

Arsenic and its species in total diet supplied from Slovenian Forces

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Information on the dietary intake of trace elements by individuals or groups can be obtained by a number of direct and indirect techniques. Only direct analysis of the food consumed during a 24-h period can provide an accurate estimate of the dietary intake of trace elements¹. All other techniques used for estimation of trace elements have limitations. In Slovenia data on the arsenic content in various foods is scarce and data on its daily intake practically does not exist. The toxicity of arsenic to humans depends strongly upon the chemical form in which it is ingested. Generally organic As compounds are considered to be less toxic than inorganic arsenic, of which trivalent arsenicals are the most toxic forms. The aim of our work was to determine arsenic and its species in 20 daily military diets in year 2002 and 15 in year 2005 sampled by the double basket method. Daily meals for soldiers were prepared according to prescribed menus². Each composite sample of total daily diet was homogenized with a titanium blender, frozen at -24°C and then lyophilized, milled in an agate mill and stored in plastic bottles. The chemical composition of nutrients and the energy value meet the recommended military nutritional standards^{2,3,4} and RDAs. For total As determination radiochemical neutron activation analysis (RNAA), with its essentially blank-free advantage and detection limit of 1 ng/g, was used. Arsenic species were determined in extracts of meals including fish using high performance liquid chromatography on anion and cation exchange columns followed by on-line UV decomposition (optional), hydride generation and atomic fluorescence spectrometry (HPLC-UV-HGAFS)⁵.

The average daily dietary As intake in both years was very similar, 13.5 μg (range 7–23 μg) for non-fish based diets (12 samples) and 247 μg (range 135–545 μg) for fish-based diets (8 samples) in the year 2002. In the year 2005, the average intake was 12 μg (4–20 μg) for 9 non-fish based diets and 158 μg (42–358 μg) for 6 fish based diets. The provisional tolerable weekly intake (PTWI) of As is 15 μg inorganic As/kg body weight⁶. In the present study fish intake once per week lead to remarkably higher As intake. The PTWI refers to inorganic As, whereas most As from food, mainly fish and seafood, is ingested in a less toxic organic form. Buchet et al (1996) reported that the amount of inorganic As ingested or released in the gastrointestinal tract following meals including marine organisms is, if any, negligible⁷. Our results confirmed their findings. Arsenobetaine, a non-toxic arsenic compound, was detected in meals containing fish in concentrations between 0.09 and 0.30 $\mu\text{g}/\text{g}$ (daily intake up to 362 μg). More toxic arsenic compounds (arsenite, arsenate, methylarsonic acid and dimethylarsinic acid) were only detected at trace levels in a few samples.

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