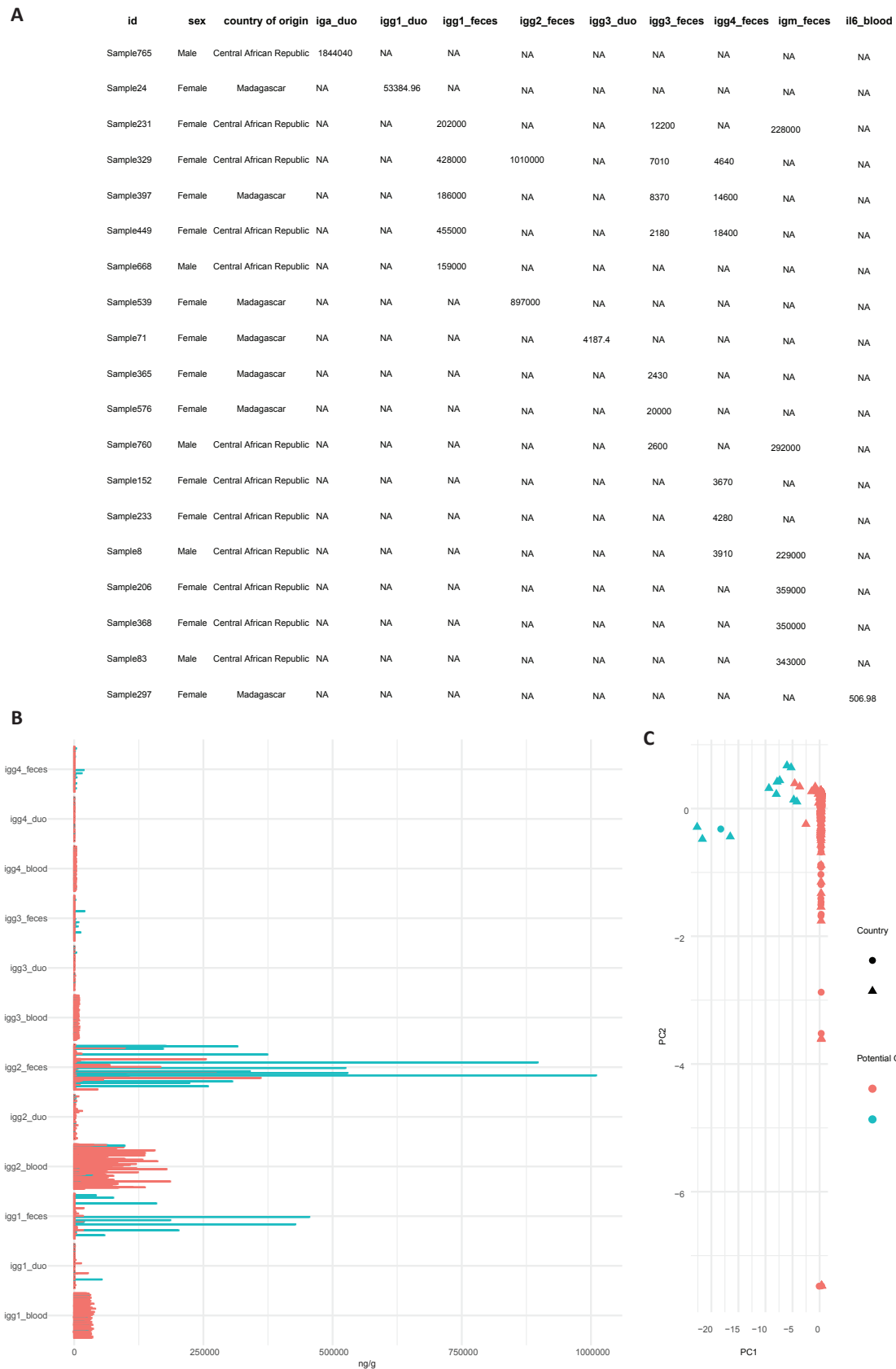
