Reproductive toxicology

In this guide

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70. Studies in laboratory animals have evaluated effects of inorganic mercuric mercury on cardiovascular function following intermediate duration oral

exposure. Results indicate that exposure to mercuric chloride alters some cardiovascular functions, including systolic and diastolic blood pressure, ventricular pressure, baroreflex sensitivity, and cardiac inotropism (ATSDR, 2022). The ATSDR (2022) identified no epidemiological studies on cardiovascular effects of exposure to inorganic mercury salts.

71. In rats exposed to mercuric chloride systolic and diastolic blood pressures were elevated at doses of 24 mg Hg/kg/day for 180 days or 6 mg Hg/kg/day for 350 days, and systolic blood pressure was also increased in rats exposed to 0.66 or 1.3 mg Hg/kg/day for 365 days; though no change was observed at 3.3 mg Hg/kg/day for 365 days, potentially due to poor general health at this dose (Carmignani and Boscolo, 1984; Carmignani et al, 1992; Perry and Erlanger, 1974). Aortic blood pressure similarly rose in rats exposed to ≥6 mg Hg/kg/day for 350 days (Boscolo et al, 1989; Carmignani et al, 1989).

72. In dietary studies, normotensive Wistar rats showed no changes in systolic blood pressure when exposed to up to 2.2 mg Hg/kg/day of mercuric chloride for 21 weeks (Takahashi et al., 2000a). Conversely, spontaneously hypertensive Wistar rats experienced a 6–10% increase in systolic blood pressure after exposure to doses of ≥0.1 mg Hg/kg/day for 4 or 5 weeks. However, no significant effects were observed at doses up to 3 mg Hg/kg/day for 6–12 weeks (Takahashi et al., 2000b).

73. Exposure to mercuric chloride in rats has been linked to changes in cardiac function, including increased left ventricular end diastolic pressure, positive inotropic effects, and altered baroreceptor reflex sensitivity. These effects were observed at daily doses ranging from 0.012 to 24 mg Hg/kg/day over periods of 1 month to 350 days (Boscolo et al., 1989; Carmignani et al., 1989, 1992; Jindal et al., 2011).

74. Decreased baroreceptor reflex sensitivity was noted in Wistar and Sprague-Dawley rats after exposure to mercuric chloride in drinking water, with a ≥27% reduction in the change in aortic blood pressure at doses ≥6 mg Hg/kg/day following administration of vasoactive drugs (e.g., norepinephrine, phenylephrine) (Boscolo et al., 1989; Carmignani and Boscolo, 1984; Carmignani et al., 1989). However, no exposure-related changes were observed in electrocardiogram parameters, stroke volume, cardiac output, left ventricular wall thickness, or carotid artery diameter or thickness in rats exposed to mercuric chloride in drinking water at doses up to 5.91 mg Hg/kg/day for 4 weeks (Wildemann et al., 2015a, 2015b, 2016).

75. No exposure-related changes in heart histology were observed in random-bred domestic adult cats following oral exposure to methylmercuric chloride at doses of up to 0.176 mg Hg/kg/day for 16 weeks, 0.074 mg Hg/kg/day for 55 weeks, or 0.046 mg Hg/kg/day for 2 years (Charbonneau et al., 1976). The control group used 10 cats, and the treatment groups used 8 cats with equal numbers of male and female.

Organic mercury

76. There is evidence in experimental animals that the cardiovascular system might be adversely affected by organic mercury. Grotto et al, (2009) reported statistically significant increases in systolic blood pressure in adult male rats given methylmercuric chloride by oral gavage for 100 days at 0.1 mg/kg bw per day, equivalent to 0.08 mg/kg bw per day expressed as mercury.

77. Studies of the Faroe Island population evaluated blood pressure in children at ages 7 and 14 (Grandjean et al., 2004; Sørensen et al., 1999). In 7-year-olds, a positive association was found between cord blood mercury (BHg) and maternal hair mercury (HHg) with systolic blood pressure, and between cord BHg and diastolic blood pressure. Specifically, an increase in cord BHg from 1 to 10 µg/L was associated with increases of 13.9 mmHg in systolic blood pressure and 14.6 mmHg in diastolic blood pressure (Sørensen et al., 1999).

78. In the follow-up study assessing blood pressure at age 14, no association was found between BHg, maternal HHg (at parturition), or child HHg (Grandjean et al., 2004). Similarly, in a study of children in the Seychelles Islands, no link was observed between prenatal exposure and systolic or diastolic blood pressure in girls at ages 12 and 15, or in boys at age 12 (Thurston et al., 2007). However, a positive association was noted between maternal HHg and diastolic blood pressure in boys at age 15. Additionally, a study of Nunavik Inuit children at age 11 found no association between cord BHg and blood pressure, even after adjusting for exposure to lead and polychlorinated biphenyls (PCBs) (Valera et al., 2012).

79. Chan et al, (2021) found that prenatal MeHg exposure was associated with decreased heart rate variability (HRV), reflecting reduced parasympathetic activity, and a sympathovagal balance shift toward sympathetic predominance in children aged 7-8 years. Adjustments for recent fish consumption increased the significance of the adverse associations.

80. Zareba et al. (2019) evaluated prenatal MeHg exposure in relation to HRV parameters in a large cohort of 19-year-old adults from the main cohort of

the Seychelles Child Development Study. After adjustments for activity levels, polyunsaturated fatty acids, and multiplicity no statistically significant trends were found. The authors concluded, prenatal and recent MeHg exposure had no consistent pattern of association in this high fish consumer study population.