Table S1. Composition and nutrient levels in the basal diets (dry matter basis)

Ingredients	g/kg diet	Nutrient analysis	g/kg diet
Ground corn	543.0	AME/(kcal/kg)	2950
Soybean oil	34.0	CP	210
Soybean meal (44%)	380.2	Calcium	10.1
Lysine (98%)	1.5	Available Phosphorus	4.5
DL-Methionine	2.5	Lysine	11.5
Calcium carbonate	11.4	Methionine	5.0
Di-calcium Phosphate	18.6	Methionine and Cystine	8.6
Sodium chloride	4.0	Manganese (mg/kg)[3]	25.62
Choline chloride	1.5		
Vitamin premix[1]	0.3		
Mineral premix[2]	3.0		
Total	1000		

[1] Provided per kilogram of diet: Vitamin A 8000 IU; Vitamin D_3 1000 IU; Vitamin E 20 IU; Vitamin K_3 0.5 mg; Pantothenic acid 10 mg; Niacin amide 35 mg; Folic acid 0.55 mg; Biotin 0.18 mg.

[2] Provided per kilogram of diet: Cu ($CuSO_4 \cdot 5H_2O$), 8 mg; Fe ($FeSO_4 \cdot 7H_2O$), 80 mg; Zn ($ZnSO_4 \cdot 7H_2O$), 70; Se ($NaSeO_3$), 0.3 mg; I (KI), 0.7 mg.

[3]Manganese concentration in the basal diet was analyzed by atomic absorption spectrophotometer.

AME, apparent metabolism energy; CP, crude protein;

Table S2. The primers for quantitative real-time PCR

Gene	Gene ID	Primer	Sequence (5′-3′)	Product Size (bp)
IL-1β	NM_204524.1	Reverse	gcatcaagggctacaagctc	131
		Forward	caggcggtagaagatgaagc	
IL-6	NM_204628.1	Reverse	ctcctcgccaatctgaagtc	100
		Forward	ccctcacggtcttctccata	
IL-8	AJ009800	Reverse	gcttgctaggggaaatgaag	136
		Forward	ggaattaccagtttgctgctg	
IL-12β	NM_213571.1	Reverse	cctgcctgtctgctaagacc	82
		Forward	atcatttgcccattggagtc	
IL-18	NM_204608.1	Reverse	tgaaatctggcagtggaatg	144
		Forward	caaccattttcccatgctct	
IFN-γ	NM_205149.1	Reverse	cagatgtagctgacggtgga	98
		Forward	catcgaaacaatctggctca	
TNF-α	GU230788.1	Reverse	gcccttcctgtaaccagatg	71
		Forward	acacgacagccaagtcaacg	
TRAF6	XM_015287208.1	Reverse	atggaagccaagccagagtt	144
		Forward	acagcgcaccagaagggtat	
NF-κB	M86930.1	Reverse	tcaacgcaggacctaaagacat	162
		Forward	gcagatagccaagttcaggatg	
MnSOD	NM_204211.1	Reverse	ttcctgacctgccttacgactat	138
		Forward	ccagcgcctctttgtatttct	
claudin-1	NM_001013611.2	Reverse	gtctttggtggcgtgatctt	117
		Forward	tctggtgttaacgggtgtga	
ZO-1	XM_015278981.2	Reverse	ggtcagccagatgtggattt	81
		Forward	ccgaagcattccatcttcat	
Occludin	NM_205128.1	Reverse	gctgagatggacagcatcaa	97
		Forward	cctctgccacatcctggtat	
β-actin	NM_205518.1	Reverse	gctacagcttcaccaccaca	90
		Forward	tctcctgctcgaaatccagt	
GAPDH	NM_204305.1	Reverse	tgggaagcttactggaatgg	88
		Forward	cttggctggtttctccagac	

IL, interleukin; *IFN*, interferon; *TNF*, tumor necrosis factor. *TRAF6*, TNF receptor-associated factor 6. *NF-κB*, nuclear transcription factor kappa B; *MnSOD*, manganese superoxide dismutase; *ZO-1*, zona occludens 1; *GAPDH*, glyceraldehyde-3-phosphate dehydrogenase.

