Carcinogenic effects of selected heavy metals in human nutrition

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Introduction: Based on a commentary of W.K.Lutz and J.Schlatter (1992) which first published that amongst other dietary constituents the heavy metals arsenic and cadmium increase tumor incidence without proven DNA adduct formation in animals, the aim of this thesis was to detect the actual carcinogenic risk of these heavy metals for human via dietary exposure. Another intention was to research whether ingestion of other heavy metals also can cause cancer and to investigate whether their actual dietary burden to human population is below the prescriptive limits.

Materials and methods, experimental design, other methodological information: A number of reviews, animal trials and human studies were used to assess the carcinogenic effects of arsenic, cadmium, chromium and lead. The selected trials based only on orally intake of the heavy metals. Within these trials the ones dealing with food intake were preferred.

Results and discussion: Arsenic may act as a carcinogen by inducing oxygen stress, oxidative damage on DNA, inhibition of several DNA repair mechanisms, influence of signal transduction and changed gene expression. Animal trials showed that ingestion of dimethylarsinic acid can cause urinary bladder cancer in rats but not in hamsters and monomethylarsinic acid had no carcinogenic effects on rats. In human beings inorganic arsenic in drinking water can induce cancer of the urinary bladder, skin, lung, kidney, liver and prostate.

After orally intake of cadmium as chloride it produces leukemia, benign testicular tumors and renal cancer in rats. A large prospective cohort study on Swedish women showed a positive dose-response-relationship between cadmium ingestion via nutrition and the risk of uterine cancer. It might also play a role in the incidence of carcinomas in testis, pancreas and gall bladder.

The cancer-causing mechanisms of chromium are unknown. It may indicate cancer by multi-stage carcinogenicity, genomic instability and epigenetic modifications. There are insufficient data of human studies to establish a cancer risk relating to human beings. But habitually intakes of 200 µg chromium/kg b.w. didn’t cause adverse effects on human beings.

Though animal trials showed up carcinogenic effects of lead in swiss mice and rats but not in hamsters, the amount of the applied dosages were not assignable to the intake of human beings via nutrition. The result of the literature research identified no human studies concerning the orally intake of lead.

Conclusion: The average intake of arsenic in adults is below the acceptable daily intake so I think there is no reason to worry about cancer development caused by arsenic. The relevance of the exposure of cadmium in nutrition is not established so there should be further research activities particularly because adults partly exceed the tolerable weekly intake of this heavy metal. Chromium doesn’t seem to be dangerous to human beings and the environmental burden of lead is decreasing since unleaded petrol is used so these two heavy metals may not contribute notably to cancer risk.

References:


