

Supplementary Information

Table S1: bWQS chemical weight threshold.

	EES	POPs	TOTAL
	t_{EEm}	t_{POPm}	t_{TOTm}
MATERNAL	$(1/3) = 0.33$	$(1/7) = 0.14$	$(1/10) = 0.10$
	t_{EEc}	t_{POPc}	t_{TOTc}
CORD	$1/3 = 0.33$	$(1/5) = 0.20$	$(1/8) = 0.125$

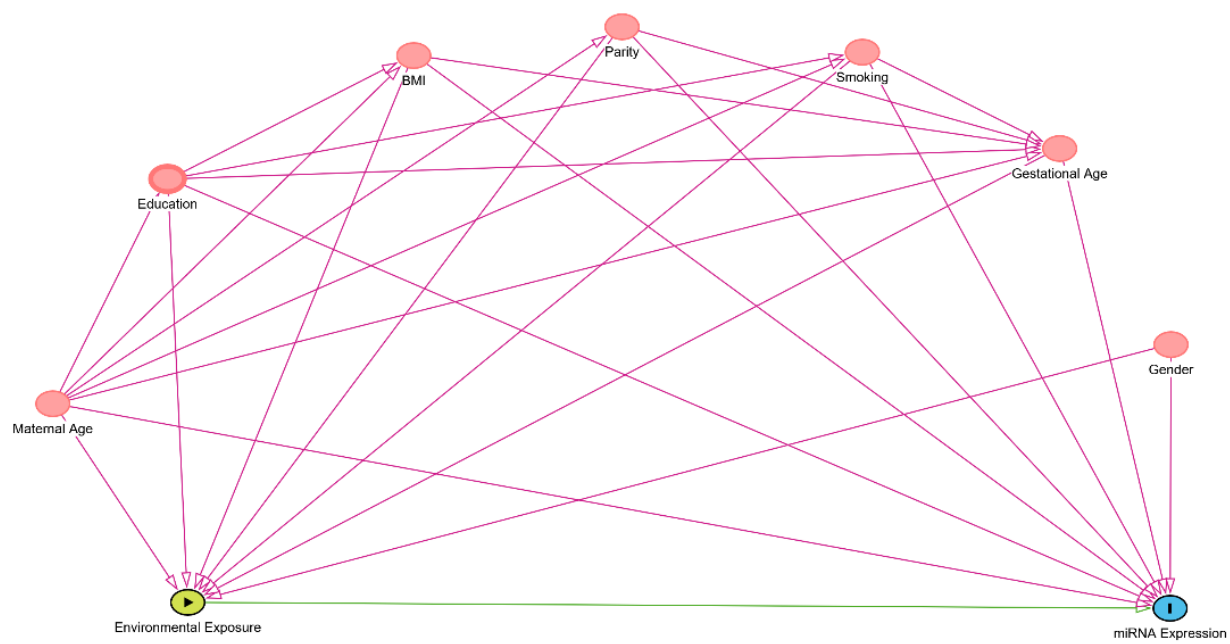


Figure S1: DAG – directed acyclic graph.

Table S2: Regression analysis results for each analyte vs miRNAs in maternal serum. The models were adjusted for the following *a priori* selected confounders: maternal age, educational level, BMI, Parity, smoking, gestational age, gender. P-values were adjusted for multiple comparisons using the Benjamini–Hochberg false discovery rate (FDR) procedure.

