

Manganese Health Research Program: Recent published literature

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Introduction

This report presents the bibliographic details of papers identified as being first published during the period December 2008 to February 2009.

The papers were selected because they address research areas that are considered of direct relevance to the health effects of manganese (Mn); in order to aid review, the papers are presented under the following categories:

Section 1 - EXPOSURE MEASUREMENT AND MODELLING: Papers relating to the measurements or modelling of environmental and occupational Mn exposure, the development of biomarkers of exposure or effect.

Section 2 - HEALTH EFFECTS: Papers on the influence of Mn on health, disease and dysfunction.

Section 3 - MECHANISM: Papers on the physiological, biochemical and cellular mechanisms underlying the toxic effects of Mn.

Section 4 - HUMAN SUSCEPTIBILITY: Papers relating to assessment of the influence of genetic and epigenetic factors on human susceptibility to the effects of Mn.

Section 5 - TREATMENT AND IMAGING: Papers on the development and implementation of new medical approaches to the treatment of excessive Mn exposure.

Section 6 - MISCELLANEOUS: Other papers considered of interest or potential relevance to the study of the health effects of Mn.

The papers presented herein were identified using a series of structured searches of the following on-line databases: Medline, Toxline, Biological Sciences and Proquest Health. The paper abstracts were reviewed and categorised by an experienced Scientist to confirm their relevance before inclusion in this report.

1. EXPOSURE MEASUREMENT AND MODELLING

Aslam, Chettle, D.R., Pejovic-Milic, A., *et al.* (2009) Opportunities to Improve the in Vivo Measurement of Manganese in Human Hands. *Physics in Medicine and Biology*, 54(1), 17-28.

Rahman, A., Azad, M.A., Hossain, I., *et al.* (2009) Zinc, Manganese, Calcium, Copper, and Cadmium Level in Scalp Hair Samples of Schizophrenic Patients. *Biological Trace Element Research*, 127(2), 102-108.

Rodrigues, J.L., Batista, B.L., Nunes, J.A., *et al.* (2008) Evaluation of the use of Human Hair for Biomonitoring the Deficiency of Essential and Exposure to Toxic Elements. *The Science of the Total Environment*, 405(1-3), 370-376.

Schlenker, T., Hausbeck, J. & Sorsa, K. (2008) Manganese in Madison's Drinking Water. *Journal of Environmental Health*, 71(5), 12-6, 39; quiz 43-4.

2. HEALTH EFFECTS

Rahman, A., Azad, M.A., Hossain, I., *et al.* (2009) Zinc, Manganese, Calcium, Copper, and Cadmium Level in Scalp Hair Samples of Schizophrenic Patients. *Biological Trace Element Research*, 127(2), 102-108.

Standridge, J.S., Bhattacharya, A., Succop, P., *et al.* (2008) Effect of Chronic Low Level Manganese Exposure on Postural Balance: A Pilot Study of Residents in Southern Ohio. *Journal of Occupational and Environmental Medicine*, 50(12), 1421-1429.

3. MECHANISM

Anderson, J.G., Fordahl, S.C., Cooney, P.T., et al. (2008) Manganese Exposure Alters Extracellular GABA, GABA Receptor and Transporter Protein and mRNA Levels in the Developing Rat Brain. *NeuroToxicology*, 29(6), 1044-1053.

Aschner, M., dos Santos, A.P.M., Erikson, K.M., et al. (2008) Manganese Transport into the Brain: Putative Mechanisms. *Metal Ions in Biology and Medicine -International Symposium-*, 10, 695-700.

Ávila, D.S., Gubert, P., Fachinetto, R., et al. (2008) Involvement of Striatal Lipid Peroxidation and Inhibition of Calcium Influx into Brain Slices in Neurobehavioral Alterations in a Rat Model of Short-Term Oral Exposure to Manganese. *NeuroToxicology*, 29(6), 1062-1068.

Finkelstein, Y., PhD, N.Z., Fitsanakis, V.A., et al. (2008) Differential Deposition of Manganese in the Rat Brain Following Subchronic Exposure to Manganese: A T1-Weighted Magnetic Resonance Imaging Study. *The Israel Medical Association Journal*, 10(11), 793-798.

