

# Intoxication of rumen microbiota with hexavalent chromium and its correction by Selenium and carotene *in vitro*

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## Introduction

Due to the widespread use of Chromium in various industries, the level of environmental pollution by Chromium(VI) compounds is quite significant, which creates a risk of their entry into the body of animals. This negatively affects the metabolism and productivity of animals, as well as the quality of livestock products. Chromium(VI) is a metal-carcinogen that is able to directly form reactive oxygen species by interacting with cellular reductants by reduction through the active intermediate forms Chromium(V) and Chromium(IV) to a stable form, Chromium(III). The negative effects of oxidative stress can be prevented by adding increased doses of antioxidants.

## Results

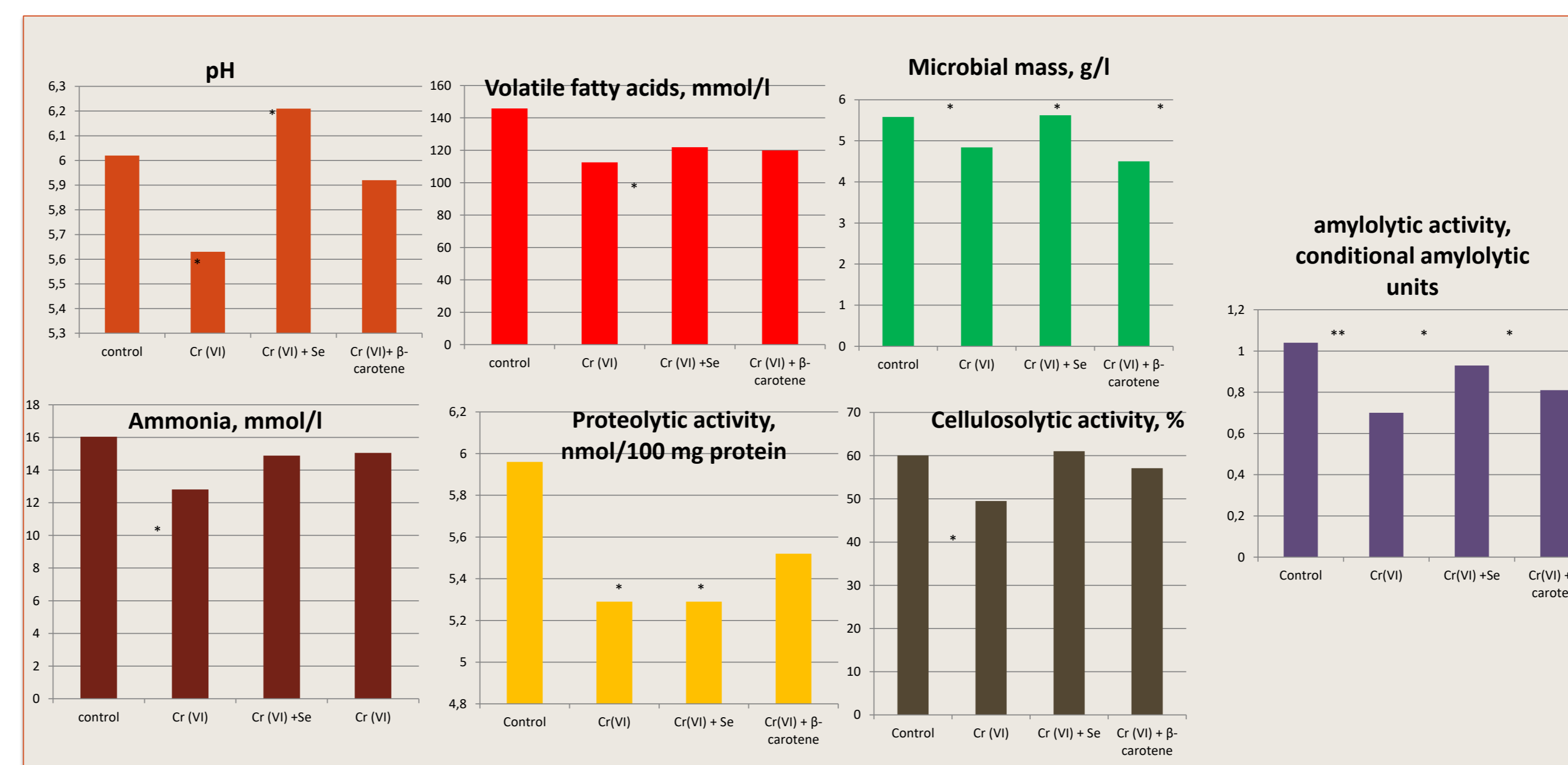
After incubation with Chromium, in the rumen content the amount of microbial mass, concentration of volatile fatty acids, amylolytic activity and pH were decreased. This effect can be explained by the powerful oxidizing action of Chromium(VI). Hydrogen is released during bacterial metabolism, and excess hydrogen can inhibit the growth of some groups of microorganisms, including cellulolytic, for which hydrogen is a strong inhibitor. The addition of potassium dichromate inhibited the formation of ammonia, the reason for this was a decrease in the proteolytic activity of microorganisms, resulting in decreased protein catabolism and deamination of amino acids.

The introduction of sodium selenite affected the hydrolytic enzymes in the incubation medium, in particular activated amylases and cellulases. Selenium decreased the concentration of ammonia and increased the concentration of short-chain fatty acids and cellulolytic activity.

Positive effects on the growth and metabolic activity of microorganisms were found with the addition of  $\beta$ -carotene, which led to the activation of the intensity the fermentation processes, growing of microbiota mass, increasing the concentration of volatile fatty acids. Amylolytic and cellulolytic activity of microorganisms and concentration of ammonia in the incubation medium have also risen.

## Material & Methods

The studies were performed *in vitro* using samples of the rumen content from three bulls-analogues of the Ukrainian dairy black-spotted breed. The contents of the rumen were taken two hours after morning feeding using a stomach pump. The filtrate of the rumen content was transferred into McDougall buffer (25 ml of filtrate + 75 ml of buffer) and performed three series of incubations with the addition: Chromium(VI) in the amount of 0.5 ppm as potassium bichromate; 0.5 ppm Chromium(VI) + 0.5 ppm sodium selenite; and 0.5 ppm Chromium(VI) + 0.5 ppm  $\beta$ -carotene. Samples without added compounds were used for control. Vessels with these mixtures were incubated in an atmosphere of carbon dioxide at a temperature of 38°C for 24 hours.



## Conclusions

From the obtained results it follows that the addition of sodium selenite and  $\beta$ -carotene stimulates the growth and functions of rumen microorganisms intoxicated with Chromium(VI).