Increased Se intakes have been associated with decreased risk of cancer and CVD. Several mechanisms have been proposed, including antioxidant effects through selenoproteins, induction of carcinogen metabolism and effects on the blood lipid profile. In a 4 x 1 week randomised, double-blind cross-over study, healthy young men supplemented their usual diet with selenate, Se-enriched yeast, Se-enriched milk or placebo (Se dose was 300 μg/d for selenate and Se-enriched yeast, and about 480 μg/d for Se-enriched milk) followed by 8-week washout periods. All Se sources increased serum Se levels after supplementation for 1 week. The effect of the organic forms did not differ significantly and both increased serum Se more than selenate. Conversely, thrombocyte glutathione peroxidase (GPX) was increased in the periods where subjects were supplemented with selenate but not in those where they were given Se-enriched yeast or Se-enriched milk. We found no effect on plasma lipid resistance to oxidation, total cholesterol, TAG, HDL- and LDL-cholesterol, GPX, glutathione reductase (GR) and glutathione S-transferase (GST) activities measured in erythrocytes, GPX and GR activities determined in plasma, or GR and GST activities in thrombocytes. Leucocyte expression of genes encoding selenoproteins (GPX1, TrR1 and SelP), and of electrophile response element-regulated genes (GCLC, Fra1 and NQO1) were likewise unaffected at all time points following intervention. We conclude that thrombocyte GPX is specifically increased by short-term selenate supplementation, but not by short-term supplementation with organic Se. Short-term Se supplementation does not seem to affect blood lipid markers or expression and activity of selected enzymes and a transcription factor involved in glutathione-mediated detoxification and antioxidation.