**Supplementary table 1 :** Characteristics of LGMD's biopsies

	LGMD2A (n=1)	LGMD2B (n=4)	LGMD2C (n=2)	LGMD2D (n=2)	LGMD2L (n=2)
Age (years)					
Mean	44,0	34,9	11,2	16,0	39,6
Range	-	24,2 - 50,1	8,6 - 13,8	12,1 - 20,0	21,3 - 57,9
Gender					
Female	-	3	1	1	-
Male	1	1	1	1	2
Age of onset (years)					
Mean	40,0	30,0	4,5	8,0	55,0
Range	-	25 - 35	4 - 5	6 - 10	-

Supplementary table 2: Oligonucleotides used in this study

| Gene symbol	Accession n°	Name	5' 3'	Amplicon length
Actb	NM_007393.5	b-actin_F	CTGGCTCCTAGCACCATGAA	123
		b-actin_R	CTGCTTGCTGATCCACATCT	
Activin A	NM_008380.2	Activin A -F	CACACTTCTGCACGCTCCAC	92
		Activin A -R	TTTGCCGAGTCAGGCACAG	
Tubb5	NM_011655.5	b-tubulin_F	CCTTCATTGGAAACAGCACA	222
		b-tubulin_R	CCTCCTCTCCGAAATCCTCT	
Gapdh	NM_001289726.1	Gapdh_F	TTGTGATGGGTGTGAACCAC	283
		Gapdh_R	TTCAGCTCTGGGATGACCTT	
Gdf11	NM_010272	Gdf11 - F	ATCAGCCGGGAGGTAGTGAA	159
		Gdf11 - R	CTGGGCCATGCTTATGACCGT	
Hprt	NM_013556.2	Hprt1_F	GCAAACTTTGCTTTCCCTGG	85
		Hprt1_R	ACTTCGAGAGGTCCTTTTCACC	
Rplp0	NM_007475.5	P0_F	CTCCAAGCAGATGCAGCAGA	87
		P0_R	ATAGCCTTGCGCATCATGG	
Acvr2b	NM_007397.3	ActrIIB_F	GCTCAGCTCATGAACGACT	68
		ActrIIB_R	CTCTGCCACGACTGCTTGT	
Fst	NM_001301373.1	Fstn_F	CTCTTCAAGTGGATGATTTTC	345
		Fstn_R	ACAGTAGGCATTATTGGTCTG	
Mstn	NM_010834.3	Mstn_F	GCACTGGTATTTGGCAGAGTA	345
		Mstn_R	CACACTCTCCTGAGCAGTAAT	
ACTIVIN A	ENST00000242208.4	F-ACTIVIN A	TTATGGAGCAGACCTCGGAG	75