Table S3. Sequences of the primers used for the determination of the microbial population

Items	**Primer**	**Sequence (5′-3′)**
Total bacteria	Reverse	gatccgcttgccttcgca
	Forward	catccagtgcaaacctaagag
Lactobacillus	Reverse	gatccgcttgccttcgca
	Forward	catccagtgcaaacctaagag
Bifidobacterium	Reverse	taagccatggactttcacacc
	Forward	gggtggtaatgccggatg
Enterococcus	Reverse	act cgttgtacttcccattgt
	Forward	cccttattgttagttgccatcatt
Salmonella	Reverse	aaacgttgaaaaactgagga
	Forward	tcgtcattccattacctacc
Escherichia coli	Reverse	agaacgctttgtggttaatcagga
	Forward	gtgtgatatctacccgcttcgc
Clostridium	Reverse	ccctttacacccagtaa
	Forward	gagtttgatcmtggctcag
Enterobacter	Reverse	ctctacgagactcaagcttgc
	Forward	cattgacgttacccgcag aagaagc

Table S4. Effects of graded Mn on *MnSOD* and inflammatory cytokine expressions in spleen, thymus, and bursa of broilers following oral *S.* Typhimurium

Gene	Tissue	Dietary Mn levels		
		Deficient diet (0 mg/kg)	Control diet (40 mg/kg)	Surfeit diet (100 mg/kg)
TNF-α	Spleen	1.03±0.06^{b}	1.33±0.06^{a}	1.33±0.01^{a}
IFN-γ	Spleen	0.91±0.17^{b}	1.48±0.18^{a}	1.51±0.20^{a}
IL-8	Spleen	0.84±0.14^{b}	1.24±0.20^{a}	1.53±0.04^{a}
IL-18	Spleen	1.32±0.07	1.43±0.10	1.54±0.32
IL-1β	Spleen	1.03±0.24^{c}	1.78±0.33^{b}	2.16±0.14^{a}
IL-10	Spleen	1.07±0.20	1.11±0.17	1.09±0.29
IL-12	Spleen	1.19±0.11^{b}	2.72±0.56^{a}	2.38±0.62^{a}
IL-6	Spleen	1.12±0.25	1.87±0.59	2.03±0.90
IL-4	Spleen	1.05±0.48^{a}	0.91±0.25^{ab}	0.60±0.18^{b}
MnSOD	Spleen	1.15±0.03^{b}	1.61±0.11^{a}	1.69±0.14^{a}
TRAF6	Spleen	1.15±0.14^{b}	1.30±0.08^{ab}	1.37±0.16^{a}
NF-κB	Spleen	1.07±0.13^{b}	1.53±0.18^{a}	1.69±0.17^{a}
IL-1β	Thymus	0.97±0.03	0.98±0.08	1.05±0.14
IL-8	Thymus	1.04±0.03^{b}	1.33±0.25^{a}	0.92±0.08^{b}
IL-6	Thymus	1.52±0.04	1.55±0.14	1.48±0.09
TNF-α	Thymus	0.89±0.04	0.91±0.04	0.98±0.04
IL-18	Thymus	1.41±0.09	1.55±0.20	1.62±0.09
IFN-γ	Thymus	0.85±0.09	1.18±0.13	1.07±0.08
IL-12	Thymus	1.03±0.05^{b}	1.73±0.26^{a}	1.68±0.44^{a}
IL-4	Thymus	1.20±0.38	1.44±0.73	1.57±0.36
IL-10	Thymus	0.87±0.06	0.63±0.03	0.91±0.10
MnSOD	Thymus	1.37±0.12	1.44±0.20	1.48±0.18
TRAF6	Thymus	1.39±0.20	1.54±0.14	1.63±0.21
NF-κB	Thymus	1.19±0.13	1.27±0.11	1.22±0.08
IL-1β	Bursa	1.04±0.22	0.97±0.15	1.09±0.06
IFN-γ	Bursa	1.08±0.30	0.91±0.25	1.17±0.21
TNF-α	Bursa	1.18±0.06	1.11±0.04	1.18±0.05
IL-8	Bursa	1.33±1.73	1.28±1.01	1.34±0.65
IL-18	Bursa	1.12±0.30	1.33±0.17	1.45±0.04
IL-12	Bursa	1.16±4.11	1.33±3.12	1.38±0.31
IL-6	Bursa	1.01±0.62^{b}	1.43±1.09^{a}	1.39±0.35^{ab}
IL-10	Bursa	1.04±0.46	1.11±0.29	0.98±0.19
MnSOD	Bursa	1.17±0.08	1.22±0.10	1.23±0.09
TRAF6	Bursa	1.26±0.06	1.32±0.08	1.37±0.10
NF-κB	Bursa	1.31±0.14	1.34±0.05	1.47±0.11

Data represent means with standard deviation. $^{a,\ b}$ Mean values with different letters are significantly different (one-way ANOVA, $P<0.05$, Tukey's *post hoc* test).

IL, interleukin; *IFN*, interferon; *TNF*, tumor necrosis factor. *TRAF6*, TNF receptor-associated factor 6. *NF-κB*, nuclear transcription factor kappa B; *MnSOD*, manganese superoxide dismutase; *GAPDH*, glyceraldehyde-3-phosphate dehydrogenase.