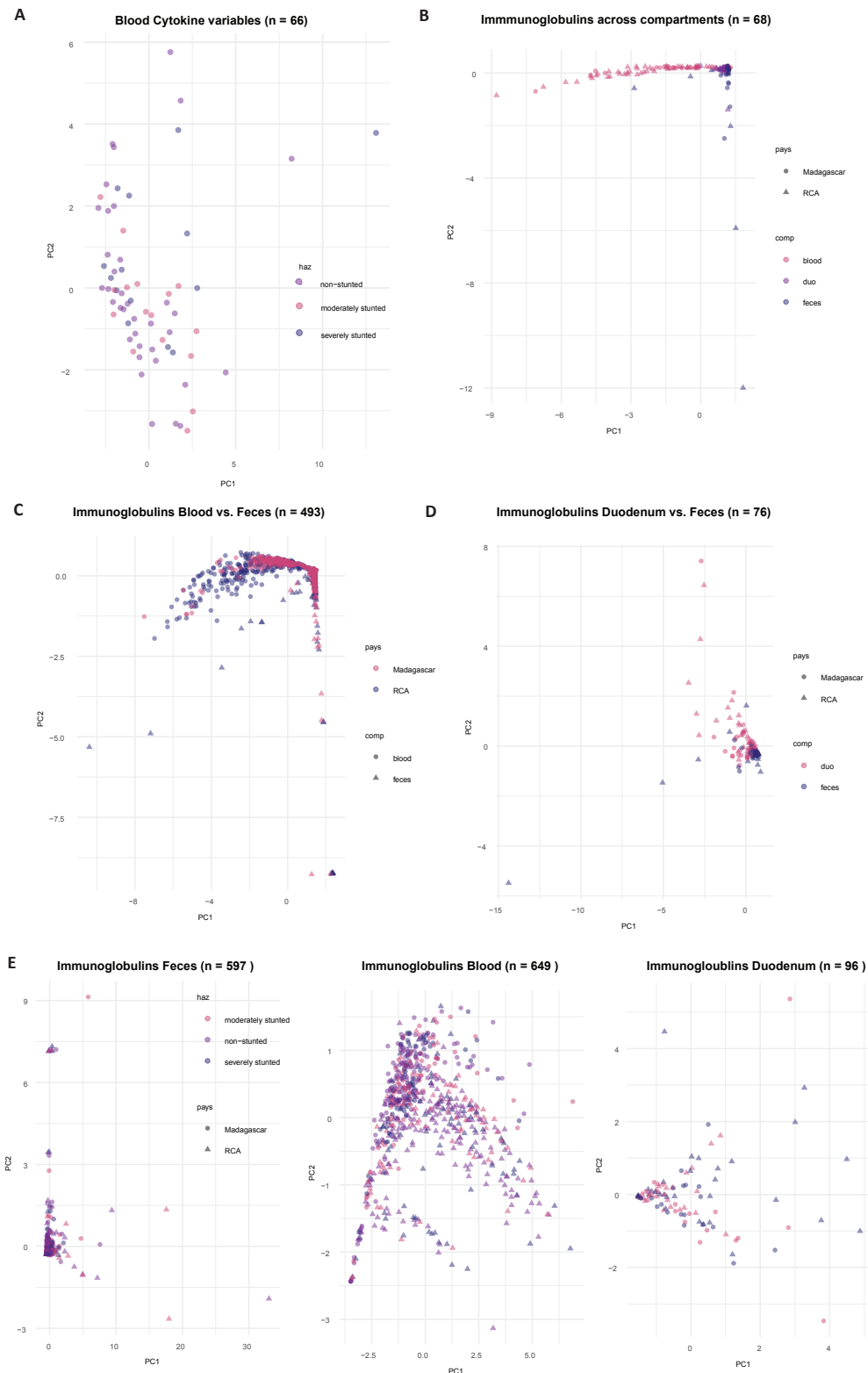


