LONGITUDINAL FOLLOW-UP OF EQUINE MUSCLE MORPHOMETRICS AND ASSOCIATED METABOLIC PROPERTIES INDUCED BY 8 WEEKS OF TREADMILL TRAINING

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Introduction

Little is known about which skeletal muscles are influenced during dry treadmill training (TT) and how they are influenced. The aim of this study was to identify which skeletal muscles significantly change in muscle diameter after 8 weeks of TT and to provide a baseline view on changes in muscular metabolic profile.

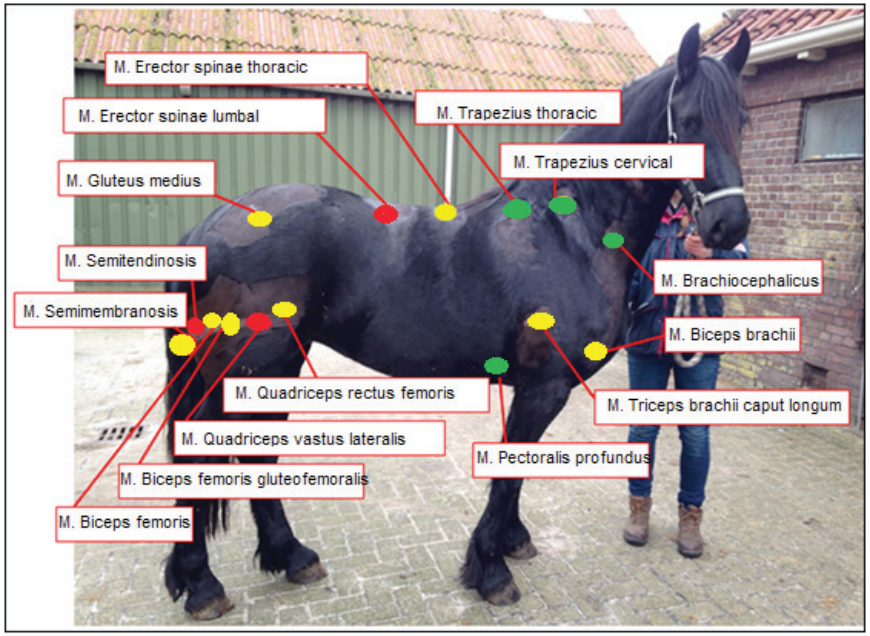

Figure 1: Overview of changes in muscle mass after 8 weeks of dry treadmill training (Van de Winkel D., de Bruijn M., Touwen N., Duchateau L., Goethals K., Oosterlinck M., Pille F., Vanderperren K., Delesalle C.)

Materials

Seven healthy untrained horses completed an 8-week TT program (20 min/session, 5 days/week, belt speed 1.25 m/sec). Morphometric assessment of 15 muscle groups was performed by ultrasound at start, after 4 weeks and at finish of the study. Muscle biopsies were harvested at rest, before and after 8 weeks of TT, from the m. Pectoralis profundus (PP) and Vastus lateralis of the m. quadriceps femoris (QF). Metabolomic profiling was performed by (RP)/UPLC-MS/MS and HILIC/UPLC-MS/MS.

Results

Eight weeks of TT significantly increases the muscle diameter of the M. Trapezius cervical part (+57%) and thoracic part (+26%), the PP (+29%), Brachiocephalicus (+10%) and significantly decreases the muscle diameter of the QF (-18,8%), the M. Erector spinae lumbal part (-8,8%) and the Semitendinosus (-6,7%) on either side of all horses (figure 1). Dry TT increased levels of long chain and decreased levels of medium chain acylcarnitines significantly in both muscle groups (figure 2). Early (glucose, glucose-6-phosphate and fructose-6-phosphate) and late stage (pyruvate and lactate) glycolytic intermediates and pentose-phosphate pathway intermediates were significantly increased in the QF. A significant increase in oxidized glutathione and intermediates of the glutamine/glutamate metabolism and a significant decrease in glycine and acetyl-glycine was found in the PP.

Conclusions

Comparison of the metabolite profiles reveals that 8 weeks of dry TT induces an upregulation of fat oxidation and glycogen storage capacity in QF muscle (decreasing muscle mass) versus an upregulation of fat oxidation capacity and amino acid metabolism in PP muscle (increasing muscle mass).

Green: Significant increase in muscle mass on either side
Yellow: No significant change in muscle mass on either side
Red: Significant decrease in muscle mass on either side

ABSTRACT PRESENTATIONS/SHORT COMMUNICATIONS

		Friesian TT Friesian UT				Friesian PP Friesian QF	
	Biochemical Name	**PP**	**QF**	**QF/PP**	**PP/QF**	**UT**	**TT**
Long chain fatty acids	palmitate (16:0)	0.60	0.82	0.72	0.69	1.14	0.84
	palmitoleate (16:1n7)	0.37	0.83	0.40	0.77	2.06	0.92
	10-heptadecenoate (17:1n7)	0.48	0.91	0.57	0.77	1.60	0.85
	stearate (18:0)	0.65	0.70	0.74	0.61	0.94	0.88
	10-nonadecenoate (19:1n9)	0.45	1.12	0.62	0.81	1.82	0.72
	arachidate (20:0)	0.69	0.65	0.72	0.63	0.91	0.97
	eicosenoate (20:1)	0.45	1.51	0.65	1.05	2.32	0.70
	oleate/vaccenate (18:1)	0.28	0.84	0.33	0.73	2.56	0.87
Acylcarnitines	acetylcarnitine (C2)	1.04	0.94	1.02	0.95	0.92	1.01
	3-hydroxybutyrylcarnitine (1)	1.98	1.59	1.28	2.45	1.24	1.54
	hexanoylcarnitine (C6)	0.51	0.54	0.44	0.62	1.23	1.16
	octanoylcarnitine (C8)	0.57	0.61	0.48	0.72	1.25	1.18
	decanoylcarnitine (C10)	0.72	0.70	0.56	0.91	1.25	1.30
	laurylcarnitine (C12)	0.64	0.50	0.55	0.58	0.90	1.16
	myristoylcarnitine (C14)	0.81	0.74	0.49	1.22	1.51	1.65
	palmitoylcarnitine (C16)	0.59	0.75	0.56	0.79	1.35	1.05
	palmitoleoylcarnitine (C16:1)	1.06	1.22	0.66	1.96	1.85	1.61
	stearoylcarnitine (C18)	1.07	0.99	0.74	1.42	1.32	1.44
	linoleoylcarnitine (C18:2)	1.42	1.42	0.89	2.26	1.59	1.59
	linolenoylcarnitine (C18:3)	1.23	1.42	0.75	2.34	1.89	1.65
	oleoylcarnitine (C18:1)	1.18	1.40	0.81	2.03	1.72	1.45
	adipoylcarnitine (C6-DC)	1.54	1.41	1.62	1.34	0.87	0.95
	arachidoylcarnitine (C20)	1.35	1.26	1.02	1.68	1.24	1.33
	arachidonoylcarnitine (C20:4)	1.64	1.85	1.04	2.92	1.78	1.58

Significantly increased metabolites

Significantly decreased metabolites

Figure 2: Metabolites of beta-oxidation qualified and quantified in the pectoralis profundus (PP) and vastus lateralis of the quadriceps femoris (QF) of untrained (UT) and treadmill trained (TT) Friesian horses.
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