Supplementary Materials for

Choline and its Metabolites Trimethylamine and Trimethylamine N-oxide Potentially Predict the Risk of Small Vulnerable Newborn and the Development of 1-Year Infants

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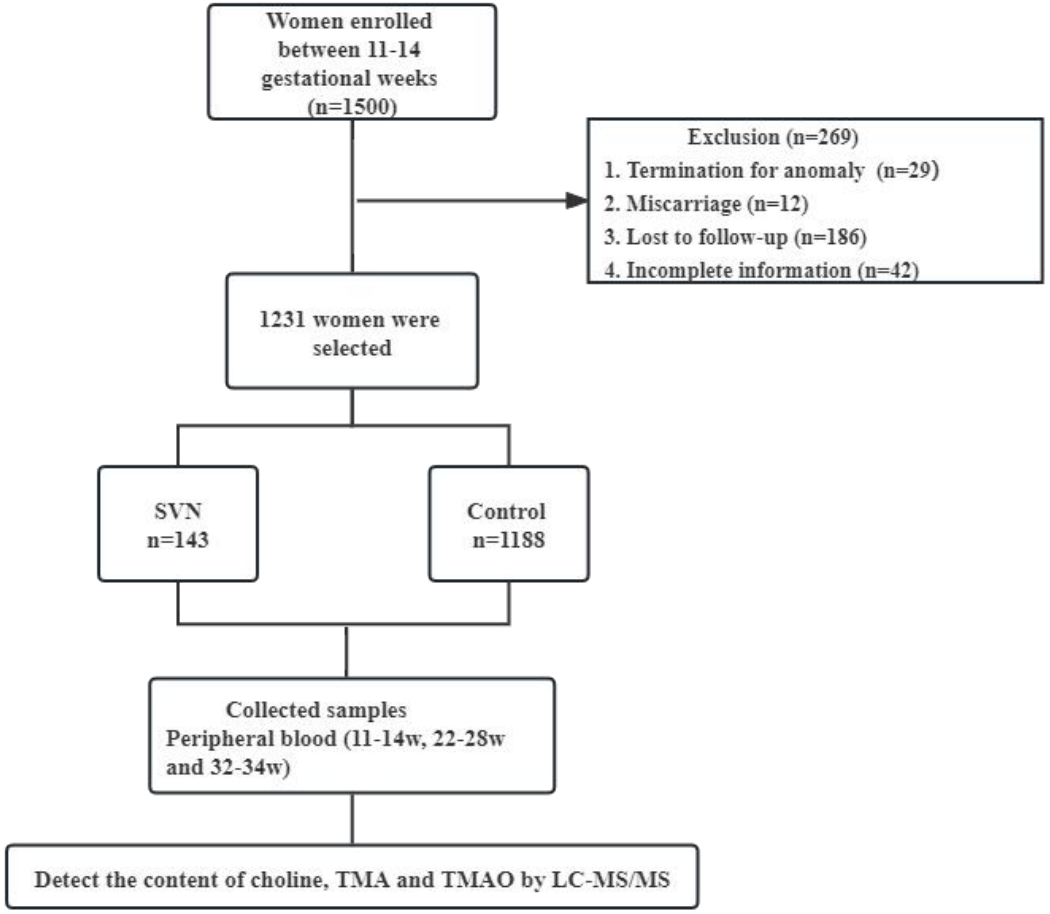

Supplemental Figure S1 Participant flow diagram.

Abbreviations: SVN, small vulnerable newborn; TMA, trimethylamine; TMAO, trimethylamine-N-oxide; LC-MS/MS, liquid chromatography-mass spectrometry.

