

Long-term assessment of horses and ponies post exposure to monensin sodium in commercial feed

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TABLE 1: Results of serum biochemical analysis and exercise electrocardiography and outcome in 37 ponies and horses after accidental exposure to monensin sodium in commercial pelleted feed

Horse	Time post exposure	Serum urea (mmol/l) rr 3.74–6.21	Serum creatinine (µmol/l) rr 87–149	Serum CK (u/l) rr 167–347	Serum AST (u/l) rr 215–347	Maximal HR during exercise (beats/min)	Comments	Outcome (≥52 months post exposure)
1								Unknown
2								Unknown
3	6 weeks					155	NSR	Flat racing; 16 starts, 3 places. Now retired
4								Subjected to euthanasia
5	3 months	5.53	69	442	300	235	NSR	Pleasure riding
6	3 months	6.84	95	502	566	204	NSR	Breeding; 2 foals
7	6 months					192	NSR	Flat racing; 24 starts, 3 wins, 7 places. Now used for showjumping
8	3 months	7.43	82	388	331		Exercise not performed as not broken in	Flat racing, details unknown
9	2 months					130	Frequent VPDs during exercise – test discontinued	Retired
9	27 months	7.0*	108*	447*	263*	220	NSR	
10	2 months					195	NSR	Retired, died
11	2 months					208	NSR	Retired
11	27 months	5.7*	95*	513*	328*	245	NSR	
12	2 months					210	NSR	Retired
12	27 months	7.0*	128*	705*	272*	220	NSR	
13	2 months					226	NSR	Retired
13	27 months	6.1*	100*	613*	364*	220	NSR	
14	2 months					190	NSR	Endurance riding, now retired and used for breeding; 2 foals
15	2 months					210	NSR	Endurance riding, now retired and used for breeding; 1 foal
16	2 months					210	Isolated VPDs during exercise	
17	14 months					200	NSR	Endurance riding
17	20 months					225	NSR	Endurance riding. Developed forelimb lameness and stumbling; subjected to euthanasia, no <i>post mortem</i> examination performed
18	14 months					176	Pre-existing TI and restrictive VSD	Breeding stallion
18	20 months						Pre-existing TI and restrictive VSD	
19	14 months					180	NSR	Pleasure riding, now retired
20	3 months					204	NSR	Endurance riding
21	3 months					234	NSR	Endurance riding, breeding stallion
22	3 months						ECG not recorded – equipment error	Endurance riding
23	3 months					198	NSR	Endurance riding
24	4 months					228	NSR	Endurance riding and breeding; 2 foals
25	4 months					228	NSR	Endurance riding
26	4 months					220	NSR	Endurance riding and breeding; 1 foal
27	4 months					226	NSR	Endurance riding and breeding. Subjected to euthanasia due to ill thrift
28	4 months					210	NSR	Breeding stallion, developed ocular SCC and retired
29	2 months	7.7	107	417	318			Retired
29	46 months	8.3	82	381	217	214	NSR	
30	2 months	7.7	120	757	320			Retired
30	46 months	6.8	114	338	239	214	NSR	
31	2 months	7.8	NR	233	NR			Retired
31	46 months	7.6	136	313	297	200	NSR	
32	2 months	6.3	110	186	215			Retired
32	46 months	5.9	101	175	181	200	NSR, mild AI	
33	2 months	6.4	77	272	382			Retired
33	46 months	3.7	82	378	294	176	NSR	
34	2 months	7.7	100	319	482			Retired
34	46 months	6.2	88	450	581	200	NSR	
35	2 months	7.6	129	456	295			Retired
35	46 months	6.7	104	701	286	230	NSR	
36	2 months	7.2	106	634	742			Retired
36	46 months	4.8	89	934	563	214	NSR	
37	2 months	6.5	115	419	241			Pleasure riding
37	16 months	5.2	80	481	331	220	NSR	

rr = reference range; AI = aortic insufficiency; AST = aspartate aminotransferase; CK = creatine kinase; HR = heart rate; NR = not recorded; NSR = normal sinus rhythm; SCC = squamous cell carcinoma; TI = tricuspid insufficiency; VPD = ventricular premature depolarisation; VSD = ventricular septal defect; * indicates post exercise sample.