Analyte	miRNA	Beta (95% CI)	P-value
Zn	hsa-miR-10b-5p	0.4 (0.19 ; 0.61)	0.005
	hsa-miR-30d-5p	-0.34 (-0.55 ; -0.12)	0.044
	hsa-miR-122-5p	0.36 (0.14 ; 0.58)	0.024
	hsa-miR-148a-3p	0.32 (0.11 ; 0.54)	0.041
	hsa-miR-205-5p	0.35 (0.14 ; 0.56)	0.025
	hsa-miR-206	0.4 (0.19 ; 0.61)	0.004
	hsa-miR-214-3p	0.34 (0.13 ; 0.56)	0.033
	hsa-miR-374a-5p	-0.36 (-0.57 ; -0.15)	0.014
p,p'-DDE	hsa-miR-1-3p	0.27 (0.06 ; 0.48)	0.031
HCB	hsa-miR-1-3p	0.43 (0.22 ; 0.64)	0.002
	hsa-miR-133a-3p	0.38 (0.17 ; 0.59)	0.005
PCB74	hsa-miR-1-3p	0.34 (0.12 ; 0.56)	0.017
PCB118	hsa-miR-1-3p	0.41 (0.2 ; 0.62)	0.002
	hsa-miR-133b	0.39 (0.18 ; 0.6)	0.005
	hsa-miR-195-5p	0.28 (0.06 ; 0.5)	0.021
PCB138	hsa-miR-1-3p	0.32 (0.09 ; 0.55)	0.03
	hsa-miR-195-5p	0.39 (0.17 ; 0.61)	0.002
	hsa-miR-30e-5p	0.31 (0.08 ; 0.53)	0.018
PCB153	hsa-miR-1-3p	0.3 (0.07 ; 0.54)	0.031
	hsa-miR-195-5p	0.44 (0.22 ; 0.66)	0.001
	hsa-miR-30e-5p	0.33 (0.1 ; 0.56)	0.018
PCB180	hsa-miR-195-5p	0.45 (0.22 ; 0.68)	0.001
	hsa-miR-30e-5p	0.33 (0.09 ; 0.57)	0.018
ΣPCBs	hsa-miR-1-3p	0.29 (0.06 ; 0.53)	0.034
	hsa-miR-195-5p	0.44 (0.22 ; 0.67)	0.001
	hsa-miR-30e-5p	0.33 (0.1 ; 0.57)	0.018