Supplementary Table S1 Participant demographics

	Total	SVN	No SVN	*P*	SGA	No SGA	*P*	LBW	No LBW	*P*	PTB	No PTB	*P*
Characteristics (n, %)	1231 (100.00)	143 (11.62)	1088 (88.38)	-	92 (7.47)	1139 (92.53)	-	31 (2.52)	1200 (97.48)	-	53 (4.31)	1178 (95.69)	-
Age, years	28.73 (3.58)	28.83 (3.18)	28.71 (3.63)	0.562	28.49 (2.95)	28.74 (3.63)	0.726	29.03 (3.76)	28.72 (3.58)	0.868	29.38 (3.45)	28.70 (3.59)	0.202
Gestational week, wk	12.63 (0.83)	12.57 (0.73)	12.63 (0.84)	0.695	12.61 (0.76)	12.63 (0.83)	0.839	12.43 (0.64)	12.63 (0.83)	0.180	12.52 (0.71)	12.63 (0.83)	0.431
BMI, kg/m^2	21.44 (2.75)	21.25 (2.92)	21.46 (2.73)	0.330	20.78 (2.87)	21.49 (2.74)	0.012*	22.11 (3.28)	21.42 (2.74)	0.309	21.99 (2.83)	21.41 (2.75)	0.137
OGTT, mmol/L													
FBG	4.67 (0.37)	4.65 (0.36)	4.67 (0.37)	0.707	4.62 (0.34)	4.67 (0.37)	0.283	4.65 (0.39)	4.67 (0.37)	0.970	4.69 (0.39)	4.66 (0.37)	0.467
1h-PBG	7.89 (1.78)	7.76 (1.81)	7.91 (1.78)	0.245	7.49 (1.80)	7.92 (1.78)	0.014*	8.18 (2.16)	7.89 (1.77)	0.570	8.19 (1.76)	7.88 (1.78)	0.254
2h-PBG	7.10 (1.35)	7.00 (1.49)	7.12 (1.33)	0.073	6.85 (1.38)	7.13 (1.34)	0.019*	7.40 (1.62)	7.10 (1.34)	0.381	7.25 (1.63)	7.10 (1.33)	0.946
Smoking or alcohol use (n, %)	5 (0.41)	1 (0.70)	4 (0.37)	0.558	1 (1.09)	4 (0.35)	0.286	0(0)	5 (0.42)	0.719	0 (0)	5 (0.42)	0.635
Education, years	15.74 (1.84)	15.84 (1.81)	15.73 (1.84)	0.619	15.61 (1.74)	15.76 (1.84)	0.653	15.73 (1.82)	15.75 (1.84)	0.966	16.25 (1.84)	15.72 (1.83)	0.199

Data are presented as means±standard deviation (SD) or n (%).

Abbreviations: BMI, body mass index; OGTT,oral glucose tolerance test; FBG, fasting blood glucose; PBG: postprandial blood glucose; SVN, small vulnerable newborn; SGA, small for gestational age; LBW, low birthweight; PTB, preterm birth.

P <0·05: *, P <0·01: **, P <0·001: ***.

Supplementary Table S2 RRs of choline and its metabolite and SVN, SGA, LBW and PTB.

