Supplementary File 1

Table S1: Multivariable model fitting

Dependant Variable	Covariates Tested
MA1: Above or below industry standards for total volume (ml)	Competing vs. non-competing, discipline, competition level, age, gel-free volume, progressive motility, concentration, total sperm count and total progressively motile sperm
MA2: Above or below industry standards for gel-free volume (ml)	Competing vs. non-competing, discipline, competition level, age, total volume, progressive motility, concentration, total sperm count and total progressively motile sperm
MA3: Above or below industry standards for progressive motility (%)	Competing vs. non-competing, discipline, competition level, age, total volume, gel-free volume, concentration, total sperm count and total progressively motile sperm
MA4: Above or below industry standards for concentration ($x10^6$/ml)	Competing vs. non-competing, discipline, competition level, age, total volume, gel-free volume, progressive motility, total sperm count and total progressively motile sperm
MA5: Above or below industry standards for total sperm count ($x10^9$)	Competing vs. non-competing, discipline, competition level, age, total volume, gel-free volume, progressive motility, concentration and total progressively motile sperm
MA6: Above or below industry standards for total progressively motile sperm ($x10^9$)	Competing vs. non-competing, discipline, competition level, age, total volume, gel-free volume, progressive motility, concentration and total sperm count

Dependant Variable	Covariates Tested
MB1: Above or below industry standards for total volume (ml)	Time between competition and collection, discipline, competition level, age, gel-free volume, progressive motility, concentration, total sperm count and total progressively motile sperm

MB2: Above or below industry standards for gel-free volume (ml)	Time between competition and collection, discipline, competition level, age, total volume, progressive motility, concentration, total sperm count and total progressively motile sperm
MB3: Above or below industry standards for progressive motility (%)	Time between competition and collection, discipline, competition level, age, total volume, gel-free volume, concentration, total sperm count and total progressively motile sperm
MB4: Above or below industry standards for concentration $(x10^6/ml)$	Time between competition and collection, discipline, competition level, age, total volume, gel-free volume, progressive motility and total progressively motile sperm
MB5: Above or below industry standards for total sperm count $(x10^9)$	Time between competition and collection, discipline, competition level, age, total volume, gel-free volume, progressive motility, concentration and total progressively motile sperm
MB6: Above or below industry standards for total progressively motile sperm $(x10^9)$	Time between competition and collection, discipline, competition level, age, total volume, gel-free volume, progressive motility, concentration and total sperm count

Supplementary File 2

Table S2: Model A1 Results of binary regression analysis, total volume industry standard; B: beta, SE: standard error, P: probability; CI: confidence interval; L: lower; U: upper

Significant Variables	**B**	**SE**	**P-values**	**Odds ratio**	**95% CI (L:U)**
Discipline			0.101		
Show Jumping	0.952	0.447	0.033	2.591	1.079:6218
Semen Parameters					
Gel-Free Volume	0.221	0.026	$0.01 x10^{-15}$	1.247	1.185: 1.312
Progressive Motility	-0.065	0.020	0.001	0.937	0.901: 0.975
Concentration	-0.016	0.005	0.003	0.984	0.974: 0.995

Total Progressively Motile Sperm	0.511	0.143	0.0003	1.667	1.260: 2.207
Non-Significant Variables	**B**	**SE**	**P-values**	**Odds ratio**	**95% CI (L:H)**
Competing vs. Non-Competing			0.498		
Competing	-0.550	0.812	0.498	0.577	0.117: 2.834
Non-Competing	Reference				
Discipline			0.101		
Dressage	0.616	0.372	0.098	1.852	0.892: 3.841
Eventing	Reference				
Competition Level			0.785		
Lower Level	0.230	0.333	0.490	1.258	0.656: 2.415
Higher Level	0.43	0.382	0.910	1.044	0.494: 2.207
Elite Level	Reference				
Age Categories			0.292		
Age 1-4	Reference				
Age 5-9	0.100	0.386	0.795	1.105	0.519: 2.357
Age 10-14	0.420	0.405	0.300	1.522	0.688: 3.369
Age 15-19	0.806	0.793	0.309	2.239	0.474: 10.588
Age 20+	-0.764	0.695	0.272	0.466	0.119: 1.820
Semen Parameters					
Total Sperm Count	0.315	0.225	0.163	1.370	0.881: 2.130

