

Supplementary Materials:

In Vitro Bioaccessibility and Health Risk of Heavy Metals from PM_{2.5}/PM₁₀ in Arid Areas—Hotan City, China

Table S1. Detection limit of heavy metals (µg/mL).

Element	Pb	Mn	Ni	Cd	As
IDLs	0.0085	0.0017	0.0028	0.0020	0.0015
MDLs	0.0256	0.0051	0.0083	0.0061	0.0044
LOQ	0.0283	0.0057	0.0093	0.0067	0.0050

Table S2. Composition and pH of extraction fluids [62].

Extraction fluid	Composition (per liter DI water)	pH
Gamble's solution	Magnesium chloride (0.095 g), sodium chloride (6.019 g), potassium chloride (0.298 g), disodium hydrogen phosphate (0.126 g), sodium sulphate (0.063 g), calcium chloride dihydrate (0.368 g), sodium acetate (0.574 g), sodium hydrogen carbonate (2.604 g), sodium citrate dihydrate (0.097 g)	7.4
Simulated gastric juice	Sodium citrate (0.5 g), malic acid (0.5 g), lactic acid (420 µL), acetic acid (500 µL), pepsin (1.25 g)	2
Simulated intestinal juice	Trypsin (0.05 g) and bile salts (0.175 g) were introduced into the reaction solution of gastric juice	7

Table S3. Reference dose (RFD) and slope factors (SF) of different exposure pathway [44].

		Pb	Mn	Ni	Cd	As
RfC _i	mg m ⁻³		5.00×10^{-5}	1.40×10^{-5}	1.00×10^{-5}	1.50×10^{-5}
RfDo	mg kg ⁻¹ day ⁻¹	3.50×10^{-3}	1.40×10^{-1}	1.10×10^{-2}	1.00×10^{-4}	3.00×10^{-4}
IUR	(µg m ⁻³) ⁻¹	1.20×10^{-5}	--	2.40×10^{-4}	1.80×10^{-3}	4.30×10^{-3}
SFo	(mg kg ⁻¹ day ⁻¹) ⁻¹	8.50×10^{-5}	--	1.70×10^0		1.50×10^0

Table S4. Parameter values used in ADD calculation models and Monte Carlo simulation of heavy metals in PM_{2.5} and PM₁₀.

Exposure parameters	Abbreviation	Unit	Distribution	Probable value		Min		Max		SD		References
				Children	Adults	Children	Adults	Children	Adults	Children	Adults	
Ingestion rate	IngR	mg/day	Triangular	200	100	143.6	71.8	244.4	122.2			[63]
Exposure frequency	EF	day/a	Triangular	180	180	60	60	345	345			[44]
Exposure duration	ED	a	Triangular	6	24	1	5	15	45			[44]
Body weight	BW	kg	Normal	14.9	58.6		42.1		71.6	5.8	5.8	[64]
Average time (carcinogenic)	ATc	d	/	25550	25550	25550	25550	25550	25550			[65]
Average time (noncarcinogenic)	ATnc	d	Triangular	2190	8760	365	1825	5475	16425			[65]

Table S5. Exposure concentration (EC_{inh}) ($\mu\text{g m}^{-3}$) and chemical daily intake (CDI_{ing}) ($\text{mg}\cdot\text{kg}^{-1}\cdot\text{d}^{-1}$) for each heavy metal by different pathways in winter.

Toxic elements		EC_{inh}				CDI_{ing}			
		non-Carcinogenic		Carcinogenic		non-Carcinogenic		Carcinogenic	
		Children	Adults	Children	Adults	Children	Adults	Children	Adults
PM _{2.5}	Pb	8.24×10^{-3}	8.24×10^{-3}	7.07×10^{-4}	2.83×10^{-3}	1.92×10^{-3}	2.44×10^{-4}	1.64×10^{-4}	8.35×10^{-5}
	Mn	6.87×10^{-3}	6.87×10^{-3}	5.89×10^{-4}	2.36×10^{-3}	1.42×10^{-3}	1.81×10^{-4}	1.22×10^{-4}	6.19×10^{-5}
	Ni	7.60×10^{-4}	7.60×10^{-4}	6.51×10^{-5}	2.60×10^{-4}	3.86×10^{-5}	4.90×10^{-6}	3.30×10^{-6}	1.68×10^{-6}
	Cd	6.85×10^{-4}	6.85×10^{-4}	5.87×10^{-5}	2.35×10^{-4}	5.50×10^{-5}	6.99×10^{-6}	4.71×10^{-6}	2.40×10^{-6}
	As	8.66×10^{-4}	8.66×10^{-4}	7.42×10^{-5}	2.97×10^{-4}	5.20×10^{-5}	6.61×10^{-6}	4.46×10^{-6}	2.27×10^{-6}
PM ₁₀	Pb	1.53×10^{-2}	1.53×10^{-2}	1.31×10^{-3}	5.25×10^{-3}	1.40×10^{-3}	1.78×10^{-4}	1.20×10^{-4}	6.12×10^{-5}
	Mn	1.35×10^{-2}	1.35×10^{-2}	1.16×10^{-3}	4.63×10^{-3}	2.09×10^{-3}	2.66×10^{-4}	1.79×10^{-4}	9.13×10^{-5}
	Ni	4.79×10^{-4}	4.79×10^{-4}	4.11×10^{-5}	1.64×10^{-4}	9.09×10^{-5}	1.16×10^{-5}	7.79×10^{-6}	3.96×10^{-6}
	Cd	1.08×10^{-3}	1.08×10^{-3}	9.28×10^{-5}	3.71×10^{-4}	6.48×10^{-5}	8.24×10^{-6}	5.56×10^{-6}	2.83×10^{-6}
	As	1.39×10^{-3}	1.39×10^{-3}	1.19×10^{-4}	4.76×10^{-4}	3.94×10^{-5}	5.02×10^{-6}	3.38×10^{-6}	1.72×10^{-6}

Table S6. Exposure concentration (EC_{inh}) ($\mu\text{g m}^{-3}$) and chemical daily intake (CDI_{ing}) ($\text{mg}\cdot\text{kg}^{-1}\cdot\text{d}^{-1}$) for each heavy metal by different pathways in summer.