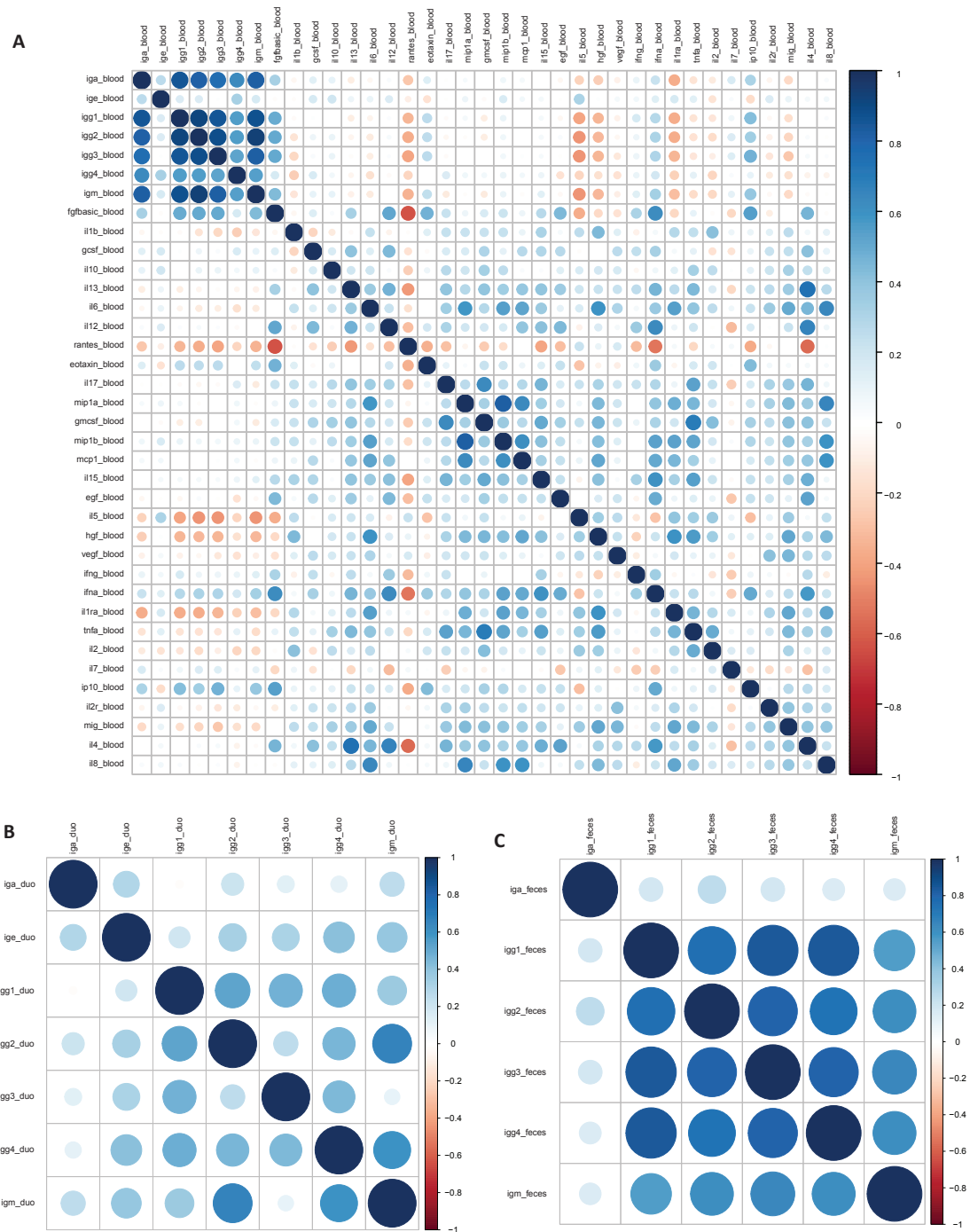
**Figure S1: Summary of available data.** Available data is indicated in black, missing/non-evaluated data in blue.



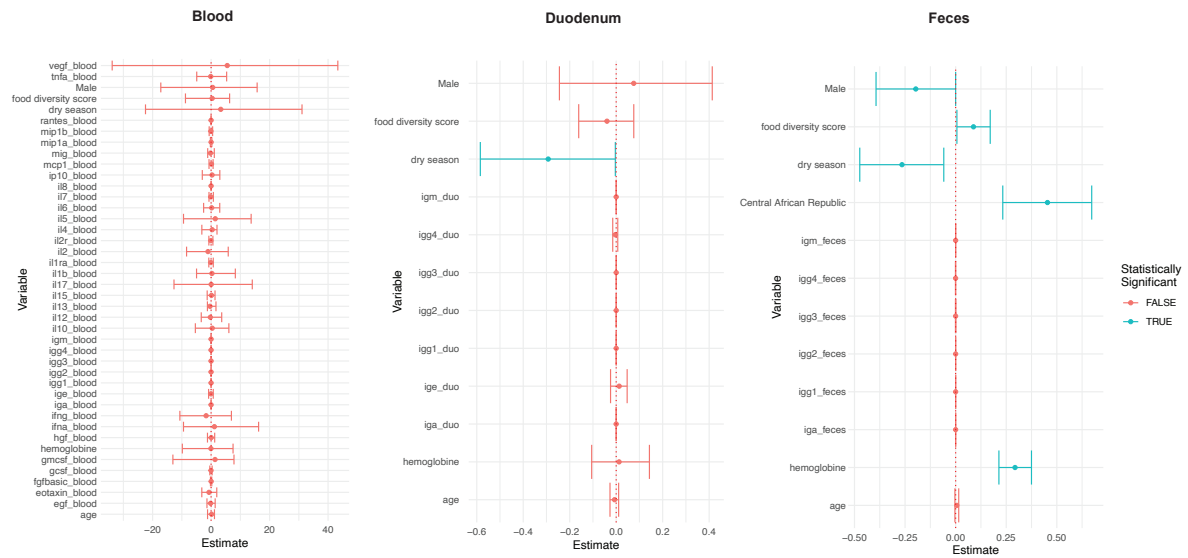
**Figure S2: Summary of potential outliers.** (a) Summary table of the samples with potential outlier values. (b) Bar plot of immunoglobulin levels and (c) PCA of immunoglobulin and cytokine levels of all samples. Potential outlier values are indicated in blue.



**Figure S3: Immunoglobulin and Cytokine values according to nutritional status and body compartment.** (a) PCA of blood cytokine variables according to nutritional status. (b) PCA comparing immunoglobulin profiles across compartments; PCA comparing immunoglobulin profiles between (c) blood and feces and (d) feces and duodenum (e) PCA comparing immunoglobulin profiles according to stunting status and country of origin.



**Figure S4: Correlations between immune markers.** Correlation in between immunoglobulins and cytokines in (a) the blood and immunoglobulin levels in (b) duodenum and (c) feces. Correlation coefficient is indicated with a color code, the strength of correlation by symbol size.



**Figure S5: Association of cytokines and/or immunoglobulins with stunted child growth.** Regression models per biomarker, taking into account associations with other biomarkers as well as potential confounding factors. The models were run on each compartment separately. Significant associations ( $p < 0.05$ ) are indicated in blue.