Supplementary File 3

Table S3: Model A2 Results of binary regression analysis, gel-free volume industry standard; B: beta, SE: standard error, P: probability; CI: confidence interval; L: lower; U: upper

Non-Significant Variables	**B**	**SE**	**P-values**	**Odds ratio**	**95% CI (L:U)**
Competing vs. Non-Competing			**0.992**		
Competing	**-17.615**	**1345.303**	**0.990**	**0.000**	**.**
Non-Competing	**Reference**				
Discipline			**1.000**		
Show Jumping	**-4.969**	**471.805**	**0.992**	**0.007**	**.**
Dressage	**-1.677**	**474.922**	**0.997**	**0.187**	**.**

	B	SE	P-values	Odds ratio	95% CI (L:U)
Eventing	Reference				
Competition Level			0.999		
Lower Level	-3.290	90.15	0.971	0.037	0.74 x10^{-80} : 1.86 x10^{75}
Higher Level	4.358	509.131	0.993	78.091	.
Elite	Reference				
Age Categories			1.000		
Age 1-4	Reference				
Age 5-9	3.436	328.954	0.992	31.049	0.31 x10^{-280} : 0.31 x10^{282}
Age 10-14	-0.644	228.322	0.998	0.525	0.20 x10^{-247} : 1.41 x10^{245}
Age 15-19	4.957	54302.921	1.000	142.126	.
Age 20+	-0.988	503.454	0.998	0.372	.
Semen Parameters					
Total Sperm Count	515.772	843.528	0.541	0.99 x10^{224}	.
Total Volume	0.349	2.377	0.883	1.418	0.013: 149.52
Progressive Motility	0.402	5.110	0.937	1.495	0.67 x10^{-4} : 3.35 x10^{4}
Concentration	-20.210	33.271	0.544	0.17 x10^{-10}	.
Total Progressively Motile Sperm	-3.489	79.369	0.965	0.031	0.84 x10^{-71}: 1.11 x10^{66}

Table S4: Model A3 Results of binary regression analysis, progressive motility industry standard; B: beta, SE: standard error, P: probability; CI: confidence interval; L: lower; U: upper

Non-Significant Variables	B	SE	P-values	Odds ratio	95% Cl (L:U)
Competing vs. Non-Competing			0.811		
Competing	343.765	1100.661	0.755	1.97 x10^{149}	.
Non-Competing	Reference				
Discipline			0.998		
Show Jumping	49.916	1295.818	0.969	4.77 x10^{21}	.
Dressage	-7.256	1792.764	0.997	0.001	.
Eventing	Reference				

	B	SE	P-values	Odds ratio	95% CI (L:U)
Competition Level			0.998		
Lower Level	-12.527	379.558	0.974	0.4 x10^{-5}	.
Higher Level	-29.771	533.098	0.955	1.18 x10^{-13}	.
Elite Level	Reference				
Age Categories			1.000		
Age 1-4	Reference				
Age 5-9	42.698	793.917	0.957	3.49 x10^{18}	.
Age 10-14	44.600	1366.540	0.974	2.34 x10^{19}	.
Age 15-19	20.729	1295.535	0.987	0.10 x10^{10}	.
Age 20+	-49.317	4342.448	0.991	3.82 x10^{-22}	.
Semen Parameters					
Total Sperm Count	-109.576	321.825	0.733	2.58 x10^{-48}	.
Total Volume	0.124	8.944	0.989	1.132	2.76 x10^{-8}: 4.65 x10^{7}
Gel-Free Volume	-0.204	8.675	0.981	0.816	3.37 x10^{-8}: 1.98 x10^{7}
Concentration	0.147	0.929	0.874	1.158	0.187: 7.157
Total Progressively Motile Sperm	307.602	831.788	0.712	3.89 x10^{133}	.