Toxic elements		EC_{inh}				CDI_{ing}			
		non-Carcinogenic		Carcinogenic		non-Carcinogenic		Carcinogenic	
		Children	Adults	Children	Adults	Children	Adults	Children	Adults
PM _{2.5}	Pb	2.82×10^{-3}	2.82×10^{-3}	2.42×10^{-4}	9.67×10^{-4}	2.26×10^{-4}	2.87×10^{-5}	1.94×10^{-5}	9.84×10^{-6}
	Mn	1.73×10^{-2}	1.73×10^{-2}	1.48×10^{-3}	5.92×10^{-3}	7.43×10^{-4}	9.44×10^{-5}	6.37×10^{-5}	3.24×10^{-5}
	Ni	1.38×10^{-3}	1.38×10^{-3}	1.18×10^{-4}	4.73×10^{-4}	5.94×10^{-5}	7.55×10^{-6}	5.09×10^{-6}	2.59×10^{-6}
	Pb	8.04×10^{-3}	8.04×10^{-3}	6.89×10^{-4}	2.76×10^{-3}	3.06×10^{-4}	3.89×10^{-5}	2.62×10^{-5}	1.33×10^{-5}
PM ₁₀	Mn	2.69×10^{-2}	2.69×10^{-2}	2.30×10^{-3}	9.21×10^{-3}	1.16×10^{-3}	1.48×10^{-4}	9.96×10^{-5}	5.07×10^{-5}
	Ni	7.26×10^{-3}	7.26×10^{-3}	6.22×10^{-4}	2.49×10^{-3}	1.17×10^{-4}	1.49×10^{-5}	1.00×10^{-5}	5.09×10^{-6}

Table S7. The Pearson correlation coefficient matrix of heavy metals in PM_{2.5} and PM₁₀ of summer and winter.

Sampling period		Pb	Mn	Ni	Cd	As
PM _{2.5} in summer	Pb	1				
	Mn	0.423	1			
	Ni	0.271	0.858**	1		
	Cd	0.425	0.466	0.06	1	
	As	0.33	0.311	−0.044	0.903**	1
PM _{2.5} in winter	Pb	1				
	Mn	−0.023	1			
	Ni	0.212	0.44	1		
	Cd	0.365	0.516*	0.426	1	
	As	−0.101	−0.058	−0.306	0.144	1
PM ₁₀ in summer	Pb	1				
	Mn	−0.041	1			
	Ni	0.662**	0.324	1		
	Cd	0.677**	0.104	0.691**	1	
	As	0.680**	0.066	0.675**	0.999**	1
PM ₁₀ in winter	Pb	1				
	Mn	0.218	1			
	Ni	0.078	0.639**	1		
	Cd	−0.077	−0.511*	−0.051	1	
	As	−0.038	−0.344	−0.014	0.815**	1

* Significant level at p-value <0.05 (two-tailed).

** Significant level at p-value <0.01 (two-tailed).

Table S8. Bioaccessibility of heavy metals in summer and winter.

			As	Cd	Mn	Ni	Pb
Summer	PM _{2.5}	lung fluid	N/A	N/A	49.9%	53.3%	51.3%
		gastric juice	N/A	N/A	64.1%	42.3%	69.2%
		intestinal fluid	N/A	N/A	40.1%	30.1%	38.3%
	PM ₁₀	lung fluid	N/A	N/A	44.4%	33.9%	47.8%
		gastric juice	N/A	N/A	52.0%	11.3%	36.8%
		intestinal fluid	N/A	N/A	41.4%	14.0%	38.5%
Winter	PM _{2.5}	lung fluid	36.8%	74.7%	43.4%	25.0%	32.3%
		gastric juice	19.9%	55.1%	88.0%	11.7%	68.1%
		intestinal fluid	N/A	37.5%	49.3%	11.5%	15.5%
	PM ₁₀	lung fluid	44.5%	62.3%	37.3%	16.2%	40.4%
		gastric juice	17.0%	49.8%	85.1%	42.3%	50.9%
		intestinal fluid	N/A	29.1%	46.3%	17.6%	13.2%

Note: N/A indicates that the concentration is lower than the detection limit.

Table S9. Coefficient of variation for each metal in summer and winter.

		Pb	Mn	Ni	Cd	As
Winter	PM ₁₀	19.46%	37.13%	13.00%	15.63%	7.75%
	PM _{2.5}	11.63%	39.84%	23.34%	12.90%	11.97%
Summer	PM ₁₀	26.97%	56.27%	23.10%	1.60%	2.04%
	PM _{2.5}	46.23%	114.25%	58.48%	118.26%	122.15%