## Supplementary Tables

Table S1: Summary of the immunoglobulin levels across body sites and country

	Madagascar		RCA	
	non-stunted (N=215)	stunted (N=202)	non-stunted (N=216)	stunted (N=171)
<b>iga_feces</b>				
Mean (SD)	209000 (655000)	227000 (829000)	239000 (927000)	260000 (1070000)
Median [Min, Max]	26600 [4.62, 7000000]	26500 [1.00, 7000000]	15500 [0.610, 7000000]	16500 [1.82, 7000000]
Missing	47 (21.9%)	42 (20.8%)	29 (13.4%)	31 (18.1%)
<b>ige_blood</b>				
Mean (SD)	5.72 (7.47)	9.32 (13.3)	3.86 (5.72)	4.70 (6.60)
Median [Min, Max]	2.67 [-0.996, 42.3]	4.11 [-0.484, 79.8]	1.76 [-0.762, 36.1]	2.09 [-0.681, 32.5]
Missing	14 (6.5%)	8 (4.0%)	13 (6.0%)	8 (4.7%)
<b>ige_duo</b>				
Mean (SD)	NA (NA)	2.43 (6.21)	NA (NA)	1.05 (2.73)
Median [Min, Max]	NA [NA, NA]	0.305 [0.00500, 31.6]	NA [NA, NA]	0.150 [0.00500, 19.0]
Missing	215 (100%)	162 (80.2%)	216 (100%)	109 (63.7%)
<b>igg1_blood</b>				
Mean (SD)	23100 (7920)	23900 (6670)	21300 (6130)	21700 (6930)
Median [Min, Max]	24600 [-783, 38500]	24700 [-353, 40700]	21900 [4190, 30800]	22700 [-185, 34200]
Missing	62 (28.8%)	64 (31.7%)	6 (2.8%)	4 (2.3%)
<b>igg1_duo</b>				
Mean (SD)	NA (NA)	1730 (8330)	NA (NA)	840 (3430)
Median [Min, Max]	NA [NA, NA]	147 [0.0400, 53400]	NA [NA, NA]	151 [0.0200, 26700]
Missing	215 (100%)	161 (79.7%)	216 (100%)	97 (56.7%)
<b>igg1_feces</b>				
Mean (SD)	170 (444)	1290 (13600)	4770 (36600)	4170 (34900)
Median [Min, Max]	43.3 [0.120, 4000]	41.6 [0.130, 186000]	45.4 [0.0200, 455000]	43.5 [0.310, 428000]
Missing	21 (9.8%)	14 (6.9%)	10 (4.6%)	15 (8.8%)
<b>igg2_blood</b>				
Mean (SD)	10300 (13900)	13300 (22900)	24500 (31300)	24000 (31500)
Median [Min, Max]	6170 [399, 94200]	6100 [1320, 140000]	11900 [879, 179000]	10500 [666, 186000]
Missing	62 (28.8%)	64 (31.7%)	6 (2.8%)	4 (2.3%)
<b>igg2_duo</b>				
Mean (SD)	NA (NA)	1880 (2810)	NA (NA)	1300 (1630)
Median [Min, Max]	NA [NA, NA]	1050 [0.00500, 15400]	NA [NA, NA]	767 [3.51, 8280]
Missing	215 (100%)	160 (79.2%)	216 (100%)	91 (53.2%)
<b>igg2_feces</b>				
Mean (SD)	5890 (63900)	2430 (24400)	12000 (57900)	22300 (104000)
Median [Min, Max]	262 [2.09, 897000]	233 [5.24, 340000]	233 [2.40, 525000]	171 [2.46, 1010000]
Missing	16 (7.4%)	8 (4.0%)	9 (4.2%)	14 (8.2%)
<b>igg3_blood</b>				
Mean (SD)	2550 (1630)	2850 (1810)	3940 (2540)	4060 (2410)