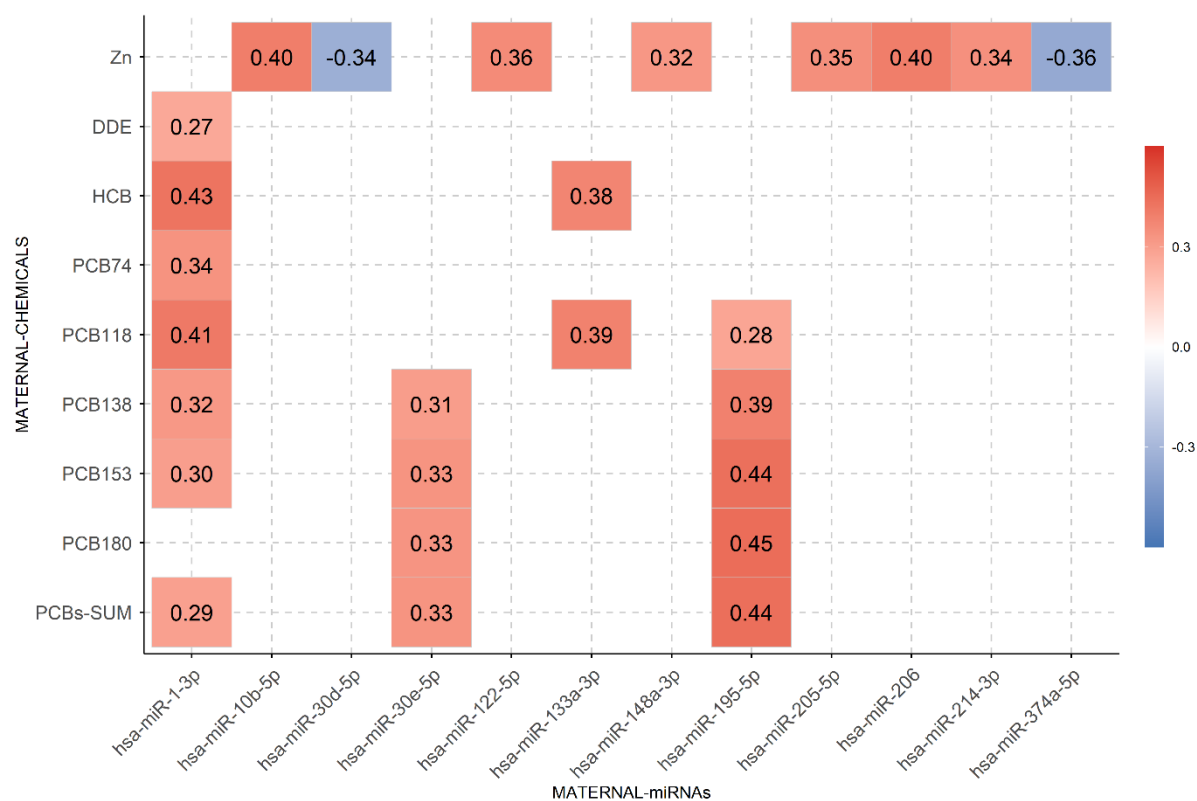


Figure S2: Heatmap showing statistically significant associations (FDR-adjusted p value < 0.05) between the concentrations of each analyte (y-axis) and the ΔC_t values of miRNAs (x-axis) in maternal serum. The colour of each box represents the magnitude and direction of the beta coefficient (reported inside the box): red indicates positive associations, while blue indicates negative associations.

Table S3: Regression analysis results for each analyte vs miRNAs in cord serum. The models were adjusted for the following *a priori* selected confounders: maternal age, educational level, BMI, Parity, smoking, gestational age, gender, delivery. P-values were adjusted for multiple comparisons using the Benjamini–Hochberg false discovery rate (FDR) procedure.

Analyte	miRNA	Beta (95% CI)	P-value
Cu	hsa-miR-7-5p	0.29 (0.08 ; 0.5)	0.031
	hsa-miR-10a-5p	0.29 (0.09 ; 0.5)	0.024
	hsa-miR-30d-5p	0.33 (0.12 ; 0.54)	0.007
	hsa-miR-195-5p	0.37 (0.17 ; 0.57)	0.005
	hsa-miR-134-5p	0.34 (0.14 ; 0.55)	0.009
	hsa-miR-122-5p	0.53 (0.33 ; 0.72)	0.001
	hsa-miR-200c-3p	0.27 (0.07 ; 0.47)	0.046
	hsa-miR-376c-3p	0.42 (0.22 ; 0.61)	0.001