Gonzalez, L.E., Juknat, A.A., Venosa, A.J., et al. (2008) Manganese Activates the Mitochondrial Apoptotic Pathway in Rat Astrocytes by Modulating the Expression of Proteins of the Bcl-2 Family. *Neurochemistry International*, 53(6-8), 408-415.

Jang, B. (2009) Induction of COX-2 in Human Airway Cells by Manganese: Role of PI3K/PKB, p38 MAPK, PKCs, Src, and Glutathione Depletion. *Toxicology in Vitro*, 23(1), 120-126.

Jin, J-J., Lu, X-J., Chen, M., et al. (2008) Toxic Mechanism in the Liver and Kidney of Mice Induced by Manganese. *Journal of Jiangsu University (Medicine Edition)*, 18(5), 419-421.

Jursa, T. & Smith, D.R. (2009) Ceruloplasmin Alters the Tissue Disposition and Neurotoxicity of Manganese, but Not its Loading Onto Transferrin. *Toxicological Sciences*, 107(1), 182-193.

Kim, H.Y., Lee, C.K., Lee, J.T., et al. (2009) Effects of Manganese Exposure on Dopamine and Prolactin Production in Rat. *Neuroreport*, 20(1), 69-73.

Kopanska, K., Pereira, D.A., Bruggraber, S.F.A., et al. (2008) The Influence of Manganese Supplementation on Blood Manganese Levels and Leucocyte Expression Or Activity of Manganese-Dependent Enzymes. *Metal Ions in Biology and Medicine -International Symposium-*, 10, 848-854.

Lazrishvili Lazriev, I.L., Shukakidze, A.A., Chkhartishvili, N.N., et al. (2009) Morphological Changes and Manganese Content in the Brains of Rat Pups Subjected to Subchronic Poisoning with Manganese Chloride. *Neuroscience and Behavioral Physiology*, 39(1), 7-12.

Liapi, C., Zarros, A., Galanopoulou, P., et al. (2008) Manganese Effects on the Adult Rat Brain Antioxidant Status and the Activities of Acetylcholinesterase, (Na⁺,K⁺)-ATPase and Mg²⁺-ATPase: Modulation by L-Cysteine. *Metal Ions in Biology and Medicine - International Symposium-*, 10, 670-675.

Wang, X., Li, G.J. & Zheng, W. (2008) Efflux of Iron from the Cerebrospinal Fluid to the Blood at the Blood-CSF Barrier: Effect of Manganese Exposure. *Experimental Biology and Medicine*, 233(12), 1561-1571.

Yang, H., Gu, L., Zhang, L., et al. (2009) Involvement of Hydrogen Peroxide in the Manganese-Induced Myocytes Mitochondrial Membrane Potential Loss. *Toxicology Mechanisms and Methods*, 19(1), 66-72.

Zawadzki, M., Gać, P., Poręba, R., *et al.* (2008) [Modification of Cardiovascular System in Animals Subjected to Intoxication with Manganese Compounds]. *Medycyna Pracy*, 59(5), 387-393.

Zhao, F., Cai, T., Liu, M., *et al.* (2009) Manganese Induces Dopaminergic Neurodegeneration Via Microglial Activation in a Rat Model of Manganism. *Toxicol.Sci.*, 107(1), 156-164.

4. HUMAN SUSCEPTIBILITY

No relevant papers identified.

5. TREATMENT AND IMAGING

Madsen, K.S., Holm, D.A., Sogaard, L.V., *et al.* (2008) Effect of Paramagnetic Manganese Cations on (1)H MRS of the Brain. *NMR in Biomedicine*, 21(10), 1087-1093.

6. MISCELLANEOUS

Cui, X. & Okayasu, R. (2008) Arsenic Accumulation, Elimination, and Interaction with Copper, Zinc and Manganese in Liver and Kidney of Rats. *Food and Chemical Toxicology*, 46(12), 3646-3650.

Peters, J., Sutton, A., Jones, D., *et al.* (2008) The Contribution of Systematic Review and Meta-Analysis Methods to Human Health Risk Assessment: Neurobehavioral Effects of Manganese. *Human and Ecological Risk Assessment*, 14(6), 1250-1272.

Santamaria, A.B. (2008) Manganese Exposure, Essentiality & Toxicity. *Indian Journal of Medical Research*, 128, 484-500.