Table S5: Model A4 Results of binary regression analysis, semen concentration industry standard; B: beta, SE: standard error, P: probability; CI: confidence interval; L: lower; U: upper

Non-Significant Variables	B	SE	P-values	Odds ratio	95% CI (L:U)
Competing vs. Non-Competing			0.966		
Competing	-6.144	142.348	0.966	0.002	1.46 x10^{-124}: 3.15 x10^{118}
Non-Competing	Reference				
Discipline			0.999		
Show Jumping	-38.208	956.663	0.968	2.55 x10^{-17}	.
Dressage	-5.534	783.746	0.994	0.004	.
Eventing	Reference				
Competition Level			1.000		
Lower Level	-0.427	240.903	0.999	0.652	5.72 x10^{-206}: 7.44

	B	SE	P-values	Odds ratio	95% CI (L:U)
					$\times 10^{204}$
Higher Level	-4.610	354.566	0.990	0.010	1.55×10^{-304}: 6.38×10^{299}
Elite Level	Reference				
Age Categories			1.000		
Age 1-4	Reference				
Age 5-9	12.195	478.135	0.980	1.98×10^{5}	.
Age 10-14	23.457	540.049	0.965	1.54×10^{10}	.
Age 15-19	11.145	1078.064	0.992	6.92×10^{4}	.
Age 20+	13.150	469.149	0.978	5.14×10^{5}	.
Semen Parameters					
Total Sperm Count	88.752	290.257	0.760	3.50×10^{38}	3.00×10^{-209}: 4.09×10^{285}
Total Volume	1.367	5.321	0.797	3.92	0.12×10^{3}: 1.33×10^{5}
Gel-Free Volume	-39.496	129.204	0.760	7.03×10^{-18}	7.39×10^{-128}: 6.69×10^{92}
Progressive Motility	-0.634	10.283	0.951	0.53	9.37×10^{-10}: 3.00×10^{8}
Total Progressively Motile Sperm	4.872	206.873	0.981	130.64	1.06×10^{-174}: 1.61×10^{178}

Table S6: Model A5 Results of binary regression analysis, total sperm count industry standard; B: beta, SE: standard error, P: probability; CI: confidence interval; L: lower; U: upper

Non-Significant Variables	B	SE	P-values	Odds ratio	95% CI (L:U)
Competing vs. Non-Competing			0.974		
Competing	72.544	2215.907	0.974	3.20×10^{31}	.
Non-Competing	Reference				
Discipline			0.922		
Show Jumping	-5.962	93.714	0.949	0.003	4.38×10^{-83}: 1.51×10^{77}
Dressage	4.769	55.384	0.931	117.819	8.48×10^{-46} : 1.64×10^{49}
Eventing	Reference				
Competition Level			0.997		

	B	SE	P-values	Odds ratio	95% CI (L:U)
Lower Level	**2.687**	**36.066**	**0.941**	**14.686**	**2.93×10^{-30}: 7.36×10^{31}**
Higher Level	**-3.760**	**303.718**	**0.990**	**0.023**	**6.94×10^{-261}: 7.81×10^{256}**
Elite Level	**Reference**				
Age Categories			**1.000**		
Age 1-4	Reference				
Age 5-9	3.370	1.04×10^4	1.000	29.087	.
Age 10-14	8.536	1.04×10^4	0.999	5.10×10^3	.
Age 15-19	56.214	1.04×10^4	0.996	2.59×10^{24}	.
Age 20+	-121.652	5.77×10^5	1.000	1.47×10^{-53}	.
Semen Parameters					
Concentration	**0.003**	**0.061**	**0.956**	**1.003**	**0.891: 1.131**
Total Volume	**0.519**	**10555**	**0.739**	**1.680**	**0.080: 35.411**
Gel-Free Volume	**0.617**	**3.442**	**0.858**	**1.853**	**0.002: 1.58×10^3**
Progressive Motility	**-50.468**	**56.674**	**0.373**	**1.21×10^{-22}**	**6.94×10^{-71}: 2.10×10^{26}**
Total Progressively Motile Sperm	**852.517**	**930.644**	**0.360**	**.**	**.**