Concentrations of choline metabolites	SVN /Total	RRs (95% CI) Adjusted	P value	SGA /Total	RRs (95% CI) Adjusted	P value	LBW /Total	RRs (95% CI) Adjusted	P value	PTB /Total	RRs (95% CI) Adjusted	P value
1st trimester												
Choline (ug/mL)												
Q1 (≤0.86)	31/309	0.958 (0.600, 1.528)	0.856	27/309	1.475 (0.819, 2.659)	0.196	7/309	1.058 (0.377, 2.969)	0.914	6/309	0.386 (0.153, 0.977)	0.045*
Q2 (0.87-1.01)	26/310	1.074 (0.682, 1.690)	0.757	20/310	1.043 (0.547, 1.987)	0.899	11/310	1.428 (0.563, 3.623)	0.453	18/310	1.067 (0.560, 2.032)	0.845
Q3 (1.02-1.18)	31/300	1.129 (0.725, 1.759)	0.592	27/300	1.510 (0.839, 2.718)	0.169	5/300	0.583 (0.173, 1.968)	0.385	11/300	0.636 (0.298, 1.358)	0.243
Q4 (≥1.18)	25/303	1	-	18/303	1	-	8/303	1	-	17/303	1	-
TMA (ng/mL)												
Q1 (≤4.99)	34/288	1.258 (0.805, 1.965)	0.314	26/288	1.066 (0.621, 1.829)	0.818	13/288	2.410 (0.842, 6.896)	0.101	15/288	1.941 (0.822, 4.585)	0.130
Q2 (5.00-9.16)	22/288	0.815 (0.494, 1.345)	0.424	20/288	0.834 (0.466, 1.495)	0.542	5/288	1.005 (0.292, 3.459)	0.994	7/288	0.882 (0.325, 2.393)	0.805
Q3 (9.17-17.12)	21/288	1.061 (0.664, 1.695)	0.805	16/288	0.698 (0.374, 1.302)	0.258	6/288	0.798 (0.210, 3.028)	0.740	20/288	2.103 (0.913, 4.841)	0.081
Q4 (≥17.13)	27/288	1	-	23/288	1	-	5/288	1	-	8/288	1	-
TMAO (ng/mL)												
Q1 (≤51.50)	32/303	1.691 (0.989, 2.891)	0.055	24/303	1.894 (0.955, 3.758)	0.068	12/303	3.480 (0.955, 12.683)	0.059	14/303	1.617 (0.670, 3.900)	0.285
Q2 (51.51-79.74)	31/304	1.838 (1.091, 3.097)	0.022*	25/304	1.899 (0.963, 3.744)	0.064	9/304	2.752 (0.732, 10.348)	0.134	13/304	1.722 (0.728, 4.075)	0.216
Q3 (79.75-116.31)	27/302	1.897 (1.127,	0.016*	25/302	2.118 (1.082,	0.029*	4/302	1.333 (0.300,	0.705	13/302	1.543 (0.640,	0.334

		3.193)			4.146)			5.925)			3.718)	
Q4 (≥116.32)	14/302	1	-	12/302	1	-	3/302	1	-	8/302	1	-
2nd trimester												
Choline (ug/mL)												
Q1 (≤1.25)	31/298	1.054 (0.664, 1.672)	0.824	29/298	1.456 (0.823, 2.576)	0.196	6/298	0.865 (0.262, 2.855)	0.812	7/298	0.485 (0.188, 1.249)	0.134
Q2 (1.26-1.42)	21/286	0.888 (0.539, 1.463)	0.642	13/286	0.674 (0.328, 1.383)	0.282	8/286	1.279 (0.447, 3.660)	0.646	15/286	1.189 (0.568, 2.488)	0.646
Q3 (1.43-1.61)	29/293	1.126 (0.707, 1.795)	0.617	24/293	1.266 (0.686, 2.336)	0.451	7/293	0.945 (0.301, 2.970)	0.923	15/293	1.009 (0.470, 2.164)	0.982
Q4 (≥1.62)	23/280	1	-	19/280	1	-	8/280	1	-	14/280	1	-
TMA (ng/mL)												
Q1 (≤6.47)	31/287	1.141 (0.728, 1.788)	0.566	24/287	1.224 (0.681, 2.200)	0.498	7/287	1.510 (0.422, 5.406)	0.527	15/287	1..028 (0.480, 2.199)	0.944
Q2 (6.48-10.33)	28/287	1.106 (0.701, 1.745)	0.666	22/287	1.217 (0.667, 2.220)	0.522	10/287	2.410 (0.770, 7.542)	0.131	14/287	1.028 (0.491, 2.153)	0.941
Q3 (10.34-15.81)	25/287	0.803 (0.486, 1.328)	0.392	21/287	1.093 (0.587, 2.035)	0.779	7/287	1.305 (0.357, 4.773)	0.688	8/287	0.485 (0.191, 1.229)	0.127
Q44 (≥15.82)	21/286	1	-	19/286	1	-	5/286	1	-	14/286	1	-
TMAO (ng/mL)												
Q1 (71.35)	35/287	1.318 (0.835, 2.080)	0.236	28/287	1.395 (0.793, 2.454)	0.249	10/287	8.104 (1.027, 63.954)	0.047*	14/287	1.238 (0.541, 2.834)	0.614
Q2 (71.36-100.77)	18/286	0.784 (0.460, 1.335)	0.371	13/286	0.600 (0.288, 1.249)	0.172	8/286	6.142 (0.763, 49.427)	0.088	12/286	1.134 (0.490, 2.624)	0.770
Q3 (100.78-144.25)	27/286	1.115 (0.686, 1.813)	0.661	22/286	1.154 (0.629, 2.119)	0.644	8/286	8.341 (1.028, 67.685)	0.047*	13/286	1.135 (0.481, 2.677)	0.772
Q4 (≥144.26)	19/286	1	-	18/286	1	-	1/286	1	-	10/286	1	-