	hsa-miR-574-3p	0.3 (0.09 ; 0.51)	0.028
Se	hsa-miR-7-5p	0.26 (0.04 ; 0.47)	0.039
	hsa-miR-22-3p	-0.33 (-0.54 ; -0.12)	0.024
	hsa-miR-29a-3p	-0.41 (-0.62 ; -0.21)	0.002
	hsa-miR-30d-5p	0.37 (0.16 ; 0.58)	0.006
	hsa-miR-122-5p	0.3 (0.08 ; 0.52)	0.025
	hsa-miR-195-5p	0.27 (0.05 ; 0.48)	0.049
Zn	hsa-miR-16-5p	-0.33 (-0.54 ; -0.12)	0.024
PCB138	hsa-miR-7-5p	0.3 (0.08 ; 0.53)	0.031
	hsa-miR-27a-3p	-0.29 (-0.51 ; -0.07)	0.031
	hsa-miR-29a-3p	-0.38 (-0.6 ; -0.17)	0.004
	hsa-miR-30d-5p	0.28 (0.06 ; 0.51)	0.031
	hsa-miR-133a-3p	-0.39 (-0.61 ; -0.17)	0.008
	hsa-miR-133b	-0.36 (-0.58 ; -0.13)	0.024
PCB153	hsa-miR-7-5p	0.27 (0.04 ; 0.5)	0.039
	hsa-miR-27a-3p	-0.32 (-0.54 ; -0.1)	0.031
	hsa-miR-29a-3p	-0.35 (-0.58 ; -0.13)	0.007
	hsa-miR-30d-5p	0.26 (0.03 ; 0.49)	0.048
	hsa-miR-133a-3p	-0.36 (-0.6 ; -0.13)	0.011
	hsa-miR-133b	-0.32 (-0.55 ; -0.08)	0.038
PCB180	hsa-miR-27a-3p	-0.3 (-0.54 ; -0.06)	0.042
	hsa-miR-29a-3p	-0.32 (-0.56 ; -0.07)	0.025
ΣPCBs	hsa-miR-7-5p	0.28 (0.04 ; 0.51)	0.039
	hsa-miR-27a-3p	-0.31 (-0.54 ; -0.09)	0.031
	hsa-miR-29a-3p	-0.36 (-0.59 ; -0.13)	0.007
	hsa-miR-30d-5p	0.27 (0.03 ; 0.5)	0.048
	hsa-miR-133a-3p	-0.36 (-0.59 ; -0.12)	0.011
	hsa-miR-133b	-0.31 (-0.55 ; -0.07)	0.038

