unpaired Student's *t* test). On the postprandial study after 1week treatment (**Fig. 3B**), Si group showed lower postprandial triglyceridaemia than control group ($p = < 0.001$, repeated measures) since the first hour ($p < 0.005$, unpaired Student's *t* test). Si administration delayed from 2h to 3h the pic level observed in the control group.

Significant differences were observed between acute and subchronic studies in Si group fasting levels ($p = 0.002$, unpaired Student's *t* test), and at 1 to 3h of postprandial study ($p < 0.01$, unpaired Student's *t* test).

4. Discussion

Our results suggest that Si acts as a powerfully hypoglycaemic and hypotriglyceridaemic agent in healthy young Wistar rats. Furthermore, this study demonstrates new mechanisms linked to Si, and highlights the potential benefits of Si supplementation for CVD and DM2.

1. Introduction

There is growing evidence that the postprandial state is an important factor in chronic diseases. Particularly, postprandial hypertriglyceridaemia and hyperglycaemia are considered risk factors for cardiovascular disease (CVD) and metabolic syndrome (SM) in that they induce endothelial dysfunction and oxidative stress (Ceriello et al., 2002). Postprandial hyperglycaemia is related to macro and microvascular complications in type 2 Diabetes mellitus (DM2) patients (Ceriello, 2005). Similarly, postprandial hypertriglyceridaemia is associated with atherosclerosis and macrovascular disease in DM2 patients (Kumar et al., 2010).

Nowadays, people in Western countries eat several times per day; they usually consume high-calorie foods and are in permanent postprandial state. This situation leads in turn to cellular dysfunction and disease. Thus, intervention to reduce the intensity and length of the postprandial period has been suggested (Burton-Freeman, 2010).

Silicon (Si) is an essential micronutrient (Carlisle, 1972) present mainly in plant foods, water, and beer (Jurkić et al., 2013). Si supplementation has been linked to the prevention of DM2 and CVD among others properties (Martin, 2013). Nevertheless, the specific mechanisms involved in those effects have not been completely described. Our previous articles (Garcimartin et al., 2015a, 2016) demonstrated that when included in a meat matrix, Si alleviated the deleterious effects of a high-saturated/high-cholesterol diet on lipoprotein profile and liver antioxidant defences of one-year-old Wistar rats. However, the impact of Si on the postprandial state, which could contribute to such effects, has not been evaluated. Therefore, we investigated the ability of Si to reduce postprandial hyperglycaemia and hypertriglyceridaemia in healthy Wistar rats.

2. Materials and Methods

2.1 α-Glucosidase activity

α-Glucosidase activity was measured *in vitro* according to the Garcimartín et al. (2015b) method. The inhibitory capacity of organic Si (Silicium organique G57™, Glycan Group, Geneva, Switzerland) was evaluated at a 40 mg/ml of maltose as substrate of reaction. The final concentration of Si in the experiment was 55 μg/ml.

2.2 *In vivo* experimental design

Two-month-old male Wistar rats, weighing approximately 200 g, were housed in groups under controlled temperature (22.3 ± 1.9°C) and light (12h light–12h dark cycle) in the Centro de Experimentación Animal of the Alcalá University, Madrid, Spain (register number # ES280050001165). The study was approved by the Spanish Science and Technology Advisory Committee and by an ethics committee of the