Median [Min, Max]	2300 [-123, 7500]	2430 [-94.7, 8500]	3520 [164, 10100]	3890 [-50.9, 9740]
Missing	62 (28.8%)	64 (31.7%)	6 (2.8%)	4 (2.3%)
<b>igg3_duo</b>				
Mean (SD)	NA (NA)	242 (726)	NA (NA)	118 (204)
Median [Min, Max]	NA [NA, NA]	5.73 [0.0200, 4190]	NA [NA, NA]	39.7 [0.00500, 1340]
Missing	215 (100%)	159 (78.7%)	216 (100%)	98 (57.3%)
<b>igg3_feces</b>				
Mean (SD)	25.9 (183)	156 (1560)	95.6 (880)	65.1 (563)
Median [Min, Max]	1.41 [0.0200, 2430]	1.50 [0.0100, 20000]	1.23 [0.0200, 12200]	1.20 [0.0300, 7010]
Missing	22 (10.2%)	9 (4.5%)	9 (4.2%)	14 (8.2%)
<b>igg4_blood</b>				
Mean (SD)	707 (768)	885 (860)	1430 (1200)	1340 (1170)
Median [Min, Max]	457 [-80.5, 3560]	675 [-73.7, 3670]	1170 [2.59, 4020]	1200 [-30.6, 4010]
Missing	62 (28.8%)	64 (31.7%)	8 (3.7%)	4 (2.3%)
<b>igg4_duo</b>				
Mean (SD)	NA (NA)	20.8 (19.0)	NA (NA)	23.1 (29.8)
Median [Min, Max]	NA [NA, NA]	15.0 [0.00500, 74.5]	NA [NA, NA]	14.1 [0.00500, 144]
Missing	215 (100%)	161 (79.7%)	216 (100%)	101 (59.1%)
<b>igg4_feces</b>				
Mean (SD)	6.93 (13.7)	85.8 (1060)	134 (1300)	142 (686)
Median [Min, Max]	1.46 [0, 78.4]	1.74 [0.0100, 14600]	1.57 [0.0200, 18400]	1.25 [0.0200, 4640]
Missing	19 (8.8%)	14 (6.9%)	10 (4.6%)	14 (8.2%)
<b>igm_blood</b>				
Mean (SD)	5480 (7220)	5770 (7270)	12000 (11200)	10900 (10400)
Median [Min, Max]	3450 [-954, 51500]	3760 [-789, 49100]	8090 [-538, 51400]	6930 [-714, 46500]
Missing	62 (28.8%)	65 (32.2%)	6 (2.8%)	4 (2.3%)
<b>igm_duo</b>				
Mean (SD)	NA (NA)	1160 (1060)	NA (NA)	602 (810)
Median [Min, Max]	NA [NA, NA]	782 [0.0800, 3860]	NA [NA, NA]	298 [0.0400, 3820]
Missing	215 (100%)	158 (78.2%)	216 (100%)	97 (56.7%)
<b>igm_feces</b>				
Mean (SD)	778 (3210)	984 (5710)	6920 (38600)	7730 (44000)
Median [Min, Max]	124 [0.270, 30200]	116 [0.150, 76900]	64.3 [0.700, 359000]	95.1 [0.750, 350000]
Missing	21 (9.8%)	7 (3.5%)	12 (5.6%)	16 (9.4%)

Table S2: Summary of the cytokine levels in the blood of children in Madagascar

	non-stunted (N=431)	stunted (N=373)		non-stunted (N=431)	stunted (N=373)
<b>fgfbasic_blood</b>			<b>vegfblood</b>		
Mean (SD)	84.0 (78.5)	67.8 (64.8)	Mean (SD)	0.291 (0.228)	0.506 (0.361)
Median [Min, Max]	59.8 [0, 244]	34.6 [1.83, 212]	Median [Min, Max]	0.244 [0.0304, 0.989]	0.401 [0.0960, 1.53]
