

Multiple Indicators of Undernutrition, Infection and Inflammation in Lactating Women Are Associated with Maternal Iron Status and Infant Anthropometry in Panama: The MINDI Cohort

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Supplementary Material

Table S1. Comparison of maternal blood, inflammation, iron and other nutritional indicators by protein status as measured by retinol binding protein (RBP): protein deficient (RBP <30 mg/L) and protein sufficient (RBP ≥30 mg/L). Means ± SD are presented for normally-distributed variables, and medians with interquartile regions for non-normally distributed variables.

	RBP <30 mg/L n=36	RBP ≥30 mg/L n=63	p
RBC indices			
Hemoglobin (g/L)	114.8 ± 1.7	119.1 ± 1.4	0.031
Hematocrit (%) [*]	36.9 ± 0.5	38.1 ± 0.4	0.023
Total RBC x10 ⁶ /mm ³	3.98 ± 0.07	4.10 ± 0.04	0.07
MCV, fL	92.9 ± 0.8	92.7 ± 0.6	0.40
MCH, pg	28.9 ± 0.3	29.1 ± 0.2	0.34
MCHC, g/L	311.3 ± 2.0	314.2 ± 1.3	0.11
RDW-CV, %	14.0 ± 0.2	13.7 ± 0.1	0.14
WBC indices x10³/mm³			
Total WBC	8.9 ± 3.4	7.8 ± 2.1	0.004
Neutrophils	4.8 (3.7 – 6.7)	4.0 (3.4 – 5.0)	0.039
Lymphocytes	2.5 ± 1.0	2.4 ± 8.1	0.21
Monocytes	0.40 (0.33 – 0.46)	0.34 (0.31 – 0.40)	0.016
Eosinophils	0.63 (0.36 – 0.91)	0.59 (0.33 – 0.91)	0.70
Basophils	0.05 (0.03 – 0.06)	0.04 (0.03 – 0.06)	0.58
Iron indicators			
Ferritin, µg/L	23.0 (13.6 – 34.2)	24.2 (13.9 – 37.6)	0.68
sTfR, mg/L	8.59 (6.62 – 10.76)	7.51 (5.87 – 9.37)	0.14
Serum iron, µmol/L	9.88 (6.77 – 12.0)	10.44 (7.45 – 14.34)	0.31
Hepcidin, µg/L	15.4 (12.0 – 21.1)	15.7 (11.3 – 20.6)	0.96
Inflammation indicators			
CRP, mg/L	1.30 (0.50 – 2.75)	1.40 (0.50 – 4.10)	0.66
NLR	1.90 (1.55 – 2.48)	1.75 (1.32 – 2.31)	0.29
Cytokines (pg/mL)			
IL-1β	1.01 (0.02 – 2.04)	0.02 (0.02 – 0.99)	0.17
IL-4	2.44 (0.24 – 3.80)	2.06 (0.24 – 5.25)	0.70
IL-6, median (min-max)	1.60 (1.60 – 88.9)	1.60 (1.60 – 51.90)	0.67
IL-10	0.32 (0.13 – 2.00)	0.32 (0.07 – 1.11)	0.23
IL-12	1.57 (0.37 – 5.49)	0.88 (0.06 – 6.11)	0.56
IL-13	0.78 (0.28 – 0.93)	0.93 (0.93 – 1.60)	0.0001
IL-17	0.79 (0.56 – 1.81)	0.93 (0.47 – 1.70)	0.77
TNF-α	5.17 (0.50 – 11.02)	4.38 (2.69 – 7.74)	0.70
IFN-γ	1.80 (0.69 – 3.72)	1.41 (0.05 – 3.48)	0.29
MCP-1	322.3 (285.6 – 429.1)	314.2 (238.0 – 388.2)	0.61
Nutritional indicators			

Retinol/RBP ratio	1.27 (1.06 – 2.14)	0.59 (0.37 – 0.86)	0.0001
Folic acid, nmol/L	11.2 (8.3 – 14.1)	12.4 (10.1 – 16.5)	0.07
Vitamin B ₁₂ , pmol/L	151.5 (121.0 – 195.5)	153.0 (129.0 – 187.0)	0.99
Vitamin A, µmol/L	1.39 (1.20 – 1.56)	1.41 (1.12 – 1.88)	0.45
IGF-1, ng/mL	28.8 (25.6 – 34.3)	31.8 (27.6 – 34.6)	0.34

*One influential observation was removed. P values<0.05 are in bold.

Abbreviations: CRP, C-reactive protein; IGF-1, insulin-like growth factor; IL, interleukin; MCH, mean corpuscular hemoglobin; MCHC, mean corpuscular hemoglobin concentration; MCP-1, monocyte chemoattractant protein-1; MCV, mean corpuscular volume; NLR, neutrophil-lymphocyte ratio; RBC, red blood cells; RBP, retinol-binding protein; RDW-CV: red cell deviation width - coefficient of variation; SD, standard deviation; sTfR, serum transferrin receptor; WBC, white blood cells.

Table S2. MFP linear regression model for log-platelet counts.