3rd trimester												
Choline (ug/mL)												
Q1 (≤0.77)	20/275	0.678 (0.404, 1.139)	0.142	18/275	0.738 (0.400, 1.363)	0.332	5/275	0.936 (0.240, 3.645)	0.924	5/275	0.529 (0.181, 1.542)	0.243
Q2 (0.78-0.98)	18/275	0.705 (0.424, 1.172)	0.177	15/275	0.602 (0.318, 1.142)	0.120	55/275	1.198 (0.322, 4.451)	0.788	12/275	1.067 (0.437, 2.604)	0.886
Q3 (0.99-1.18)	30/275	1.134 (0.732, 1.759)	0.573	25/275	1.002 (0.576, 1.745)	0.993	8/275	1.807 (0.553, 5.902)	0.327	15/275	1.591 (0.718, 3.524)	0.252
Q4 (≥1.18)	28/274	1	-	25/274	1	-	5/274	1	-	11/274	1	-
TMA (ng/mL)												
Q1 (≤999.20)	22/267	0.725 (0.455, 1.158)	0.177	21/267	0.926 (0.521, 1.647)	0.794	1/267	0.094 (0.011, 0.778)	0.028*	7/267	0.429 (0.172, 1.068)	0.069
Q2 (999.21-1626.03)	26/267	0.688 (0.424, 1.114)	0.128	22/267	0.968 (0.534, 1.754)	0.914	5/267	0.471 (0.162, 1.367)	0.166	6/267	0.364 (0.143, 0.928)	0.034*
Q3 (1626.04-2259.15)	21/267	0.693 (0.433, 1.109)	0.126	18/267	0.776 (0.422, 1.427)	0.415	6/267	0.459 (0.161, 1.304)	0..144	11/267	0.546 (0.244, 1.222)	0.141
Q4 (≥2259.15)	28/267	1	-	22/267	1	-	12/267	1	-	19/267	1	-
TMAO (ng/mL)												
Q1 (≤49.96)	37/279	1.797 (1.092, 2.956)	0.021*	31/279	1.817 (0.991, 3.332)	0.054	11/279	9.698 (1.269, 74.103)	0.029*	13/279	1.921 (0.769, 4.081)	0.162
Q2 (49.97-58.07)	22/279	1.216 (0.710, 2.083)	0.477	19/279	1.187 (0.612, 2.299)	0.612	4/279	3.812 (0.430, 33.819)	0.230	10/279	1.303 (0.480, 3.537)	0.604
Q3 (58.08-82.74)	23/279	1.354 (0.799, 2.292)	0.260	19/279	1.297 (0.674, 2.495)	0.436	8/279	7.011 (0.876, 56.106)	0.066	13/279	1.630 (0.642, 4.138)	0.304
Q4 (≥82.74)	17/278	1	-	16/278	1	-	1/278	1	-	8/278	1	-

Abbreviations: TMA, trimethylamine; TMAO, trimethylamine-N-oxide; RR, relative risk; CI, confidence interval; SVN, small vulnerable

newborn; SGA, small for gestational age, LBW, low birthweight, PTB, preterm birth.

Multivariate model was adjusted for body mass index, age, blood glucose, complex lipids and gestational week.

*P*1: *P* value for unadjusted model; *P*2: *P* value for multivariate model.

P <0.05: *, *P* <0.01: **, *P* <0.001: ***.

Supplementary Table S3 Area under curve (AUC) and 95% confidence interval of receiver operating characteristic (ROC).

