Effect of a polysaccharide extract from *Cystoseira usneoides* on serum glucose and lipids in normal rabbits

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INTRODUCTION

A number of reports indicate that seaweeds are still employed in folk medicine as treatments of several diseases[1]. Hypocholesterolemic compounds were isolated from algae[2] and extracts from *Phyllophora, Cystoseira, Sargassum* species shown antilipemic properties. *Sargassum confusum, Sargassum vulgare, Gracilaria verrucosa, Corallina juvens* and other possessed hypoglycemiant activities.

For this purpose, several brown algae were studied in our laboratory for their effects on glycemia and a number of them significantly reduced blood glucose levels in experimental animals[3].

The effects of *Cystoseira usneoides* on glucose and lipid metabolism are studied in this paper, in order to determine its hypoglycemic and hypocholesterolemic properties.

MATERIALS AND METHODS

PREPARATION OF THE SEAWEED EXTRACT

Cystoseira usneoides (L) Roberts (*Cystoseiraceæ*) was collected in the Ria de Noia (La Coruña, Spain) and authenticated in the Plant Biology Department of the University of Santiago de Compostela, Spain. The fresh seaweed was washed with tap water and dried in a forced-air oven at 50 °C. The powdered material was extracted with boiling methanol and the algal residue was then sequentially extracted with 2% aqueous calcium chloride and dilute hydrochloric acid (pH 2)[4]. Hydrochloric acid extractive solution was poured into excess of ethanol and the resulting precipitate dissolved in water and dialyzed against distilled water in cellulose tubing, in order to obtain the polysaccharide extract. The non dialyzed portion was finally freeze-dried (Yield = 7.6%).

BIOLOGICAL ASSAYS

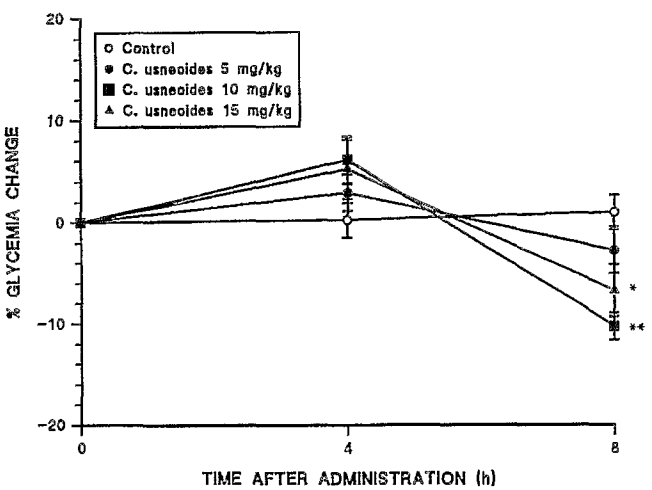
Normal male N.Z. rabbits, weighing approximately 1.5 kg were used. All assays were performed on animals fasted for 20 h. Doses of 5, 10 and 15 mg/kg were administered intravenously and blood samples taken from the ear vein, immediately before administration and 4 and 8 h later. The following parameters in serum were determined: Glucose, Cholesterol, Triglycerides, Lipoproteins, Lipase, Aspartic transaminase (GOT) and Alanine transaminase (GPT). Control animals were dosed with saline solution.

STATISTICAL ANALYSIS

Differences with respect to control group were evaluated using the Mann-Whitney U test. Differences with $p < 0.05$ were considered statistically significant.

Fig 1

Effect of the *C. usneoides* extract on serum glucose levels. Each point represents the mean ±S.E.M. of 5-8 animals. Differences with respect to the control group: * $p < 0.05$; ** $p < 0.01$.



RESULTS AND DISCUSSION

Fig. 1 shows the effect of *C. usneoides* on serum glucose levels. A dose of 10 mg/kg significantly lowered glycemia 8 h after administration. This hypoglycemic effect had been previously reported[3]. At the same dose, cholesterol was reduced 4 hours after administration. The extract produced a statistically significant 20% reduction (Fig. 2) but all of the assayed doses significantly increased serum triglyceride levels at +4 and +8 h (Fig. 3). Although the relationship between lipid and glucose metabolism suggested that the glycemia and triglyceride results ought to be related, a discrepancy, *a priori*, was found,

since glucose levels lowered and triglycerides rose (insulin release does not seem to be involved in the hypoglycemic effect). Table 1 lists the effects of the extract on serum lipoproteins. High density lipoproteins were not significantly modified in the treated animals (data not shown), whereas low density lipoprotein (LDL) concentrations significantly lowered 4 h after administration, about 30-40%. However, very low density lipoprotein (VLDL) levels were enhanced according to the triglyceride increase. On the other hand, *C. usneoides* caused significant 23% and 44% drops in the lipase activity at 4 and 8 h after administration, respectively (Fig. 4).

The effects of seaweed on GPT and GOT are listed in Table 2. Doses of 10 and 15 mg/kg significantly lowered GPT activity at the 4th hour, but GOT was significantly increased by the extract at the highest dose 8 h after administration.