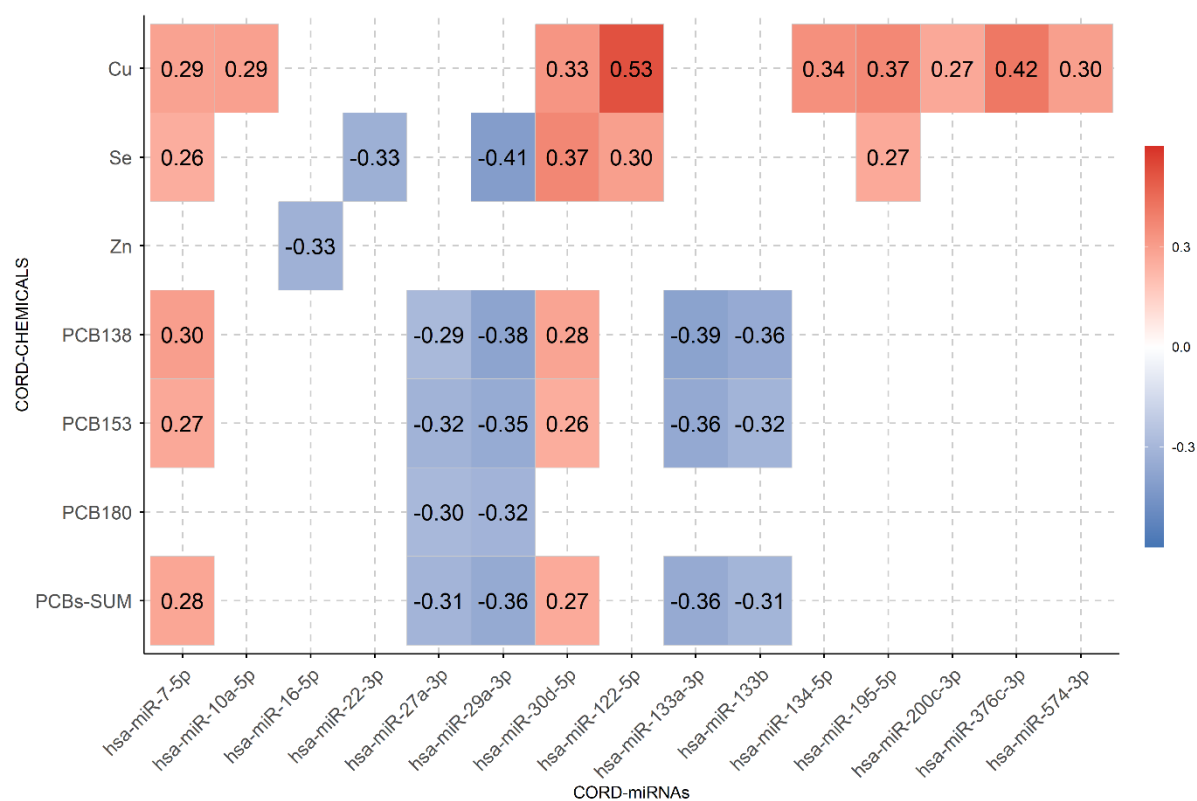


Figure S3: Heatmap illustrating the associations passing the FDR-adjusted significant threshold ($p < 0.05$) between analyte concentrations and miRNA ΔC_t values in cord serum. The colour gradient reflects the direction and strength of the beta coefficient, with red shades indicating positive associations and blue shades indicating negative associations.

Table S4: bWQS results from maternal serum.

miRNA	EE mixture β(95%CI)	POP mixture β(95%CI)	Total mixture β(95%CI)
hsa-miR-1-3p		0.49 (0.27 ; 0.73)\$	0.68 (0.34 ; 0.93)\$
hsa-miR-7-5p	0.43 (0.16 ; 0.67)		
hsa-miR-10b-5p	0.5 (0.25 ; 0.7)\$		
hsa-miR-15a-5p		-0.24 (-0.47 ; -0.01)	-0.27 (-0.59 ; -0.03)
hsa-miR-17-5p		0.24 (0.02 ; 0.43)	
hsa-miR-18a-5p	-0.41 (-0.67 ; -0.14)		
hsa-miR-20a-5p		0.23 (0.01 ; 0.42)	
hsa-miR-25-3p		-0.2 (-0.47 ; -0.02)	
hsa-miR-27a-3p	-0.3 (-0.6 ; -0.09)		
hsa-miR-29a-3p		-0.26 (-0.51 ; -0.05)	
hsa-miR-30d-5p	-0.35 (-0.66 ; -0.14)\$		
hsa-miR-31-5p		-0.26 (-0.5 ; -0.03)	
hsa-miR-96-5p		-0.21 (-0.45 ; -0.03)	
hsa-miR-100-5p	0.33 (0.04 ; 0.57)		
hsa-miR-122-5p	0.43 (0.12 ; 0.67)\$		
hsa-miR-126-3p	-0.31 (-0.58 ; -0.06)		
hsa-miR-128-3p		-0.25 (-0.49 ; -0.08)	-0.27 (-0.59 ; -0.01)
hsa-miR-130b-3p	-0.34 (-0.61 ; -0.11)		
hsa-miR-133a-3p		0.43 (0.2 ; 0.64)\$	0.62 (0.2 ; 0.87)
hsa-miR-133b	0.4 (0.12 ; 0.68)		0.56 (0.11 ; 0.89)
hsa-miR-134-5p	-0.39 (-0.67 ; -0.11)		
hsa-miR-143-3p	0.37 (0.05 ; 0.61)		
hsa-miR-145-5p	0.43 (0.12 ; 0.68)		0.42 (0.02 ; 0.76)
hsa-miR-193a-5p	0.39 (0.11 ; 0.62)		
hsa-miR-195-5p		0.39 (0.14 ; 0.56)\$	0.57 (0.22 ; 0.84)
hsa-miR-200a-3p	0.31 (0.03 ; 0.52)		
hsa-miR-200b-3p		0.3 (0.04 ; 0.52)	0.37 (0.08 ; 0.66)
hsa-miR-203a-3p		0.23 (0 ; 0.45)	
hsa-miR-205-5p	0.43 (0.21 ; 0.64)\$		
hsa-miR-210-3p		-0.24 (-0.48 ; 0)	
hsa-miR-214-3p	0.56 (0.27 ; 0.79)\$		0.59 (0.15 ; 0.92)
hsa-miR-296-5p	-0.2 (-0.45 ; 0)		-0.32 (-0.77 ; -0.03)
hsa-miR-374a-5p	-0.43 (-0.7 ; -0.19)\$		
hsa-miR-375-3p	0.27 (0 ; 0.49)		
hsa-miR-376c-3p	-0.32 (-0.64 ; -0.05)		
\$ indicates if the miRNA was previously identified in single-chemical regression of analytes included in the same family.			