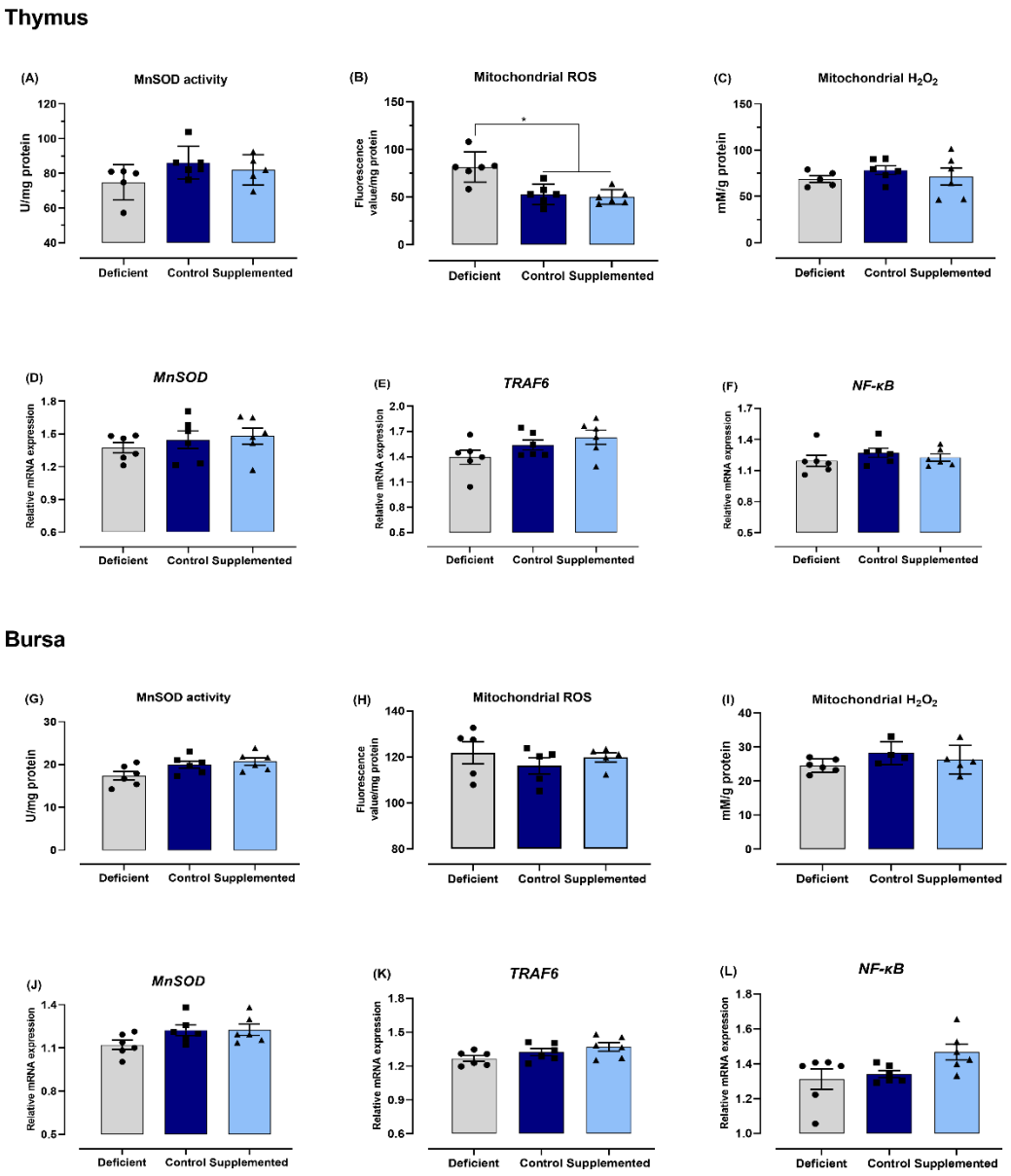

Figure S1 Effect of dietary Mn alterations on the activation of redox-sensitive signaling and downstream transcription factors in thymus and bursa of birds challenged with *S.* Typhimurium. (A) and (G) Manganese superoxide dismutase (MnSOD) activity, (B) and (H) reactive oxygen species (ROS) level, and (C) and (I) hydrogen peroxide (H_2O_2) concentration were determined in mitochondria isolated from thymus or bursa, respectively. Meanwhile, mRNA expression of (D) *MnSOD*, (E) tumor necrosis factor receptor-associated factor 6 (*TRAF6*), and (F) nuclear factor kappa-B (*NF-κB*) in thymus or bursa were measured by RT-PCR, respectively. Data represent means with standard deviation. **P* < 0.05.