TABLE 2: Results of resting and post exercise echocardiography performed on 36 horses and ponies after accidental exposure to monensin sodium in commercial pelleted feed

Horse	Breed	Age	Sex	Time post exposure	Resting echocardiographic examination								Post exercise echocardiographic examination						
					LVIDd (cm)	LVIDs (cm)	FS (%)	LAI Dd (cm)	ET (ms)	MVEF slope (mm/s)	HR (beats /min)	ESSP (mm)	LVIDd (cm)	LVIDs (cm)	FS (%)	HR (beats /min)			
1	TB	10 yo	G	7 weeks	10.91	6.43	41.06	10.04	430	19.92	35	0.38	9.70	5.80	40.21	60			
2	TB	10 yo	F	7 weeks	9.94	5.88	40.83	11.00	340	22.01	40	0.49	9.77	6.27	35.82	59			
3	TB	13 mo	F	6 weeks	9.18	5.54	39.65	10.71	370	24.90	36	0.65	9.33	5.95	36.23	48			
4	TB	5 yo	G	6 weeks	10.53	7.97	24.31	11.94	460	27.43	39	1.32							
5	WMP	11 yo	G	3 months	7.73	5.04	34.78	7.63	410	19.55	45	0.13	7.35	4.91	33.14	124			
7	TB	2 yo	G	3 months	Unable to image due to interference from adipose tissue														
7				6 months	8.79	5.35	39.14	7.89			60	0.15	11.18	7.06	36.84	60			
8	TB	2 yo	F	3 months	Unable to image due to refractory patient temperament														
8				6 months	11.14	6.82	38.73			21.36	42		Excessive patient movement						
9	ASH	13 yo	G	2 months	10.65	5.98	43.79	9.64	370	19.43	41	0.88	Developed frequent VPDs during exercise						
9				27 months	10.08	5.98	40.63	10.12	440	22.36	48	0.94	9.88	5.35	45.83	140			
10	ASH	16 yo	G	2 months	10.59	6.61	37.58	12.37	410	14.01	44	0.69	13.36	10.52	21.23	102			
11	TB	4 yo	F	2 months	10.21	6.99	31.48	10.25	430	26.55	41	1.01	10.39	7.56	27.27	86			
11				27 months	10.59	6.61	37.58	11.04			55		12.06	8.18	32.17	115			
12	TB	11 yo	F	2 months	10.96	6.99	36.21	12.58	420	24.70	38		11.28	6.74	40.22	106			
12				27 months	11.21	6.80	39.33	12.30	400	22.48	40	0.63	11.03	5.04	54.31	150			
13	TB	7 yo	G	2 months	11.84	7.94	32.98		400	12.89	43	0.69	11.41	5.86	48.62	129			
13				27 months	12.22	6.99	42.80	11.13	410	14.25	43	0.94	10.88	6.00	44.86	133			
14	Arabian	13 yo	F	2 months	10.81	6.82	36.87	11.61	380	18.88	41	0.98	11.12	6.82	38.62	83			
15	Arabian	14 yo	F	2 months	11.47	5.94	48.21	10.89		31.95	50	0.75	10.35	5.47	47.16	102			
16	Arabian	5 yo	F	2 months	9.82	6.53	33.53	9.96	410	26.03	38	0.70	7.31	4.54	37.93	82			
17	Arabian	9 yo	G	3 months	10.90	7.81	28.32	12.27	440	21.02	36	0.94							
17				14 months	9.95	6.24	37.34	11.13			38		10.96	7.05	35.63	79			
17				20 months	12.12	7.89	34.90	10.67			38		10.84	7.18	33.72	95			
18	Arabian	15 yo	M	3 months	11.59	8.29	28.43	12.18	340	17.88	41	0.35							
18				14 months	12.60	8.07	36.00	12.32	420	25.51	36		11.66	7.25	37.84	53			
18				20 months	11.08	7.41	33.12	12.20											
19	Arabian	3 yo	G	3 months	11.25	7.92	29.61	11.33	460	23.23	36	0.82							