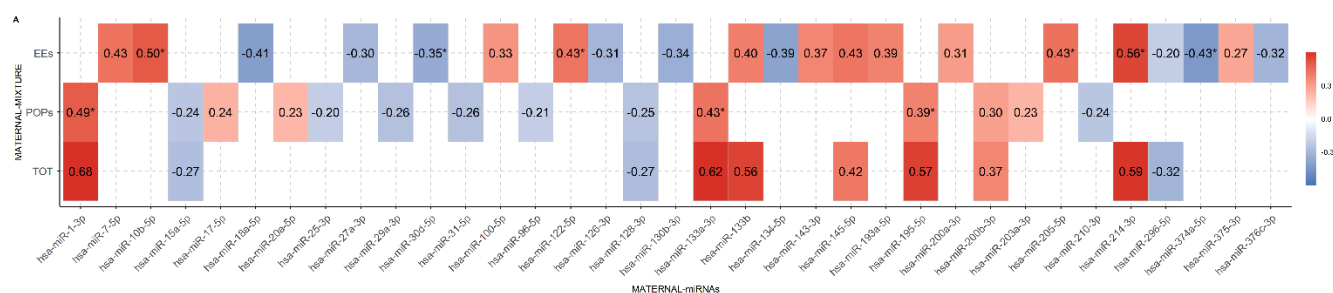


Figure S4: Heatmap reporting associations between maternal miRNAs and exposure mixtures (EEs, POPs, and TOT) obtained from the bwQS analysis. The colour scale reflects the direction and magnitude of the β coefficients, with red indicating positive and blue indicating negative relationships. Associations also identified in single-analyte regression models are marked with an asterisk “*”.

Table S5: bWQS results from cord serum.

miRNA	EE mixture β(95%CI)	POP mixture β(95%CI)	Total mixture β(95%CI)
hsa-miR-7-5p	0.31 (0.1 ; 0.54)\$	0.28 (0.01 ; 0.56)\$	0.49 (0.07 ; 0.77)
hsa-miR-9-5p		-0.27 (-0.52 ; -0.02)	
hsa-miR-16-5p	-0.33 (-0.62 ; -0.11)\$		
hsa-miR-17-3p		-0.3 (-0.65 ; -0.06)	-0.34 (-0.73 ; -0.02)
hsa-miR-19b-3p	-0.25 (-0.47 ; -0.05)		
hsa-miR-22-3p	-0.39 (-0.66 ; -0.16)		-0.55 (-0.95 ; -0.23)
hsa-miR-25-3p		0.33 (0.07 ; 0.54)	
hsa-miR-27a-3p		-0.33 (-0.6 ; -0.13)	-0.32 (-0.7 ; -0.02)
hsa-miR-29a-3p	-0.43 (-0.68 ; -0.21)\$	-0.43 (-0.73 ; -0.16)\$	-0.71 (-1.05 ; -0.44)
hsa-miR-30d-5p	0.42 (0.13 ; 0.64) \$	0.3 (0.02 ; 0.55) \$	0.57 (0.24 ; 0.82)
hsa-miR-34a-5p		-0.33 (-0.69 ; -0.07)	
hsa-miR-122-5p	0.64 (0.36 ; 0.85) \$		0.77 (0.47 ; 1.07)
hsa-miR-124-3p		-0.31 (-0.63 ; -0.08)	
hsa-miR-125b-5p	0.37 (0.04 ; 0.64)		
hsa-miR-133a-3p		-0.49 (-0.79 ; -0.22)\$	-0.49 (-0.87 ; -0.18)
hsa-miR-133b		-0.39 (-0.68 ; -0.1)\$	-0.48 (-0.86 ; -0.14)
hsa-miR-134-5p	0.36 (0.13 ; 0.57)		
hsa-miR-141-3p	-0.31 (-0.55 ; -0.09)	-0.31 (-0.6 ; -0.07)	-0.51 (-0.9 ; -0.18)
hsa-miR-143-3p		-0.32 (-0.61 ; -0.1)	-0.31 (-0.77 ; -0.01)
hsa-miR-145-5p		-0.27 (-0.58 ; -0.02)	-0.35 (-0.66 ; -0.04)
hsa-miR-150-5p	-0.26 (-0.52 ; 0)		
hsa-miR-191-5p	-0.28 (-0.58 ; -0.06)		
hsa-miR-195-5p	0.44 (0.18 ; 0.67)\$		0.42 (0.04 ; 0.76)
hsa-miR-200a-3p		-0.29 (-0.57 ; -0.03)	
hsa-miR-205-5p		-0.35 (-0.67 ; -0.09)	-0.35 (-0.75 ; -0.06)
hsa-miR-206	0.33 (0.06 ; 0.55)		
hsa-miR-374a-5p		0.3 (0 ; 0.55)	
hsa-miR-375-3p	0.3 (0.04 ; 0.57)		
hsa-miR-376c-3p	0.46 (0.23 ; 0.68)\$		0.45 (0.02 ; 0.74)
hsa-miR-499a-5p		-0.32 (-0.62 ; -0.06)	-0.33 (-0.64 ; -0.03)

