# Analysis of elemental impurities in dietary supplements for weight loss and assessment of potential risk to human health


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## Introduction

Dietary supplements for weight loss are one of the best-selling products outside the pharmaceutical distribution network. They often contain plants in their composition, which are known sources of toxic elements (Rebiere et al. 2012; Zin 2014).

## Work Purposes

- To compare the concentration of elemental impurities (Cr, Cu, Ir, Mn, Mo, Ni, Os, Pb, Pt, Rh and Ru) found in dietary supplements for weight loss with specified limits set by international agencies;
- To assess the cumulative non-carcinogenic risk to human health due to exposure to mixtures of such elements.

## Materials & Methods

- **Samples**: 25 dietary supplements for weight loss, randomly purchased in 5 different suppliers in Portugal.
- **Analytical Technique:** Wavelength Dispersive X ray Fluorescence (WDXRF) spectrometry (Figueiredo et al. 2016), using a 4 kW WDXRF spectrometer (S4 Pioneer, Bruker AXS).
- All reagents were of high analytical grade (≥99% Reagent or Ph. Eur.).
- **Risk assessment**: performed according to Environmental Protection Agency (EPA) guidelines, through the Hazard Index (HI) (U.S. EPA 2001).

## Results

**Table 1.** Elemental impurities concentrations measured in 25 dietary supplements

| Element | Concentration [a] (μg/g) | Legal limit (μg/g) | | Number of samples > limit | HQ (median) | HQ (max) |
|---|---|---|---|---|---|---|
| | | Dietary Supplements | Drug Products | | | |
| Cr | 42.54 (22.19; 63.12) | - [b] | 25 | 2 | 3.4E-4 | 5.0E-4 |
| Mn | 99.77 (66.63; 896.08) | - | 250 | 1 | 8.5E-3 | 7.7E-2 |
| Mo | 7.13 (5.57; 10.44) | - | 25 | 0 | 1.7E-2 | 2.5E-2 |
| Os | 2.84 (2.19; 3.39) | - | 10 | 0 | n.a | n.a. |
| Pb | 2.04 (1.74; 2.48) | 1 | 0.5 | 1 | 6.8E-3 | 8.3E-3 |
| | | | | HI | 3.3E-2 | 1.1E-1 |

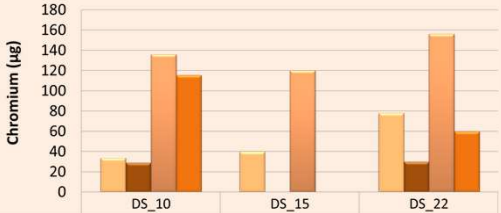
*HQ- Hazard Quotient; n.a. - not applicable*
*[a] Levels expressed as median, minimum and maximum in brackets; [b] 40 μg/day (Reference daily dose for Cr as ingredient)*


**2 Supplements with Cr > limit**

**1 Supplement = Pb + Mn > limit (both neurotoxic)**

**Label Discrepancies**

- **1 Supplement** → **Label:** Cr as active ingredient; **Result of analysis:** not detected
- **2 Supplements** → **Measured Cr levels << Labeled values**



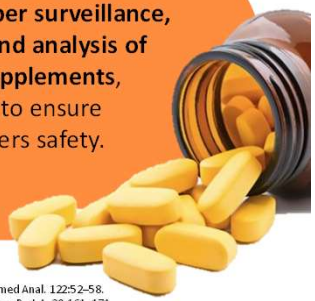

| | DS_10 | DS_15 | DS_22 |
|---|---|---|---|
| Label μg/pill | 34 | 40 | 78 |
| Measured μg/pill | 28.9 | 0 | 29.9 |
| | | 120 | 156 |
| | | 0 | 59.8 |

**Figure 1.** Label discrepancies found in the analyzed dietary supplements

## Conclusions

- Some of the analyzed dietary supplements revealed **high levels of Mn** and **Pb above the imposed limit**.
- Risk Assessment **did not reveal non-carcinogenic effects to human health** (**HI<1**). However, these results only reflect the intake of these elements through dietary supplements consumption and do **not consider the cumulative risk associated with other routes of exposure**.
- **Unconformities** were detected **between the labeled and the determined values of Cr**.

Results of this study highlight the **need of a deeper surveillance, legislation and analysis of dietary supplements**, in order to ensure consumers safety.

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*To the memory of late Professor José Martins dos Santos*



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