TRANSCRIPTOMIC STUDY OF LUMBAR SPINAL CORD AFTER QUADRICIPITAL ECCENTRIC EXERCISE

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Introduction

Intense eccentric (ECC) muscle contractions induce more "Delayed Onset Muscle Soreness" (DOMS) than concentric (CONC) and/or isometric muscle contractions. We previously showed that eccentric exercise is followed by modifications in muscle fiber typology with a decrease of glycolytic fibers number in a favor of an increase of oxidative fibers (Hody, 2013). The only systematic intervention that provides a muscle protection against DOMS is to do submaximal eccentric contractions with a progressively increased intensity. This protective mechanism, called the "Repeated Bout Effect" (RBE), is not well understood so far. However, it is likely explained by cellular, mechanical and neural theories (McHugh, 2003). Regarding the hypothesis of a neural theory, the existence of a protective contralateral effect of a unilateral eccentric exercise emphasizes the implication of neural adaptations (Starbuck, 2012).

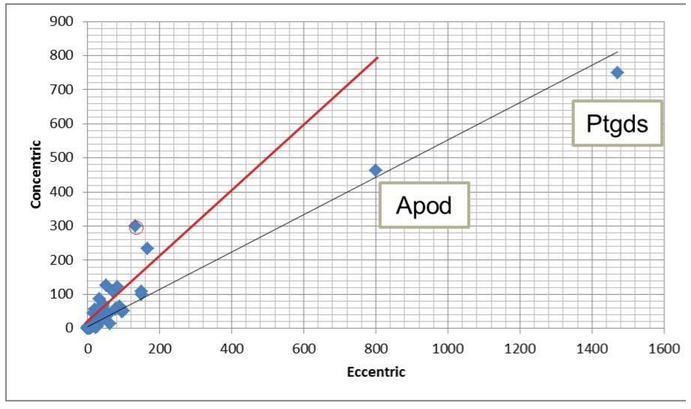
The objective of this study is to better understand which neural signal would be elicited in the lumbar spinal cord after eccentric contractions, and would bring protection through RBE.

Materials & Methods

Male adult mice (C57BL6) were randomly divided into three groups: (1) downhill running with quadricipital eccentrically-biased contractions, (2) uphill running with quadricipital concentrically-biased contractions and (3) untrained control group. Running groups performed an exercise on an inclined treadmill at a velocity of 20cm/s. This latter consisted of running 18 bouts of 5 minutes interspersed with a 2 minutes rest. Lumbar spinal cord was dissected 24h after the running exercise. Total RNA were extracted and analyzed by RNA Seq.

Results & Discussion

By this approach, we want to identify modifications in gene expressions that would be specifically triggered by eccentric exercise. RNA Seq identified 117 genes over expressed in eccentric group in comparison with concentric and control groups. Two genes obtain high level of expression: PTGDS (1471,35 in eccentric and 749,856 in concentric with a fold change (log2) of -0,97) and APOD (800,224 in eccentric and 463,647 in concentric with a fold change (log2) of -0.79). Other genes were significantly more upregulated like LCN2, PLAUR, MAFF, TNFSF8 but APOD and PTGDS are more interesting to explain the possible mechanisms which influence the muscle fibers typology by modulating motoneuron signaling coming from lumbar spinal cord.



Graph 1. Scatter Plot of RNA Seq genes expression

Gene	ECC	CONC	Log 2
Tnfsf8	0,608	0,109	-2,468
Maff	6,995	1,043	-2,745
Plaur	3,056	0,413	-2,885
Lcn2	22,018	1,800	-3,612
Apod	800,224	463,647	-0,787
Ptgds	1471,35	749,856	-0,972

Table 1. Results of best RNA Seq genes (value of gene expression)

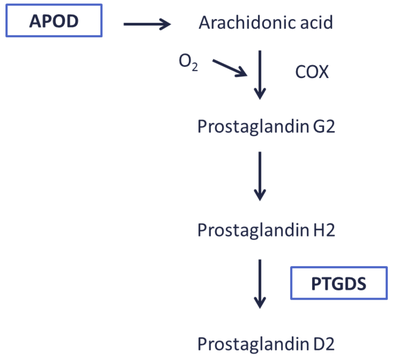


Figure 1. Links between APOD and PTGDS

Conclusions

1. 117 genes are upregulated in eccentric compared with concentric conditions.
2. APOD and PTGDS can potentially influence muscle fiber typology by modulating motoneuron signaling from lumbar spinal cord.

→ Validation by QRTPCR

References

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