AUC (95% CI)	SVN	SGA	LBW	PTB
Model 1	0.646 (0.462, 0.830)	0.692 (0.495, 0.889)	0.625 (0.436, 0.815)	0.603 (0.398, 0.807)
Model 2	0.763 (0.606, 0.920)	0.871 (0.741, 1.000)	0.756 (0.595, 0.917)	0.804 (0.659, 0.949)
Model 3	0.753 (0.591, 0.915)	0.866 (0.750, 0.982)	0.769 (0.607, 0.932)	0.705 (0.512, 0.898)
Model 4	0.854 (0.734, 0.974)	0.719 (0.540, 0.898)	0.923 (0.839, 1.000)	0.920 (0.819, 1.000)

Abbreviations: SVN, small vulnerable newborn; SGA, small for gestational age, LBW, low birthweight, PTB, preterm birth.

Model 1 was traditional risk factors model. Traditional risk factors included age, BMI, fasting blood glucose (FBG), one-hour postprandial blood glucose (1h-PBG), two-hour postprandial blood glucose (2h-PBG), and placental growth factor (PLGF). Model 2, 3 and 4 were inclusion of choline and its metabolites TMA and TMAO in the first trimester (CTT1) or the second trimester (CTT2) or the third trimester (CTT3) in the models, prospectively.

Supplementary Table S4 Association between placental growth factor (PLGF) and choline and its metabolites.

	PLGF in the second trimester			
	Adjusted			
	β	95% CI	*P*	*q*
1st trimester				
TMA (ng/mL)	-0.542	-1.235, -0.075	0.030*	0.032*
TMAO (ng/mL)	0.584	0.160, 1.455	0.019*	0.032*

Abbreviations: TMA, trimethylamine; TMAO, trimethylamine-N-oxide; PLGF, placental growth factor.

Multivariate model was adjusted for body mass index, age, blood glucose, complex lipids and gestational week.

P <0.05: *, P <0.01: **, P <0.001: ***.

Supplementary Table S5 RRs of choline and its metabolite and SVN, SGA, LBW and PTB (recalculated by logistic regression).

Concentrations of choline metabolites	SVN			SGA			LBW			PTB		
	RRs	95% CI	*P*	RRs	95% CI	*P*	RRs	95% CI	*P*	RRs	95% CI	*P*
1st trimester												
Choline (ug/mL)												
Q1 (≤0.86)	0.952	0.565, 1.605	0.755	1.523	0.808, 2.873	0.194	1.060	0.364, 3.091	0.915	0.373	0.143, 0.972	0.044*
Q2 (0.87-1.01)	1.084	0.652, 1.802	0.592	1.045	0.530, 2.060	0.900	1.446	0.539, 3.877	0.464	1.070	0.527, 2.172	0.951
Q3 (1.02-1.18)	1.148	0.693, 1.902	0.852	1.565	0.831, 2.948	0.166	0.577	0.167, 1.998	0.386	0.622	0.276, 1.400	0.251
Q4 (≥1.18)	1	1	-	1	1	-	1	1	-	1	1	-
TMA (ng/mL)												
Q1 (≤4.99)	1.300	0.783, 2.156	0.311	1.072	0.590, 1.947	0.820	2.487	0.857, 7.217	0.094	2.004	0.830, 4.842	0.122
Q2 (5.00-9.16)	0.797	0.457, 1.389	0.423	0.821	0.435, 1.549	0.543	1.005	0..286, 3.527	0.994	0.878	0.313, 2.464	0.805
Q3 (9.17-17.12)	1.069	0.634, 1.802	0.802	0.678	0.349, 1.317	0.251	0.794	0.210, 3.00	0.734	2.185	0.923, 5.172	0.076
Q4 (≥17.13)	1	1	-	1	1	-	1	1	-	1	1	-
TMAO (ng/mL)												
Q1 (≤51.50)	1.781	0.994, 3.190	0.052	1.972	0.959, 4.058	0.065	3.583	0.972, 13.206	0.055	1.647	0.660, 4.108	0.284
Q2 (51.51-79.74)	1.957	1.104, 3.469	0.021*	1.978	0.967, 4.048	0.062	2.809	0.732, 10.773	0.132	1.760	0.714, 4.335	0.219
Q3 (79.75-116.31)	2.028	1.145, 3.592	0.015*	2.228	1.094, 4.536	0.027*	1.338	0.296, 6.050	0.705	1.569	0.630, 3.907	0.333
Q4 (≥116.32)	1	1	-	1	1	-	1	1	-	1	1	-
2nd trimester												
Choline (ug/mL)												
Q1 (≤1.25)	1.061	0.623, 1.807	.0.828	1.509	0.803, 2.838	0.201	0.863	0.255, 2.915	0.812	0.473	0.173, 1.294	0.145
Q2 (1.26-1.42)	0.876	0.503, 1.525	0.640	0.658	0.307, 1.409	0.281	1.288	0.439, 3.779	0.644	1.202	0.550, 2.628	0.645
Q3 (1.43-1.61)	1.144	0.676, 1.936	0.615	1.291	0.671, 2.485	0.444	0.943	0.298, 2.984	0.921	1.009	0.449, 2.268	0.982
Q4 (≥1.62)	1	1	-	1	1	-	1	1	-	1	1	-
TMA (ng/mL)												

