A STUDY USING NEUTRON ACTIVATION ANALYSIS OF THE SHORT-TERM CHANGES IN THE SELENIUM CONTENT OF BLOOD COMPONENTS IN HUMAN FOLLOWING SUPPLEMENTATION WITH LOW DOSES OF SELENIUM

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A study was undertaken to evaluate the short-term changes in the concentration of selenium in whole blood, plasma and erythrocytes following supplementation with low doses of four different selenium supplements. Fourteen volunteers took one of the supplements each day with breakfast for a period of six weeks. Two blood samples were taken each week during this time and selenium was determined on its components using neutron activation analysis via the $^{77}$Se isotope.

Introduction

The use of selenium as a supplement for human dietary intake has only occurred recently for a number of reasons. When it was realised that selenium was essential to the human system studies were undertaken in many countries to determine the selenium status of the population of those countries. The analysis of human blood and its components revealed large world-wide variations in their selenium content. Countries such as Finland, New Zealand and the Keshan region of China were found to be low selenium when compared with countries such as Canada and USA. Dietary intake for the Finish population was only 20–30 μg per day and 6–35 μg per day for those from New Zealand. The adult selenium intake in the Keshan region of China was estimated to be less than 17 μg per day. By comparison, average dietary selenium intake of persons from Canada and USA were in the range 113–220 and 60–150 μg per day respectively.

Certain diseases such as cancer and heart disease have been related to selenium deficiency in the human system and this has prompted selenium supplementation in an attempt to reduce or overcome some of the resulting symptoms.

Some investigators studied changes in the blood selenium content of healthy persons following selenium supplementation while others compared the long-term changes in whole blood, plasma and erythrocyte selenium concentration using different forms of...

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selenium supplementation. Researchers in different countries have used various types and amounts of selenium as supplements in their studies.

Robinson and co-workers have carried out a large number of supplementation studies on persons from all over New Zealand. Most studies involved daily doses of 100 μg as either selenite or selenomethionine with other work using 500 μg or more. They analysed whole blood, plasma, erythrocytes and excretion products for selenium as well as studying changes in glutathione peroxidase (GSHPx) activity during supplementation. They found that selenite produced only small changes in blood selenium content even when taken for a number of months. By comparison selenomethionine produced significant increases in a much shorter time which were sustained in erythrocytes even when supplementation ceased.

Researchers in other countries have studied the change in the selenium content of whole blood, plasma and erythrocytes following supplementation studies carried out over periods from 11 weeks to 4 months. Supplements studied included selenate, selenite, selenomethionine, selenium yeast and high selenium wheat taken in daily doses of 100 or 200 μg selenium. LEVANDER et al. and ALFTHAN et al. found large changes in both plasma and erythrocyte selenium when selenium yeast was used. CLAUSEN and NIELSEN found similar changes in whole blood with both selenium yeast and selenomethionine. JOHANSSON found only small changes in plasma and erythrocyte selenium as a result of using a mixture of selenite and selenomethionine (plus vitamins). By comparison the same doses of selenate and selenite yielded very small changes in all cases.

A recent study estimated the average adult selenium intake of Australians to be 62–96 μg per day. This was found to be low compared with other western countries due mainly to the lower selenium content of Australian cereal products. Although supplementation studies have been more common in countries with low selenium status, few studies have been carried out with dietary selenium intakes similar to Australians.

The major aim of this work was to evaluate the short-term effect of four different types of selenium supplement on the human blood of Australians and compare this with results found by overseas researchers. Sodium selenate, sodium selenite and selenomethionine (or selenium yeast) have been used overseas and were used in this study along with an "antioxidant capsule". The antioxidant capsule was supplied to compare its effectiveness as an alternate selenium supplement. This formulation should not only increase the selenium content of the blood but should also impart the beneficial properties of the other antioxidant components present.

Most previous studies have only monitored changes in blood selenium at two week intervals or more or used people restricted by diet and lifestyle during supplementation. In this study no such restrictions were imposed and blood selenium concentration was determined twice weekly.