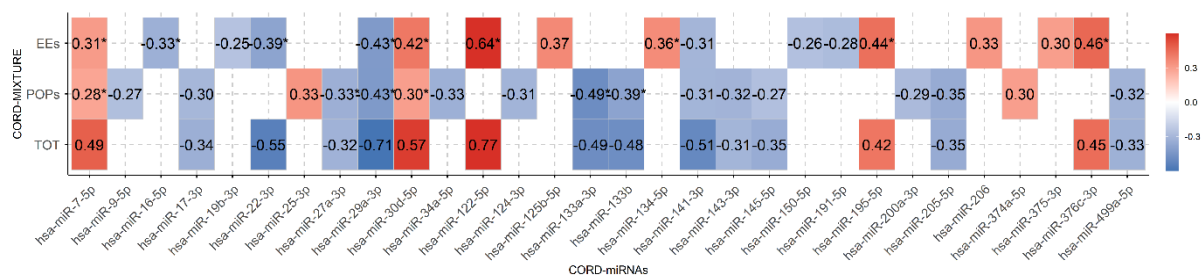


Figure S5: Associations between cord miRNAs and chemical mixtures (EEs, POPs, and TOT) derived from bWQS analysis. Colours reflect the sign and intensity of the β coefficients (red: positive; blue: negative). Asterisks (“*”) mark miRNAs also identified in single-exposure models.

Table S6: Comparison of maternal and cord serum bWQS results.

miRNA	MATERNAL		CORD	
	MIXTURE	DIRECTION	MIXTURE	DIRECTION
hsa-miR-7-5p	EEs	POS	EEs	POS
			POPs	POS
			TOT	POS
hsa-miR-25-3p	POPs	NEG	POPs	POS
hsa-miR-27a-5p	EEs	NEG	POPs	NEG
			TOT	NEG
hsa-miR-29a-3p			EEs	NEG
	POPs	NEG	POPs	NEG
			TOT	NEG
hsa-miR-30d-5p	EEs	NEG	EEs	POS
			POPs	POS
			TOT	POS
hsa-miR-122-5p	EEs	POS	EEs	POS
			TOT	POS
hsa-miR-133a-3p	POPs	POS	POPs	NEG
	TOT	POS	TOT	NEG
hsa-miR-133b	EEs	POS	POPs	NEG
	TOT	POS	TOT	NEG
hsa-miR-134-5p	EEs	NEG	EEs	POS
hsa-miR-143-3p	EEs	POS	POPs	NEG
			TOT	NEG
hsa-miR-145-5p	EEs	POS	POPs	NEG
	TOT	POS	TOT	NEG
hsa-miR-195-5p	POPs	POS	EEs	POS
	TOT	POS	TOT	POS
hsa-miR-200a-3p	EEs	POS	POPs	NEG
hsa-miR-205-5p	EEs	POS	POPs	NEG
			TOT	NEG
hsa-miR-374a-5p	EEs	NEG	POPs	POS
hsa-miR-375-3p	EEs	POS	EEs	POS
hsa-miR-376c-3p	EEs	NEG	EES	POS
			TOT	POS