Q1 (≤6.47)	1.162	0.695, 1.944	0.568	1.246	0.654, 2.374	0.503	1..522	0.421, 5.498	0.521	1.029	0.464, 2.280	0.945
Q2 (6.48-10.33)	1.121	0.668, 1.881	0.665	1.238	0.646, 2.374	0.521	2.468	0.759, 8.028	0.133	1.030	0.471, 2.253	0.941
Q3 (10.34-15.81)	0.783	0.446, 1.376	0.395	1.101	0.563, 2.153	0.779	1.311	0.345, 4.981	0.691	0.471	0.175, 1.267	0.136
Q44 (≥15.82)	1	1	-	1	1	-	1	1	-	1	1	-
TMAO (ng/mL)												
Q1 (71.35)	1.369	0.812, 2.307	0.239	1.441	0.770, 2.696	0.253	8.331	1.032, 67.278	0.047*	1.250	0.528, 2.960	0.612
Q2 (71.36-100.77)	0.764	0.425, 1.376	0.370	0.581	0.268, 1.259	0.169	6.266	0.747, 52.557	0.091	1..140	0.472, 2.750	0.771
Q3 (100.78-144.25)	1.130	0.657, 1.944	0.659	1.168	0.6054, 2.255	0.643	8.582	1.064, 69.244	0.044*	1.141	0.474, 2.746	0.768
Q4 (≥144.26)	1	1	-	1	1	-	1	1	-	1	1	-
3rd trimester												
Choline (ug/mL)												
Q1 (≤0.77)	0.647	0.364, 1.152	0.139	0.718	0.372, 1.387	0.324	0.934	0.229, 3.085	0.925	0.518	0.170, 1.576	0.246
Q2 (0.78-0.98)	0.675	0.382, 1.191	0.175	0.577	0.289, 1.153	0.120	1.202	0.318, 4.542	0.786	1.071	0.425, 2.695	0.885
Q3 (0.99-1.18)	1.157	0.692, 1.933	0.578	1.002	0.544, 1.848	0.994	1.834	0.540, 6.226	0.331	1.633	0.693, 3.848	0.262
Q4 (≥1.18)	1	1	-	1	1	-	1	1	-	1	1	-
TMA (ng/mL)												
Q1 (≤999.20)	0.692	0.403, 1.186	0.181	0.920	0.478, 1.772	0.804	0.090	0.011, 0.705	0.022*	0.409	0.165, 1.016	0.409
Q2 (999.21-1626.03)	0.652	0.377, 1.126	0.125	0.965	0.504, 1.849	0.914	0.459	0.156, 1.348	0.157	0.345	0.133, 0.896	0.345
Q3 (1626.04-2259.15)	0.657	0.382, 1.130	0.129	0.760	0.386, 1.496	0.427	0.447	0.152, 1.315	0.143	0.526	0.228, 1.213	0.526
Q4 (≥2259.15)	1	1	-	1	1	-	1	1	-	1	1	-
TMAO (ng/mL)												
Q1 (≤49.96)	1.943	1.112, 3.395	0.020	1.922	0.990, 3.728	0.053	10.075	1.274, 79.670	0.029*	1.978	0.769, 5.093	0.157
Q2 (49.97-58.07)	1.242	0.686, 2.247	0.474	1.202	0.590, 2.449	0.612	3.858	0.427, 34.831	0.229	1.315	0.479, 3.613	0.595
Q3 (58.08-82.74)	1.401	0.780, 2.516	0.259	1.323	0.654, 2.676	0.436	7.195	0.877, 59.052	0.066	1.664	0.630, 4.390	0.304
Q4 (≥82.74)	1	1	-	1	1	-	1	1	-	1	1	-

