Selenium concentrations and antioxidant enzymes activities in rat during selenium deficiency and sodium selenite and selenium-enriched Spirulina supplementations.

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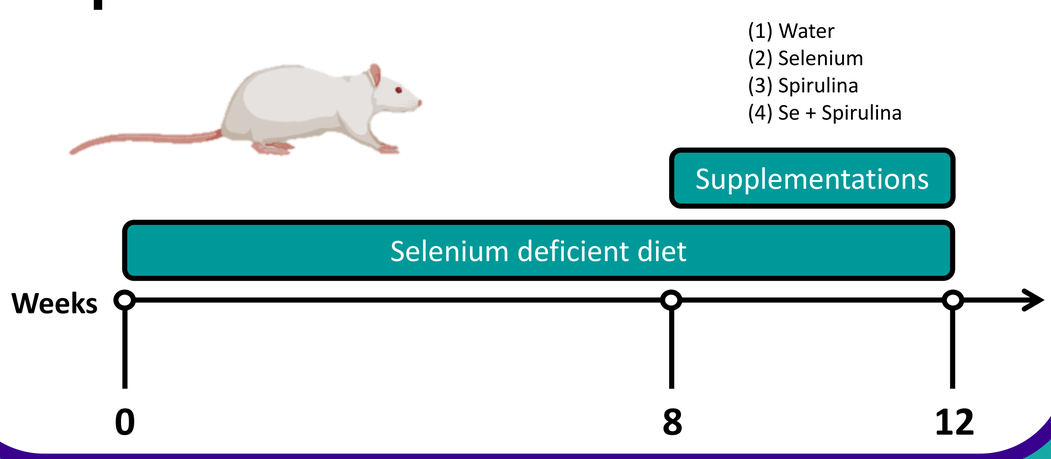
Introduction

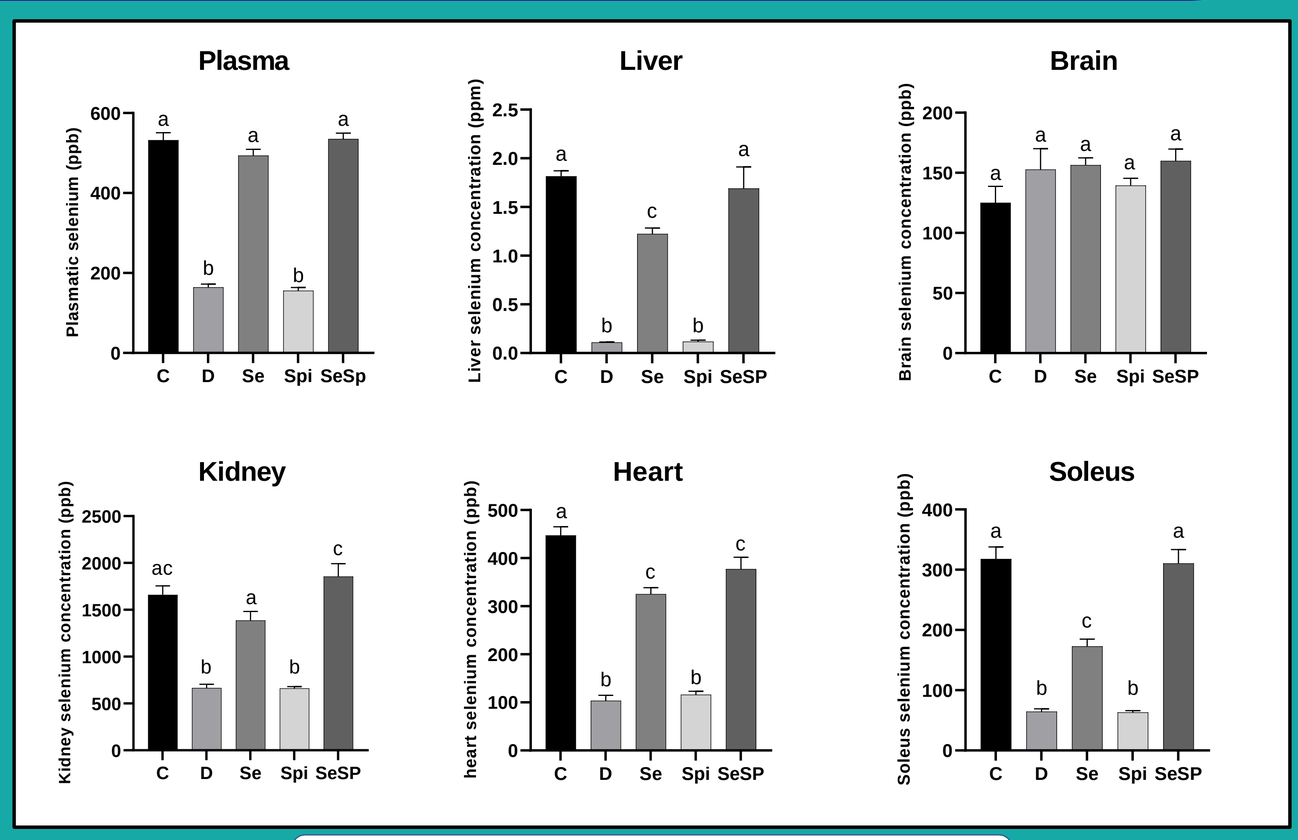
Selenium is a trace element essential for human life. It is provided by diet and displays many physiological functions through selenoproteins such as Glutathione Peroxidase. Selenium is involved in fertility, oxidative stress defense, growth and cardiac function. Furthermore, selenium deficiency is responsible for cardiac (Keshan's disease) and renal disorders often caused by a reduction of the antioxidant defenses. Spirulina is a blue-green algae known for its nutritive properties. Moreover, Spirulina shows very interesting antioxidant activities and could be enriched in selenium during its culture. The objective of this study was to determine how selenium was redistributed in the organism following deficiency and supplementation with sodium selenite (Se), spirulina (Spi) and selenium-enriched Spirulina (SeSP) and to investigate whether these supplementations were sufficient to restore antioxidant capacity.

