Antibodies as tools to detect free metal ions in food extracts and beverages: myth or reality?

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INTRODUCTION

Immunospecificity to free metal ions has been described in few scientific manuscripts. These rare instances include reports on antibodies with affinity towards soluble mercury (II) [1,2] or lead (II) [3]. This is contradictory to the most common approach, where protein carriers are first conjugated to the metal [4,5]. In most articles it is usually the macromolecular complex that stimulates allergenicity and binds IgG in a subsequent in-vitro assay.

EXPERIMENTAL METHODS

In our work we used rabbit and mouse IgG antibodies that had been raised in response to Ni-BSA (i.e. Bovine Serum Albumine) and Ni-NikR (nickel responsive bacterial regulator). They were assayed for specificity towards soluble nickel (II). Due to numerous disadvantages exhibited by standard ELISA detection technique, the antibodies were immobilized on magnetic beads. Simple dimethylglyoxime reaction was used as spectroscopic reporter to quantify bound analyte. The study allows quantitative trace analysis with fairly good detection limits and could potentially be useful in chemical evaluation of beverages and food extracts.

RESULTS AND DISCUSSION

We have found that both anti Ni-BSA and anti Ni-NikR antibodies bound nickel at higher level than control antibodies did. The method allowed extraction of nickel ions at amounts ranging from 12 to 24 nmol, while non-specific antibody yielded less than 10 nmol Ni^{2+}. However, parallel comparison study with the use of iron ions indicated unspecificity in regard to metal recognition, with binding range of 17-45 nmol, relative to control sample value of 7 nmol.

CONCLUSIONS

Antibodies obtained from animal immunization with nickel-carrier protein complex did not exhibit linear specificity for desired chemical element. It remains to be investigated if the reported phenomenon extends to a wide range of divalent metal binding, or is it limited to particular, physiologically relevant ions.

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