Log-platelets ¹	Coef ± SE	95% CI	β	p-value	Ranking	Standardized dominance
t- CRP, mg/L	0.02 ± 0.007	0.01, 0.04	0.30	0.001	1	0.283
t- Weeks post-partum	-0.01 ± 0.003	-0.02, -0.005	-0.29	<0.0001	2	0.234
t- Cups of coffee/d	0.07 ± 0.02	0.03, 0.11	0.29	<0.0001	3	0.165
t- Serum iron, µmol/L	-0.01 ± 0.005	-0.02, -0.0002	-0.17	0.044	4	0.103
t- Scabies, presence	0.17 ± 0.08	0.01, 0.33	0.17	0.037	5	0.078
t- Bacteriuria, presence	-0.18 ± 0.07	-0.32, -0.04	-0.20	0.011	6	0.077
t- Urinary specific gravity	0.01 ± 0.003	0.002, 0.02	0.21	0.008	7	0.060
Constant	5.74 ± 0.02	5.69, 5.79		<0.0001	Overall fit statistic=0.499	

¹ Log platelets model (n=94, p<0.0001, adj. R²=0.46, VIF=1.11, condition number=1.83). Variables with ≥500 bootstrap repetitions excluded by MFP process: fieldwork, exclusive breastfeeding, hematocrit, monocytes, hemoglobin, IL-17 square root, vitamin B₁₂.

Transformation of covariates:.

t- Weeks post-partum = weeks post-partum – 11.67021277.

t- Cups of coffee/d = cups of coffee/d – 2.138297872.

t- C-reactive protein (CRP) = CRP – 2.97765958.

t- Urinary specific gravity = urinary specific gravity – 1017.87234.

t- Serum iron = serum iron – 10.69734034.

Table S3. Spearman correlation matrix for weeks post-partum and (A) iron status indicators, (B) serum nutritional indicators, (C) inflammation biomarkers.

A.		Weeks post-partum	Hemoglobin, g/L	Hematocrit, %	Ferritin, µg/L	Serum iron, µmol/L	sTfR, mg/L	Hepcidin, µg/L
Weeks post-partum		1						
Hemoglobin, g/L	r	0.2825	1					
	p	0.0046						
Hematocrit, %	r	0.281	0.9299	1				
	p	0.0048	0					
Ferritin, µg/L	r	-0.0921	0.3143	0.2721	1			
	p	0.3645	0.0015	0.0064				
Serum iron, µmol/L	r	0.0665	0.4352	0.3897	0.3968	1		
	p	0.5134	0	0.0001	0			

sTfR, mg/L	r	-0.0071	-0.0474	0.0287	-0.2864	-0.2301	1						
	p	0.9446	0.641	0.7783	0.0041	0.0219							
Hepcidin, µg/L	r	-0.1185	0.2733	0.2571	0.6436	0.3178	-0.1552	1					
	p	0.2425	0.0062	0.0102	0	0.0013	0.1252						
B.		Weeks post-partum		Folic acid, nmol/L		Vitamin B-12, pmol/L	Vitamin A, µmol/L	RBP, mg/L	IGF-1, pmol/L				
Weeks post-partum		1											
Folic acid, nmol/L	r												
	p	0.3276		1									
Vitamin B-12, pmol/L	r												
	p	-0.159		-0.077	1								
Vitamin A, µmol/L	r												
	p	-0.0141		0.2144	-0.1096	1							
RBP, mg/L	r	0.1067		0.1519	0.0051	0.0523	1						
	p	0.3061		0.1439	0.9612	0.6167							
IGF-1, pmol/L	r	0.0103		0.0067	0.0829	0.0626	-0.0483	1					
	p	0.9215		0.9488	0.427	0.5488	0.6439						
		Week											
		s PP	CRP	IL-1β	IL4	IL6	IL10	IL12	IL13	IL17	IFN-γ	TNF-α	MCP-1
Weeks PP		1											
CRP	r	-0.275	1										
	p	0.006											
IL-1β	r	-0.086	0.023	1									
	p	0.394	0.817										
IL-4	r	-0.203	0.205	0.229	1								
	p	0.044	0.042	0.023									
IL-6	r	0.115	0.032	0.158	0.180	1							
	p	0.257	0.749	0.118	0.075								
IL-10	r	-0.214	-0.033	0.333	0.185	0.095	1						
	p	0.033	0.742	0.001	0.067	0.352							
IL-12	r	-0.197	0.016	0.397	0.283	-0.032	0.329	1					
	p	0.050	0.876	0	0.004	0.753	0.001						
IL-13	r	0.275	-0.017	-0.347	-0.046	0.084	-0.453	-0.237	1				
	p	0.006	0.870	0.0004	0.653	0.410	0	0.018					
IL-17	r	-0.110	0.061	0.242	0.391	0.236	0.252	0.231	-0.006	1			
	p	0.279	0.551	0.016	0.0001	0.019	0.012	0.022	0.949				
INF-γ	r	-0.182	0.049	0.490	0.324	0.148	0.271	0.404	-0.114	0.608	1		
	p	0.072	0.629	0	0.001	0.144	0.007	0	0.261	0			
TNF-α		r	0.037	0.069	0.184	0.305	0.387	0.164	0.155	-0.046	0.210	0.215	1

	p	0.716	0.496	0.068	0.002	0.0001	0.104	0.125	0.647	0.037	0.033		
MCP-1	r	-0.230	-0.051	0.299	0.288	0.154	0.259	0.180	-0.158	0.180	0.262	0.253	1
	p	0.022	0.615	0.003	0.004	0.128	0.010	0.075	0.118	0.076	0.009	0.012	

PP: post-partum.