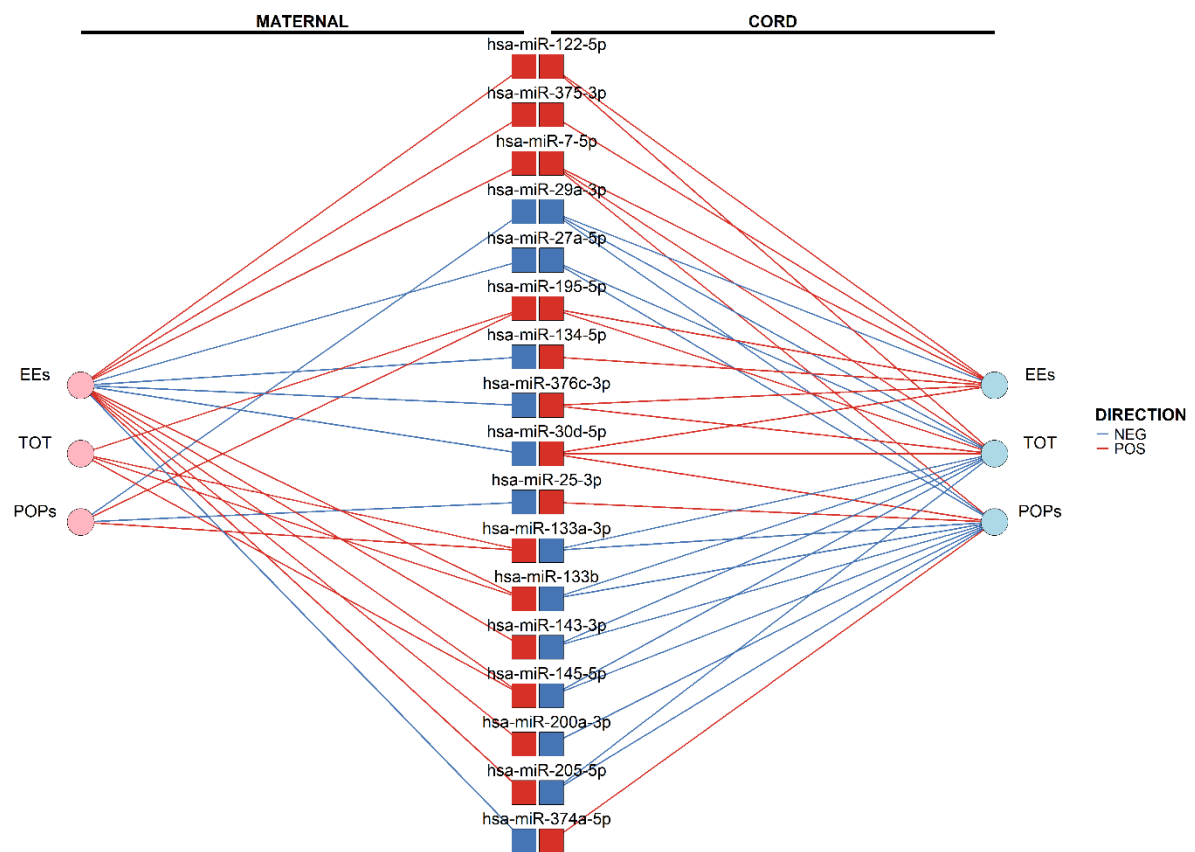


Figure S6: Additional representation of Figure 6 including the total mixture results.