Supplementary Information

**Investigation of contamination pathway and human health risk assessment from metals in milk from the cows grazing in an industrial area: a mass balance approach**

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**Table S1** ICP-OES instrumental parameters for the analysis of metals

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Value** | **Parameter** | **Value** |
| Nebuliser type | Cross-flow | Processing mode | Area |
| Spray chamber type | Scott-type | Read delay | 45 s |
| RF power | 1450 W | Calibration type | Linear |
| Plasma gas flow | 10 L min-1 | Purge | Normal |
| Auxiliary gas flow | 0.2 L min-1 | Rinse | 20 s |
| Plasma viewing | Axial/radial | Replicates | 3 |
| Sample flow rate | 1 mL min-1 | Carrier solution | Aqua regia |
| Nebuliser gas flow | 0.7 L min-1 | Rinse solution | 1. % HNO3
 |

**Table S2** Mean metal concentrations in cow’s tail switch hair samples

|  |  |
| --- | --- |
| **Type of sample** | **Parameter** |
| **Al** | **Cd** | **Cr** | **Cu** | **Fe** | **Mn** | **Pb** | **Zn** |
| Cow’s tail switch hair | 1374.07 ± 0.88 | 0.11 ± 0.00 | 31.63 ± 0.41 | 15.80 ± 0.15 | 1546.26 ± 1.66 | 77.94 ± 90 | 5.63 ± 0.11 | 410.09 ± 1.44 |

**Risk estimation**

Total number of cattle grazing regularly in the study area was found to be ninety-one. From this, cattle owners in the surrounding villages (Puliyanthangal and Periyanthangal) were identified to be thirty-eight. Total milk yield per day from cattle was found to be 339 L/day from cow herds.

Total milk yield per day from ninety-one cattle = 339 L/day

The self-consumption of milk per family per day from thirty-eight families of cattle owner’s was estimated by surveys and found to be 21 L per day. The mean self-consumption of milk per family was 0.56 L/day.

Self-consumption of milk by thirty-eight families = 21 L/day

Mean self-consumption of one family = 0.56 L/day

Hence, 21 L of milk among total milk yield of 339 L was consumed by thirty-eight families of cattle owner’s per day, the rest 318 L of milk per day was sold to the consumers in the near-by villages.

Amount of milk sold to the consumers = 318 L/day

From the surveys, the number of children and adults consuming milk per family among thirty-eight families was estimated; found to be thirty-five children and eighty-nine adults. Thus, it was approximated that the number of children consuming milk per family was 1; number of adults consuming milk per family was 2.4. From the market survey conducted among milk buyers from the study area, the average daily intake of milk among children and adults were identified.

Average daily intake of child per day = 145 mL/day

Average daily intake of adult per day = 206.5 mL/day

Total number of children consuming milk per family = 1

Total number of adults consuming milk per family = 2.4

From this data, the number of families consuming 318 L milk per day can be calculated as follows:

Let ‘x’ be the number of families consuming 318 L of milk per day; 2.4 adults and 1 child per family consumes milk in a day,

 $x× 2.4 × \frac{206.5}{1000} + x× 1 × \frac{145}{1000} =318 L $

$$⇒x= \frac{318}{\left(2.4 ×0.2065\right) +\left(1 ×0.145\right)}$$

$$⇒x ≈496 families$$

The total number of adults and children consuming the milk every day in the cattle owner families were identified already and found to be thirty-five children and eighty-five adults. The number of children and adults consuming the milk in the buyer’s families were estimated to be 1 and 2.4 respectively. From this data, the total number of children and adults consuming the metal contaminated milk everyday can be calculated as follows:

Total number of children consuming the metal contaminated milk = Number of children consuming milk in cattle owner’s families + number of children consuming milk in milk buyer’s families

$$⇒35 +(1×496)$$

$≈$ 531 children

Total number of adults consuming the metal contaminated milk = Number of adults consuming milk in cattle owner’s families + number of adults consuming milk in milk buyer’s families

$$⇒89 +(2.4 ×496)$$

= 89 $+$ 1140.4

$≈$ 1279 adults

Approximately, there is considerable risk for 531 children and 1279 adults for consuming metal contaminated milk from the cattle reared in the Puliyanthangal Lake.

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