Abbreviations: TMA, trimethylamine; TMAO, trimethylamine-N-oxide; RR, relative risk; CI, confidence interval; SVN, small vulnerable newborn; SGA, small for gestational age, LBW, low birthweight, PTB, preterm birth.

Multivariate model was adjusted for body mass index, age, blood glucose, complex lipids and gestational week.

*P*1: *P* value for unadjusted model; *P*2: *P* value for multivariate model.

P <0.05: *, *P* <0.01: **, *P* <0.001: ***.

Supplementary Table S6 RRs of choline and its metabolite and SVN, SGA, LBW and PTB (recalculated after multiple imputation).

Concentrations of choline metabolites	SVN			SGA			LBW			PTB		
	RRs	95% CI	*P*	RRs	95% CI	*P*	RRs	95% CI	*P*	RRs	95% CI	*P*
1st trimester												
Choline (ug/mL)												
Q1 (≤0.86)	0.906	0.573, 1.435	0.677	1.392	0.781, 2.478	0.259	0.941	0.346, 2.558	0.901	0.372	0.148, 0.935	0.035*
Q2 (0.87-1.01)	1.065	0.686, 1.654	0.769	1.033	0.553, 1.930	0.920	1.387	0.576, 3.341	0.460	1.075	0.573, 2.018	0.808
Q3 (1.02-1.18)	1.098	0.712, 1.693	0.667	1.429	0.803, 2.543	0.223	0.658	0.200, 1.966	0.451	0.679	0.328, 1.407	0.299
Q4 (≥1.18)												
TMA (ng/mL)												
Q1 (≤4.99)	1.285	0.842, 1.962	0.273	1.102	0.645, 1.883	0.735	2.560	0.904, 7.247	0.076	1.895	0.802, 4.479	0.139
Q2 (5.00-9.16)	0.770	0.474, 1.253	0.481	0.867	0.489, 1.538	0.622	0.949	0.274, 3.286	0.938	0.845	0.310, 2.300	0.750
Q3 (9.17-17.12)	1.124	0.726, 1.742	0.553	0.690	0.370, 1.288	0.245	1.166	0.351, 3.867	0.805	2.447	1.084, 5.523	0.031
Q4 (≥17.13)	1											
TMAO (ng/mL)												
Q1 (≤51.50)	1.831	1.081, 3.102	0.025*	1.958	0.993, 3.842	0.053	4.176	1.176, 14.836	0.028*	1.845	0.786, 4.331	0.159
Q2 (51.51-79.74)	1.879	1.117, 3.1632	0.017*	1.965	1.000, 3.861	0.050	3.176	0.849, 11.878	0.085	1.733	0.731, 4.110	0.209
Q3 (79.75-116.31)	1.952	1.165, 3.280	0.011*	2.136	1.090, 4.083	0.027*	1.339	0.298, 6.013	0.707	1.644	0.693, 3.900	0.260
Q4 (≥116.32)												
2nd trimester												
Choline (ug/mL)												
Q1 (≤1.25)	0.939	0.601, 1.466	0.796	1.315	0.756, 2.286	0.329	0.787	0.270, 2.292	0.675	0.489	0.203, 1.180	0.119
Q2 (1.26-1.42)	0.795	0.491, 1.289	0.350	0.610	0.302, 1.233	0.169	0.991	0.375, 2.620	0.990	1.045	0.515, 2.119	0.895
Q3 (1.43-1.61)	1.036	0.664, 1.617	0.880	1.155	0.639, 2.087	0.634	0.841	0.303, 2.333	0.736	0.995	0.491, 2.018	0.996
Q4 (≥1.62)												