Supplementary File 4

Table S7: Model A6 Results of binary regression analysis, total progressively motile sperm industry standard; B: beta, SE: standard error, P: probability; CI: confidence interval; L: lower; U: upper

Significant Variables	B	SE	P-values	Odds ratio	95% CI (L:U)
Semen Parameters					
Gel-Free Volume	0.023	0.011	0.038	1.024	1.001: 1.046
Progressive Motility	0.225	0.028	0.009×10^{-13}	1.252	1.185: 1.323
Total Sperm Count	1.940	0.199	0.01×10^{-20}	6.960	4.714: 10.275
Non-Significant Variables	**B**	**SE**	**P-values**	**Odds ratio**	**95% CI (L:H)**
Competing vs. Non-Competing			0.547		
Competing	0.890	1.478	0.547	2.435	0.134: 44.150
Non-Competing	Reference				
Discipline			0.137		
Show Jumping	-0.632	0.630	0.316	0.531	0.155: 1.828

	B	SE	P-values	Odds ratio	95% CI (L:U)
Dressage	0.309	0.623	0.620	1.363	0.402: 4.624
Eventing	Reference				
Competition Level			0.905		
Lower Level	0.188	0.449	0.676	1.206	0.500: 2.911
Higher Level	0.183	0.643	0.776	1.200	0.340: 4.233
Elite Level	Reference				
Age Categories			0.683		
Age 1-4	Reference				
Age 5-9	-0.399	0.551	0.539	0.731	0.242: 2.098
Age 10-14	-0.138	0.586	0.814	0.871	0.276: 2.748
Age 15-19	-1.633	1.169	0.162	0.195	0.020: 1.931
Age 20+	-1.228	2.685	0.647	0.293	0.002: 56.478
Semen Parameters					
Concentration	-0.003	0.003	0.356	0.997	0.990: 1.004
Total Volume	-0.002	0.020	0.900	0.998	0.960: 1.037

Supplementary File 5

Table S8: Model B1 Results of binary regression analysis, total volume industry standard; B: beta, SE: standard error, P: probability; CI: confidence interval; L: lower; U: upper

Significant Variables	B	SE	P-values	Odds ratio	95% CI (L:U)
Semen Parameters					
Concentration	-0.066	0.007	0.01×10^{-18}	0.936	0.923: 0.949
Total Sperm Count	1.363	0.145	0.006×10^{-18}	3.908	2.940: 5.194
Non-Significant Variables	B	SE	P-values	Odds ratio	95% CI (L:H)
Timing Between Competition and Collection			0.298		
Timing	-0.006	0.005	0.232	0.994	0.984: 1.004
Discipline			0.246		
Show Jumping	0.729	0.435	0.094	2.073	0.883: 4.866
Dressage	0.512	0.572	0.371	1.669	0.544: 5.124
Eventing	Reference				
Competition Level			0.594		
Lower Level	-0.015	0.619	0.981	0.985	0.293: 3.317
Higher Level	-0.644	0.635	0.311	0.525	0.151: 1.825
Elite Level	Reference				

Age Categories			0.310		
Age 1-4	Reference				
Age 5-9	0.767	0.710	0.280	2.154	0.536: 8.663
Age 10-14	1.100	0.742	0.138	3.004	0.702: 12.857
Semen Parameters					
Gel-Free Volume	-0.024	0.048	0.623	0.977	0.888: 1.073
Progressive Motility	-0.054	0.035	0.127	0.948	0.884: 1.015
Progressively Motile Sperm	0.082	0.206	0.689	1.086	0.725: 1.625