The results show that polysaccharides from hydrochloric acid extract possess hypoglycemiant and hypocholesterolemic properties. More studies are being carried out on hyperglycemic animals in order to determine the potential antidiabetic activity of *C. usneoides*.

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Table 1

Effect of the *C. usneoides* extract on serum LDL and VLDL levels. Each value represents the mean ±S.E.M. of 4-10 animals. Differences with respect to the control group: * $p < 0.05$; ** $p < 0.01$.

Treatment	% LDL change		% VLDL change	
	4 h.	8 h.	4 h.	8 h.
Control	–3.6 ± 5.3	–11.0 ± 4.6	2.3 ± 4.4	24.6 ± 5.8
C. usneoides 5 mg/kg	–34.1 ± 8.0**	–8.6 ± 21.9	28.9 ± 12.3	12.8 ± 15.7
C. usneoides 10 mg/kg	–30.0 ± 11.1*	–22.7 ± 8.8	70.9 ± 48.3*	45.2 ± 19.0
C. usneoides 15 mg/kg	–39.2 ± 6.6**	–33.6 ± 14.0	59.3 ± 15.9**	52.7 ± 22.0

Table 2

Effect of the *C. usneoides* extract on serum GOT and GPT levels. Each value represents the mean ±S.E.M. of 4-10 animals. Differences with respect to the control group: * $p < 0.05$; ** $p < 0.01$.

Treatment	% GOT change		% GPT change	
	4 h.	8 h.	4 h.	8 h.
Control	37.4 ± 26.2	12.6 ± 17.6	5.9 ± 5.7	15.3 ± 7.0
C. usneoides 5 mg/kg	22.3 ± 27.0	69.1 ± 51.4	–1.5 ± 5.7	5.2 ± 8.5
C. usneoides 10 mg/kg	41.6 ± 32.8	64.9 ± 17.7	–23.9 ± 6.2**	13.6 ± 7.1
C. usneoides 15 mg/kg	44.9 ± 15.7	143.8 ± 25.5**	–6.9 ± 1.7*	7.9 ± 6.2

Fig. 2

Effect of the *C. usneoides* extract on serum cholesterol levels. Each point represents the mean ±S.E.M. of 4-10 animals. Differences with respect to the control group: * $p < 0.05$; ** $p < 0.01$.

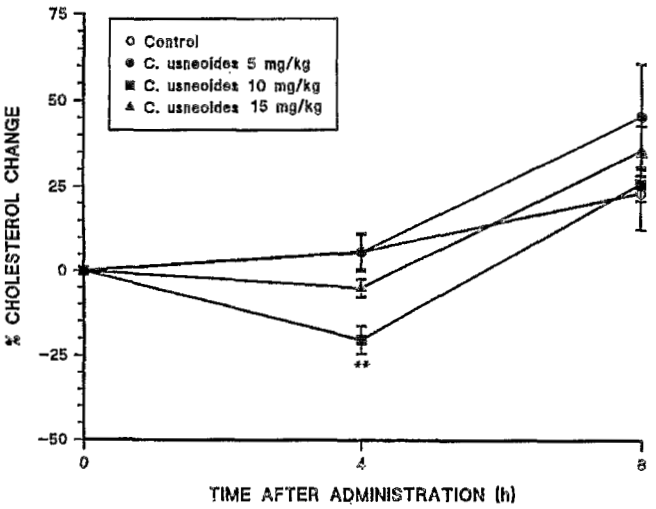

Fig. 3

Effect of the *C. usneoides* extract on serum triglyceride levels. Each point represents the mean ±S.E.M. of 4-10 animals. Differences with respect to the control group: ** $p < 0.01$.

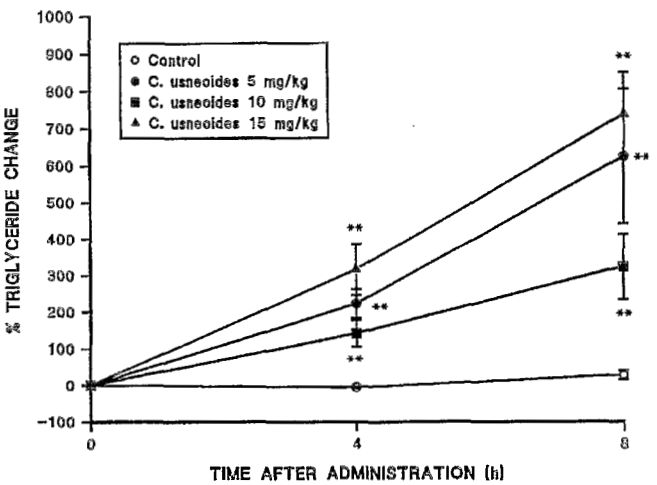

Fig. 4

Effect of the *C. usneoides* extract on serum lipase levels. Each point represents the mean ±S.E.M. of 4-10 animals. Differences with respect to the control group: ** $p < 0.01$.