TMA (ng/mL)												
Q1 (≤6.47)	1.143	0.734, 1.779	0.552	1.292	0.723, 2.307	0.395	1.416	0.439, 4.565	0.550	1.091	0.530, 2.247	0.777
Q2 (6.48-10.33)	1.080	0.687, 1.697	0.743	1.236	0.677, 2.255	0..493	1.954	0.677, 5.639	0.216	0.961	0.466, 1.980	0.916
Q3 (10.34-15.81)	0.869	0.534, 1.406	0.566	1.154	0.624, 2.133	0.657	1.371	0.439, 4.279	0.581	0.568	0.247, 1.303	0.189
Q44 (≥15.82)												
TMAO (ng/mL)												
Q1 (71.35)	1.373	0.875, 2.153	0.166	1.430	0.817, 2.503	0.211	10.086	1.317, 77.267	0.026*	1.432	0.647, 3.171	0.361
Q2 (71.36-100.77)	0.849	0.505, 1.427	0.530	0.649	0.318, 1.325	0.232	8.005	1.033, 62.013	0..046	1.205	0.529, 2.744	0.630
Q3 (100.78-144.25)	1.146	0.707, 1.857	0.580	1.148	0.625, 2.108	0.655	8.258	1.016, 67.135	0.048	1.323	0.578, 3.026	0.504
Q4 (≥144.26)												
3rd trimester												
Choline (ug/mL)												
Q1 (≤0.77)	0.652	0.395, 1.075	0.089	0.754	0.416, 1.365	0.340	0.987	0.289, 3.366	0.975	0.438	0.156, 1.229	0.116
Q2 (0.78-0.98)	0.736	0.456, 1.188	0.206	0.625	0.336, 1.162	0.135	0.988	0.284, 3.437	0.984	1.069	0.477, 2.399	0.874
Q3 (0.99-1.18)	1.122	0.738, 1.707	0.615	1.069	0.629, 1.816	0.821	1.490	0.482, 4.602	0.497	1.355	0.642, 2.862	0.443
Q4 (≥1.18)												
TMA (ng/mL)												
Q1 (≤999.20)	0.673	0.428, 1.058	0.088	0.873	0.498, 1.528	0.632	0.085	0.010, 0.702	0.023*	0.388	0.159, 0.947	0.040*
Q2 (999.21-1626.03)	0.661	0.417, 1.048	0.079	0.973	0.553, 1.714	0.919	0.421	0.147, 1.209	0.109	0.316	0.126, 0.792	0.014
Q3 (1626.04-2259.15)	0.704	0.452, 1.096	0.122	0.763	0.423, 1.374	0.363	0.503	0.192, 1.315	0.163	0.599	0.289, 1.241	0.172
Q4 (≥2259.15)												
TMAO (ng/mL)												
Q1 (≤49.96)	1.812	0.127, 2.912	0.015	1.934	1.083, 3.454	0.024*	11.026	1.442, 84.287	0.021*	1.652	0.686, 3.977	0.266
Q2 (49.97-58.07)	1.224	0.731, 2.047	0.446	1.200	0.632, 2.279	0.568	3.996	0.450, 35.475	0.215	1.275	0.504, 3.224	0.607
Q3 (58.08-82.74)	1.309	0.790, 2.169	0.302	1.195	0.623, 2.271	0.571	7.957	1.015, 62.395	0.049*	1.638	0.688, 3.902	0.263

Q4 (≥82.74)									

Abbreviations: TMA, trimethylamine; TMAO, trimethylamine-N-oxide; RR, relative risk; CI, confidence interval; SVN, small vulnerable newborn; SGA, small for gestational age, LBW, low birthweight, PTB, preterm birth.

Multivariate model was adjusted for body mass index, age, blood glucose, complex lipids and gestational week.

*P*1: *P* value for unadjusted model; *P*2: *P* value for multivariate model. $P < 0.05$: *, $P < 0.01$: **, $P < 0.001$: ***.