Supplementary File 6

Table S9: Model B2 Results of binary regression analysis, gel-free volume industry standard; B: beta, SE: standard error, P: probability; CI: confidence interval; L: lower; U: upper

Non-Significant Variables	B	SE	P-values	Odds ratio	95% Cl (L:H)
Timing Between Competition and Collection			0.996		
Timing	0.029	5.190	0.996	1.030	0.39×10^4 : 2.69×10^4
Discipline			1.000		
Show Jumping	16.480	1539.634	0.991	1.44×10^6	.
Dressage	-15.442	777.417	0.984	1.97×10^{-4}	.
Eventing	Reference				
Competition Level			1.000		
Lower Level	17.139	3852.996	0.996	2.78×10^7	.
Higher Level	12.818	1026.842	0.990	3.69×10^5	.
Elite Level	Reference				
Age Categories			1.000		
Age 1-4	Reference				
Age 5-9	10.796	2289.653	0.996	4.88×10^4	.
Age 10-14	13.326	2400.473	0.996	6.13×10^5	.
Semen Parameters					
Total Volume	0.024	49.373	1.000	1.025	9.64×10^{-43} : 1.09×10^{42}
Progressive Motility	0.097	40.489	0.998	1.102	3.78×10^{-35} : 3.21×10^{34}

Concentration	-4.986	41.366	0.904	0.007	4.20×10^{-38} : 1.11×10^{33}
Total Sperm Count	124.806	1034.679	0.904	1.59×10^{54}	.
Progressively Motile Sperm	-0.854	193.690	0.996	0.426	5.75×10^{-166} : 3.15×10^{164}

Table S10: Model B3 Results of binary regression analysis, progressive motility industry standard; B: beta, SE: standard error, P: probability; CI: confidence interval; L: lower; U: upper

Non-Significant Variables	B	SE	P-values	Odds ratio	95% CI (L:H)
Timing Between Competition and Collection			**0.986**		
Timing	**-0084**	**4.752**	**0.986**	**0.920**	**0.000083: 10196.007861**
Discipline			**1.000**		
Show Jumping	**-8.172**	**1179.451**	**0.994**	**0.000282**	**0.0E0: .**
Dressage	**-10.341**	**1237.371**	**0.993**	**0.000032**	**0.0E0: .**
Eventing	**Reference**				
Competition Level			**1.000**		
Lower Level	**9.758**	**4197.490**	**0.998**	**17300.388**	**0.0E0: .**
Higher Level	**-8.618**	**2057.511**	**0.997**	**0.000181**	**0.0E0:**
Elite Level	**Reference**				
Age Categories			**1.000**		
Age 1-4	**Reference**				
Age 5-9	**9.940**	**3150.416**	**0.997**	**20749.593**	**0.0E0: .**
Age 10-14	**15.991**	**2469.675**	**0.995**	**8806933.000**	**0.0E0: .**
Semen Parameters					
Total Volume	**-0.317**	**24.660**	**0.990**	**0.729**	**7.4464E-22: 7.1282E20**
Gel-Free Volume	**0.240**	**49.325**	**0.996**	**1.272**	**1.3154E-42: 1.2295E42**
Concentration	**0.096**	**20.312**	**0.996**	**1.101**	**5.6514E-18: 2.1432E17**
Total Sperm Count	**-51.219**	**706.532**	**0.942**	**5.7025E-23**	**00.0E0: .**

Progressively Motile Sperm	133.423	1663.278	0.936	8.8119E57	0.0E0: .