Methods

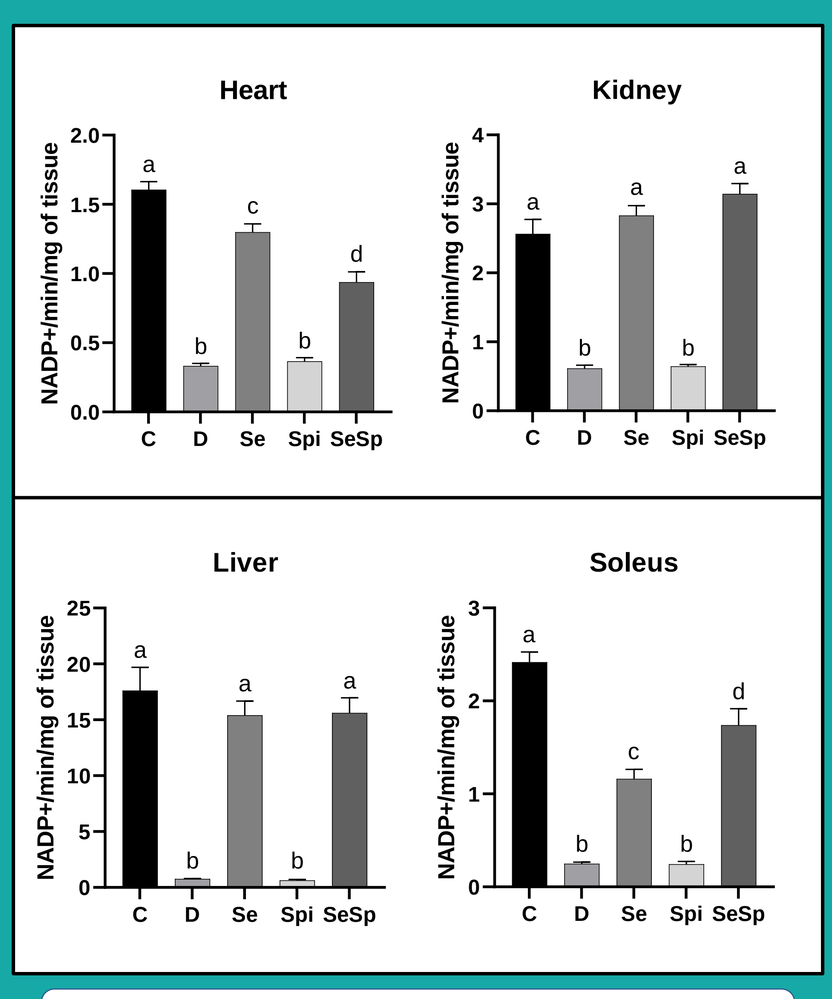
40 Wistar female rats were included in this study. 32 were fed with a selenium deficient diet for 12 weeks. At week 8, the 32 rats were randomly divided into 4 groups and supplemented with water only (D), sodium selenite (20 µg/kg BW/day, Se), Spirulina (3 g/kg BW/day, Spi) or selenium-enriched Spirulina (3g/kg BW/day corresponding to a dose of 20 µg/kg BW/day of selenium, SeSP) for 4 weeks. The last 8 rats were fed with normal food and water throughout the experiment and constitute the control group (C). At the end of the 12th week, tissues were harvested and frozen. 100 mg of tissue was collected and mixed with 2 mL 14N HNO_3 + 0.5 mL H_2O_2 and evaporated to dryness. The selenium concentration in the different tissues was determined by ICP-MS. GPx activity was determined from the decrease of NADPH induced by glutathione reductase and was expressed in nmol $NADP^+$/min/mg of tissue.

Experimental Protocol





Tissue selenium concentration



Glutathione Peroxidase Activity

Results

Brain: No significant difference was observed in brain selenium concentration.

Plasma: Se and SeSP supplementations could restore selenium concentration in plasma.

Heart: Selenium concentration was higher in Se than SeSP group but was not sufficient to fully restore Se concentration.

Liver: selenium concentration was restored following SeSP but not Se supplementation. However, GPx activity in the liver is identical in Se and Se Sp groups.

Kidney: selenium concentrations in the Se and SeSP groups are identical to the control as well as GPx activity.

Soleus: the selenium concentration in the SeSP group is fully restored but not in the Se group but these concentrations are not sufficient to restore GPx activity.

Conclusion

To conclude we can see that brain is protected from selenium deficiency. Sodium selenite supplementation seems to be more efficient to improve GPx activity while SeSP allows to restore selenium concentration in every tissues.