Missing	395 (91.6%)	343 (92.0%)	Missing	395 (91.6%)	343 (92.0%)
<b>il1b_blood</b>			<b>ifng_blood</b>		
Mean (SD)	2.62 (2.58)	2.67 (1.82)	Mean (SD)	4.16 (3.20)	3.94 (3.37)
Median [Min, Max]	1.54 [0.0597, 12.4]	2.16 [0.0597, 6.10]	Median [Min, Max]	3.05 [0.345, 13.4]	3.05 [0.919, 18.2]
Missing	395 (91.6%)	343 (92.0%)	Missing	395 (91.6%)	343 (92.0%)
<b>gcsfblood</b>			<b>ifna_blood</b>		
Mean (SD)	30.0 (30.1)	36.8 (37.6)	Mean (SD)	2.21 (2.10)	2.62 (2.08)
Median [Min, Max]	14.7 [0, 100]	22.2 [0, 152]	Median [Min, Max]	1.86 [0.0852, 10.5]	1.98 [0.209, 9.74]
Missing	395 (91.6%)	343 (92.0%)	Missing	395 (91.6%)	343 (92.0%)
<b>il10_blood</b>			<b>il1ra_blood</b>		
Mean (SD)	3.47 (3.37)	3.77 (3.90)	Mean (SD)	12.3 (18.2)	22.1 (50.3)
Median [Min, Max]	2.39 [0.0692, 16.9]	1.99 [0, 17.4]	Median [Min, Max]	6.78 [0, 94.3]	8.19 [1.07, 272]
Missing	395 (91.6%)	343 (92.0%)	Missing	395 (91.6%)	343 (92.0%)
<b>il13_blood</b>			<b>tnfa_blood</b>		
Mean (SD)	4.57 (6.56)	9.37 (15.0)	Mean (SD)	8.68 (23.8)	7.24 (18.9)
Median [Min, Max]	2.19 [0, 30.9]	3.48 [0, 76.4]	Median [Min, Max]	0.821 [0, 105]	1.61 [0.216, 97.4]
Missing	395 (91.6%)	343 (92.0%)	Missing	395 (91.6%)	343 (92.0%)
<b>il6_blood</b>			<b>il2_blood</b>		
Mean (SD)	16.8 (84.5)	4.27 (9.36)	Mean (SD)	2.44 (2.50)	1.98 (2.00)
Median [Min, Max]	0.868 [0.373, 507]	1.32 [0.244, 41.0]	Median [Min, Max]	1.36 [0, 7.13]	1.20 [0.0805, 7.13]
Missing	395 (91.6%)	343 (92.0%)	Missing	395 (91.6%)	343 (92.0%)
<b>il12_blood</b>			<b>il7_blood</b>		
Mean (SD)	12.1 (6.13)	12.4 (5.37)	Mean (SD)	16.3 (13.2)	17.9 (13.2)
Median [Min, Max]	10.6 [4.64, 27.2]	11.3 [4.47, 26.9]	Median [Min, Max]	28.5 [0.0359, 28.5]	28.5 [0.220, 28.5]
Missing	395 (91.6%)	343 (92.0%)	Missing	395 (91.6%)	343 (92.0%)
<b>rantes_blood</b>			<b>ip10_blood</b>		
Mean (SD)	1070 (638)	1080 (645)	Mean (SD)	1.93 (3.30)	3.61 (9.87)
Median [Min, Max]	913 [117, 2760]	756 [98.7, 2340]	Median [Min, Max]	0.863 [0.199, 19.5]	1.15 [0.0809, 54.7]
Missing	395 (91.6%)	343 (92.0%)	Missing	395 (91.6%)	343 (92.0%)
<b>ectaxin_blood</b>			<b>il2r_blood</b>		
Mean (SD)	4.53 (5.57)	4.04 (3.43)	Mean (SD)	18.6 (13.9)	30.6 (34.1)
Median [Min, Max]	3.37 [0.549, 33.7]	3.00 [0.527, 12.7]	Median [Min, Max]	14.3 [0.556, 72.9]	21.0 [0, 172]
Missing	395 (91.6%)	343 (92.0%)	Missing	395 (91.6%)	343 (92.0%)