19				14 months	11.18	6.82	38.99	10.68		28.13	46		10.90	6.93	36.42	83			
20	Arabian	2 yo	G	3 months	9.39	5.68	39.53	10.39	420	15.37	37	0.38	9.43	6.00	36.36	70			
21	Arabian	3 yo	M	3 months	10.70	6.71	37.24	10.59	420	17.85	39	0.71	11.19	6.71	40.00	73			
22	Arabian	4 yo	G	3 months	10.53	7.06	32.95		410	28.13	41	0.29	10.10	6.06	40.00	77			
23	Arabian	2 yo	G	3 months	9.83	6.39	35.00	11.70	440	25.41	38	0.76	9.22	4.89	46.99	104			
24	Arabian	1 yo	F	4 months	9.01	5.62	37.58	8.84	400	10.09	48	0.55	8.85	4.05	54.24	65			
25	Arabian	1 yo	M	4 months	8.97	4.84	46.07	7.73	380	23.15	48	0.45	8.87	5.50	38.02	90			
26	Arabian	1 yo	F	4 months	9.13	5.95	34.81	7.63	406	13.65	45	0.40	8.52	5.30	37.76	123			
27	Arabian	1 yo	F	4 months	8.62	5.24	39.18	8.46	400	14.91	47	0.30	9.79	6.28	35.85	102			
28	Arabian	2 yo	F	4 months	8.72	5.29	39.31	9.49	350	20.18	48	0.50	8.77	5.22	40.41	123			
29	Shetland	4 yo	F	2 months	Unable to image														
29				46 months	6.77	4.40	35.00	7.98					Unable to complete examination due to excessive patient movement and body fat						
30	Pony	10 yo	F	2 months	10.65	7.12	33.14	9.05	480	21.50	28								
30				46 months	9.58	6.20	35.28	9.34			44		Unable to complete examination due to excessive patient movement, good contractility subjectively						
31	Arabian	6 yo	G	2 months	11.09	7.56	31.82	10.96	450	27.43	29	1.26							
31				46 months	11.17	7.24	35.18	9.34			44		10.21	7.24	30.00	112			
32	Arabian	11 yo	F	2 months	10.02	7.81	22.01	12.29	450	19.21	30	1.26							
32				46 months	Aortic insufficiency									9.47	5.75	39.28	66		
33	WMP	1 yo	M	2 months	11.60	6.99	39.74	11.74			35								
33				46 months	6.45	4.64	28.13	6.35		23.80	47		8.74	6.16	29.52	67			
34	Arabian pony	5 yo	G	2 months	7.48	5.27	29.63	7.39	410	12.64	47	0.46							
34				46 months	7.71	4.65	39.69	8.14			48		Unable to complete examination due to excessive patient movement, good contractility subjectively						
35	Arabian pony	5 yo	F	2 months	7.99	5.73	28.32	6.61	470	28.32	36	0.69							
35				46 months	8.10	5.14	36.54	8.77			46		6.77	4.77	29.54	121			
36	Arabian pony	6 yo	F	2 months	7.25	5.08	29.94	8.41		14.75	40								
36				46 months	7.93	4.92	37.95	8.65			44		Unable to complete examination due to excessive patient movement, good contractility subjectively						
37	Arabian	11 yo	G	2 months	9.78	6.55	32.99	7.90	470	9.43	41	0.50							
37				16 months	8.37	4.98	40.50	8.62			42		10.18	5.82	42.77	104			

ASH = Australian Stock Horse; F = female; G = gelding; HR = heart rate; M = entire male; MV = mitral valve; TB = Thoroughbred; VPD = Ventricular premature depolarisation; WMP = Welsh Mountain Pony; * Horse 6 did not have an echocardiographic examination performed.