**For information on**
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**LegCo Panel on Food Safety and Environmental Hygiene**

# Study on Dietary Exposure to Mercury of Secondary School Students (A Follow-up Report)

## PURPOSE

This paper presents the findings of the study conducted by the Food and Environmental Hygiene Department (FEHD) on the dietary exposure and health effects of total mercury and methylmercury to secondary school students.

## BACKGROUND

### *2002 Study*

2. In 2002, FEHD had included mercury as one of the three heavy metals being assessed in the study of secondary school students on dietary exposure to heavy metals. The study result showed that dietary exposure of an average secondary student to total mercury was estimated to be 2.98 µg/kg body weight (bw)/week. This level was below the provisional tolerable weekly intake (PTWI)[1] level of 5µg/kg bw/week established by the Joint Food and Agriculture Organisation/World Health Organisation Expert Committee on Food Additives (JECFA). For a high consumer, the dietary exposure was estimated to be 6.41µg/kg bw/week which exceeded the PTWI.

3. It was noted that there were certain limitations in the previous study. The study employed data extracted from FEHD's food surveillance programme which is mainly for enforcement purposes and the limit of detection[2] (LOD) was considered high if used for research studies. For example, cereal, cereal products and vegetables were found to be important sources of mercury in

[1] PTWI is an estimate of the amount of a contaminant that can be ingested over a lifetime without appreciable risk. Its value represents permissible human weekly exposure to a contaminant unavoidably with the consumption of food.

[2] The limit of detection is the smallest measure that can be detected with reasonable certainty for a given analytical procedure.

foods and the results were not consistent with those reported in the literature. Analyses for mercury were also determined in the form of total mercury but not methylmercury.

4. In view of the limitations in the previous study and the availability of methylmercury testing locally, a follow-up study on dietary exposure to total mercury and methylmercury was conducted to re-examine the issue with a view to obtaining more precise estimates of dietary exposure to mercury.

***Mercury***

5. Mercury is naturally present in the environment and can occur in organic, inorganic and metallic forms. It can change from one form to another under certain conditions. Organic methylmercury, formed by microorganisms in aquatic environment from inorganic mercury, bioaccumulates in the food chain and can result in high concentration in large predatory fish.

6. Among all sources of exposure to mercury, dietary intake is the most prominent one. Fish and other seafood products are the main sources of methylmercury of which large predatory fish such as swordfish and tuna tend to accumulate a relatively high level of methylmercury.

7. Organic mercury compounds are more harmful than inorganic mercury. The highly-toxic methylmercury can cause adverse effect to the nervous system especially the developing brain. Hence unborn foetus, infants and young children are more susceptible. On the other hand, acute mercury toxicity is often related with occupational exposure but rarely associated with dietary exposure.

## INTERNATIONAL REFERENCE ON SAFE INTAKE LEVEL

8. JECFA has adopted PTWIs of 5μg/kg bw/week for total mercury and 3.3μg/kg bw/week for methylmercury respectively. In 2003, JECFA, in view of the greater risk of methylmercury to foetus and infants, reduced the PTWI for methylmercury to 1.6μg/kg bw/week to provide better protection to the developing foetus, the most sensitive subgroup of the population.

## SCOPE AND METHOD OF STUDY

9. Six major food groups – cereal and cereal products; vegetables; meat, poultry and their products; fish; seafood other than fish; milk and dairy

products, were covered in the current study. These food groups were the same as those in our previous study and the data on food consumption pattern was obtained from the Food Consumption Survey conducted in local secondary school students by FEHD in 2000. A total of 347 samples from these food groups were taken specifically for the study for analysis of total mercury and methylmercury by the Food Research Laboratory of FEHD. The LODs for total mercury and methylmercury are 3μg/kg and 1μg/kg respectively, as compared to the LOD of 30μg/kg for total mercury in the previous study. A half-LOD value was assigned to all results below the LODs.

10. Dietary exposure estimate for each student was obtained by summing exposures from individual food items which were in turn obtained by combining the food consumption data and the median concentration of the respective food items. The exposure estimates of average students and high consumers were then compared with the PTWIs as established by JECFA and the adverse effects likely to occur in the target population are assessed.

## RESULTS

11. The dietary exposures to total mercury and methylmercury of the average secondary school students were 0.92 and 0.35μg/kg bw/week respectively. For high consumers, their dietary exposures represented by the 95th percentile exposure level were 2.33 and 0.87μg/kg bw/week for total mercury and methylmercury respectively.

12. The exposure estimates for both average secondary school student and the high consumer fall below the PTWIs of 5μg/kg bw/week and 1.6μg/kg bw/week for total mercury and methylmercury respectively. Therefore, it can be concluded that they are unlikely to experience major undesirable health effects caused by total mercury and methylmercury.

13. The food group “fish” is the main food source attributable to the total mercury and methylmercury exposures and this is followed by “seafood other than fish” and these findings are in line with those reported in overseas studies. However, these differ from the results of our previous study which had overestimated the contribution of cereal and cereal products because of the limitations mentioned in paragraph 3.

14. Of the foods analysed, large predatory fish such as swordfish and tuna had the highest mercury level and this finding is similar to those obtained in our previous study and in overseas studies.

15. Since the data on consumption pattern for pregnant women is not available, the risk of methylmercury exposure for foetus cannot be fully assessed. However, the result showed that even the 95$^{th}$ percentile exposure level of 0.87µg/kg bw/week for methylmercury in secondary school students is still below the respective PTWI of 1.6µg/kg.

## RISK REDUCTION

16. "Fish" is the food group identified as the main dietary exposure source of total mercury and methylmercury. Large predatory fish such as swordfish and tuna had the highest concentration of mercury and they may be a significant dietary source of mercury especially when consumed in large amount. A balanced diet is always essential to avoid an excessive risk of mercury exposure from a small range of food items. Susceptible groups such as children and pregnant women should be careful in food selection. They are advised not to consume excessive amount of predatory fish. As fish is a good source of high-quality protein and is low in saturated fat, moderate consumption of fish is recommended.

## WAY FORWARD

17. FEHD will publicize the findings of the study through various channels to advise the public of the risk factors concerned and the ways to reduce the possible risk through dietary intake. The reports of the study have been uploaded onto the FEHD Website (http://www.fehd.gov.hk) and will be available at major libraries and FEHD Communication Resource Unit and Health Education Exhibition and Resource Centre.

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