<b>il17_blood</b>			<b>mig_blood</b>		
Mean (SD)	1.08 (3.62)	1.03 (2.46)	Mean (SD)	6.77 (9.57)	11.7 (14.2)
Median [Min, Max]	0.378 [0, 21.7]	0.378 [0, 13.2]	Median [Min, Max]	2.98 [0, 47.4]	8.02 [0.446, 64.6]
Missing	395 (91.6%)	343 (92.0%)	Missing	395 (91.6%)	343 (92.0%)
<b>mip1a_blood</b>			<b>il4_blood</b>		
Mean (SD)	27.8 (77.0)	15.3 (20.8)	Mean (SD)	9.20 (9.13)	10.2 (9.90)
Median [Min, Max]	4.19 [1.00, 372]	6.37 [0.543, 77.1]	Median [Min, Max]	5.80 [0.340, 32.4]	6.54 [0.340, 36.4]
Missing	395 (91.6%)	343 (92.0%)	Missing	395 (91.6%)	343 (92.0%)
<b>gmcsfblood</b>			<b>il8_blood</b>		
Mean (SD)	1.52 (3.80)	1.69 (3.41)	Mean (SD)	117 (199)	334 (808)
Median [Min, Max]	0.290 [0.0156, 22.6]	0.357 [0, 14.9]	Median [Min, Max]	55.0 [3.43, 922]	89.6 [1.18, 4220]
Missing	395 (91.6%)	343 (92.0%)	Missing	395 (91.6%)	343 (92.0%)
<b>mip1b_blood</b>					
Mean (SD)	34.3 (39.0)	35.9 (36.3)			
Median [Min, Max]	14.1 [2.49, 153]	23.0 [5.34, 162]			
Missing	395 (91.6%)	343 (92.0%)			
<b>mcp1_blood</b>					
Mean (SD)	17.1 (16.3)	31.5 (40.8)			
Median [Min, Max]	10.8 [0, 72.6]	14.3 [0, 192]			
Missing	395 (91.6%)	343 (92.0%)			
<b>il15_blood</b>					
Mean (SD)	19.2 (18.2)	25.9 (32.4)			
Median [Min, Max]	16.9 [0, 101]	19.2 [2.77, 180]			
Missing	395 (91.6%)	343 (92.0%)			
<b>egfblood</b>					
Mean (SD)	19.2 (9.76)	18.4 (8.54)			
Median [Min, Max]	18.4 [3.36, 40.8]	18.8 [4.91, 33.6]			
Missing	395 (91.6%)	343 (92.0%)			
<b>il5_blood</b>					
Mean (SD)	0.941 (1.72)	0.751 (1.49)			
Median [Min, Max]	0.208 [0, 5.06]	0.176 [0.0135, 5.06]			
Missing	395 (91.6%)	343 (92.0%)			
<b>hgb_blood</b>					
Mean (SD)	9.98 (10.1)	15.3 (24.4)			
Median [Min, Max]	6.80 [2.31, 48.1]	8.98 [1.10, 137]			
Missing	395 (91.6%)	343 (92.0%)			

Table S3: Summary of the endocab levels in the blood of children in Madagascar

	<b>non-stunted (N=431)</b>	<b>stunted (N=373)</b>
<b>amu</b>		
Mean (SD)	16.0 (8.59)	29.5 (56.5)
Median [Min, Max]	12.8 [6.52, 44.5]	13.7 [8.93, 344]
Missing	406 (94.2%)	337 (90.3%)
<b>mmu</b>		
Mean (SD)	27.8 (10.9)	25.1 (8.38)
Median [Min, Max]	29.7 [8.95, 51.8]	26.4 [11.7, 42.4]
Missing	406 (94.2%)	337 (90.3%)
<b>gmu200</b>		
Mean (SD)	52.6 (37.5)	63.8 (70.2)
Median [Min, Max]	48.0 [18.2, 197]	50.7 [17.0, 419]
Missing	406 (94.2%)	337 (90.3%)