Table S11: Model B4 Results of binary regression analysis, semen concentration industry standard; B: beta, SE: standard error, P: probability; CI: confidence interval; L: lower; U: upper

Non-Significant Variables	B	SE	P-values	Odds ratio	95% CI (L:H)
Timing Between Competition and Collection			0.938		
Timing	-0.0501	6.478	0.938	0.606	0.02×10^{-4}: 19.81×10^4
Discipline			0.998		
Show Jumping	-25.028	450.918	0.956	1.35×10^{-11}	.
Dressage	16.626	3785.032	0.996	1.66×10^7	.
Eventing	Reference				
Competition Level			1.000		
Lower Level	7.441	802.375	0.993	1704.525	.
Higher Level	-5.120	889.757	0.995	0.006	.
Elite Level	Reference				
Age Categories			0.997		
Age 1-4	Reference				
Age 5-9	-12.382	187.324	0.947	0.4×10^{-5}	1.49×10^{-165} : 1.18×10^{154}
Age 10-14	9.931	566.338	0.986	2.06×10^4	.
Semen Parameters					
Total Volume	3.225	133.184	0.981	25.164	1.08×10^{-112} : 5.86×10^{114}
Gel-Free Volume	-131.445	384.519	0.732	8.21×10^{-58}	.
Progressive Motility	-0.009	3.539	0.998	0.991	0.001: 10.19×10^2
Total Sperm Count	525.986	1538.495	0.732	2.71×10^{228}	.
Total Progressively Motile Sperm	-0.180	160.892	0.999	0.836	9.34×10^{-138} : 7.47×10^{136}

Table S12: Model B5 Results of binary regression analysis, total sperm count industry standard; B: beta, SE: standard error, P: probability; CI: confidence interval; L: lower; U: upper

Non-Significant Variables	B	SE	P-values	Odds ratio	95% CI (L:H)
Timing Between Competition and Collection			0.929		
Timing	-0.291	3.264	0.929	0.748	**0.001: 448.835**
Discipline			1.000		
Show Jumping	61.664	4972.086	0.990	6.03×10^{26}	.
Dressage	34.612	4376.208	0.994	1.07×10^{15}	.
Eventing	Reference				
Competition Level			0.999		
Lower Level	19.910	446.731	0.964	4.44×10^{8}	.
Higher Level	-0.085	3824.128	1.000	0.918	.
Elite Level	Reference				
Age Categories			1.000		
Age 1-4	Reference				
Age 5-9	0.523	896.402	1.000	1.687	.
Age 10-14	4.997	1480.570	0.997	147.897	.
Semen Parameters					
Total Volume	0.821	17.740	0.963	2.272	**1.80×10^{-15} : 2.86×10^{15}**

Supplementary File 7

Table S13: Model B6 Results of binary regression analysis, total progressively motile sperm industry standard; B: beta, SE: standard error, P: probability; CI: confidence interval; L: lower; U: upper

Significant Variables	B	SE	P-values	Odds ratio	95% CI (L:U)
Semen Parameters					
Progressive Motility	0.204	0.049	0.029×10^{-3}	1.226	1.114: 1.349
Total Sperm Count	0.097	0.405	0.014×10^{-10}	9.947	4.499: 21.990
Non-Significant Variables	B	SE	P-values	Odds ratio	95% CI (L:H)
Time Between Competition and Collection			0.610		
Timing	-0.005	0.010	0.610	0.995	0.976: 1.014
Discipline			0.293		
Show Jumping	0.863	0.880	0.327	2.369	0.422: 13.293
Dressage	-1.148	1.378	0.405	0.317	0.021: 4.730

Eventing	Reference				
Competition Level			0.859		
Lower Level	-0.319	1.217	0.793	0.727	0.067: 7.893
Higher Level	0.306	1.158	0.791	1.359	0.141: 13.133
Elite Level	Reference				
Age Categories			0.516		
Age 1-4	Reference				
Age 5-9	1.298	1.290	0.314	3.006	0.293: 45.876
Age 10-14	1.547	1.356	0.254	4.699	0.330: 67.004
Semen Parameters					
Total Volume	-0.004	0.028	0.898	0.996	0.944: 1.052
Gel-Free Volume	0.038	0.028	0.168	1.039	0.984: 1.097
Concentration	0.000327	0.007	0.964	1.000	0.986: 1.015