		R-ACTIVIN A	AAATCTCGAAGTGCAGCGTC	
B2M	NM_004048	F_B2M	CTCTCTTTCTGGCCTGGAGG	67
		R_B2M	TGCTGGATGACGTGAGTAAACC	
GAPDH	ENST00000229239	F-GAPDH2	AAGGTGAAGGTCGGAGTCAACGG	199
		R-GAPDH2	TGACAAGCTTCCCGTTCTCAGCC	
GUS	ENST00000304895	F-GUS	CTCATTTGGAATTTTGCCGATT	81
		R-GUS	CCGAGTGAAGATCCCCTTTTTA	
RPLP0	ENSG00000089157	F-P0	TCCAGGCTTTAGGTATCACCAC	94
		R-P0	GCTCCCACTTTGTCTCCAGTC	
PPIA	ENST00000355968	F-PPIA	CCTAAAGCATACGGGTCCTG	133
		R-PPIA	TTTCACTTTGCCAAACACCA	
ACVR2B	ENST00000352511	F52-AcvRIIb	CTCCTCTGGGGATCGCTGT	84
		R135-AcvRIIb	CTCCCAGTTGGCGTTGTAGT	
FSTL	ENST00000256759	F1-FSTL	CGGCTGAGCACCTCGTG	155
		R1-FSTL	TTCTTGTTCATTCGGCATTT	
GDF11	ENST00000257868.9	F-GDF11	ATTGGCAGAGCATCGACTTC	182
		R-GDF11	TTTTGTGTTCTCTAGGACTCG	
MSTN	NM_005259	F-972	TTTTACCCAAAGCTCCTCCA	258
		R-3017	GAGTCTCGACGGGTCTCAAA	
MYL1	ENST00000352451	F-MYL1	GCAATGAAGAGCTGAATGCCA	126
		R-MYL1	TGTCAAAGACACGCAGACCCT	
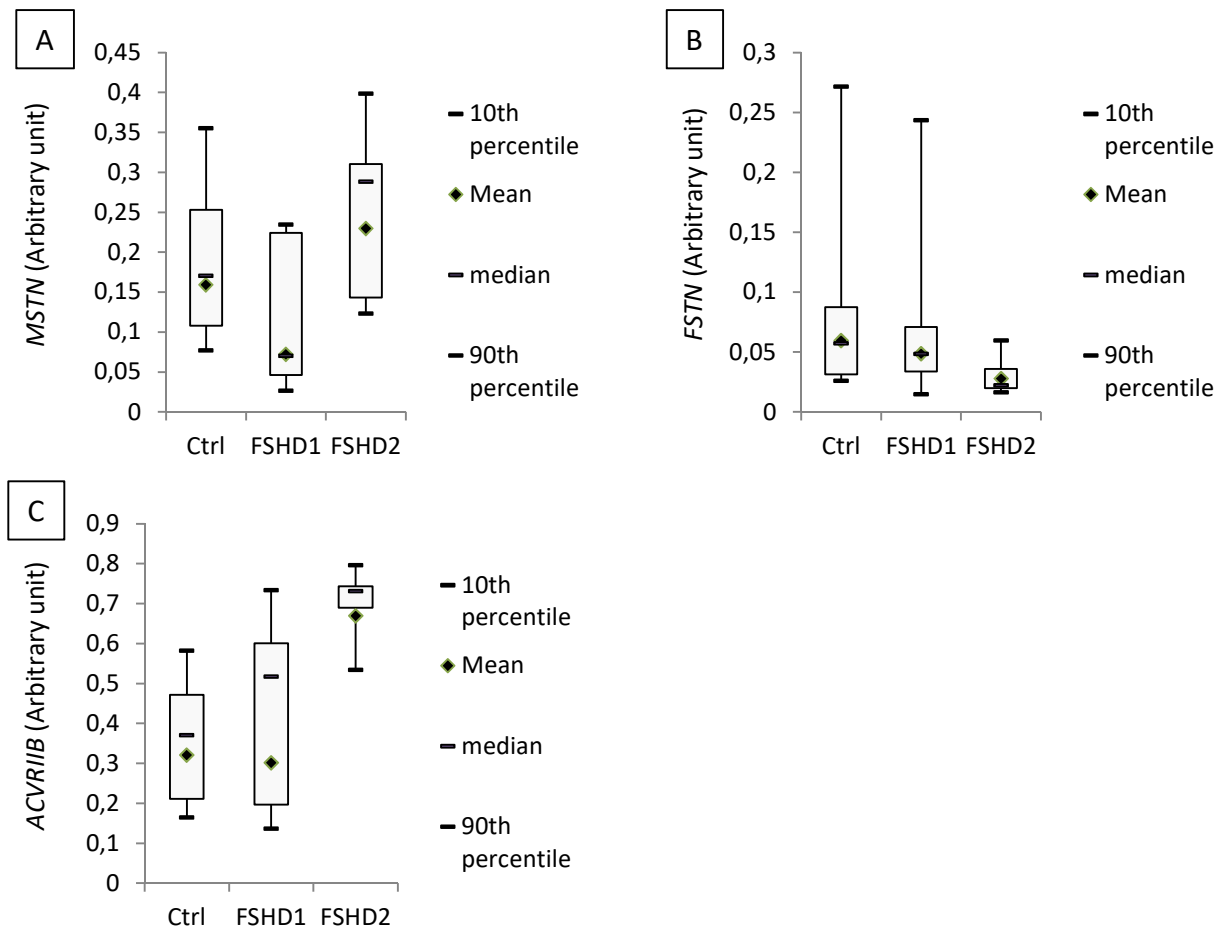
Supplementary figure 1: mRNA levels of either *MSTN (A), FSTN (B), or ACVRIIB (C)* were measured by RT-qPCR in in healthy controls (Ctrl, N=9), FSHD1 (N=8), FSHD2 (N=5) patients. Horizontal lines are medians, the extremities of the boxes are delimitated by the first and third quartile, and the whiskers correspond to the 10th and 90th percentile. A one-way ANOVA, followed by the Fisher's Least Significant Difference multiple comparison test was performed.
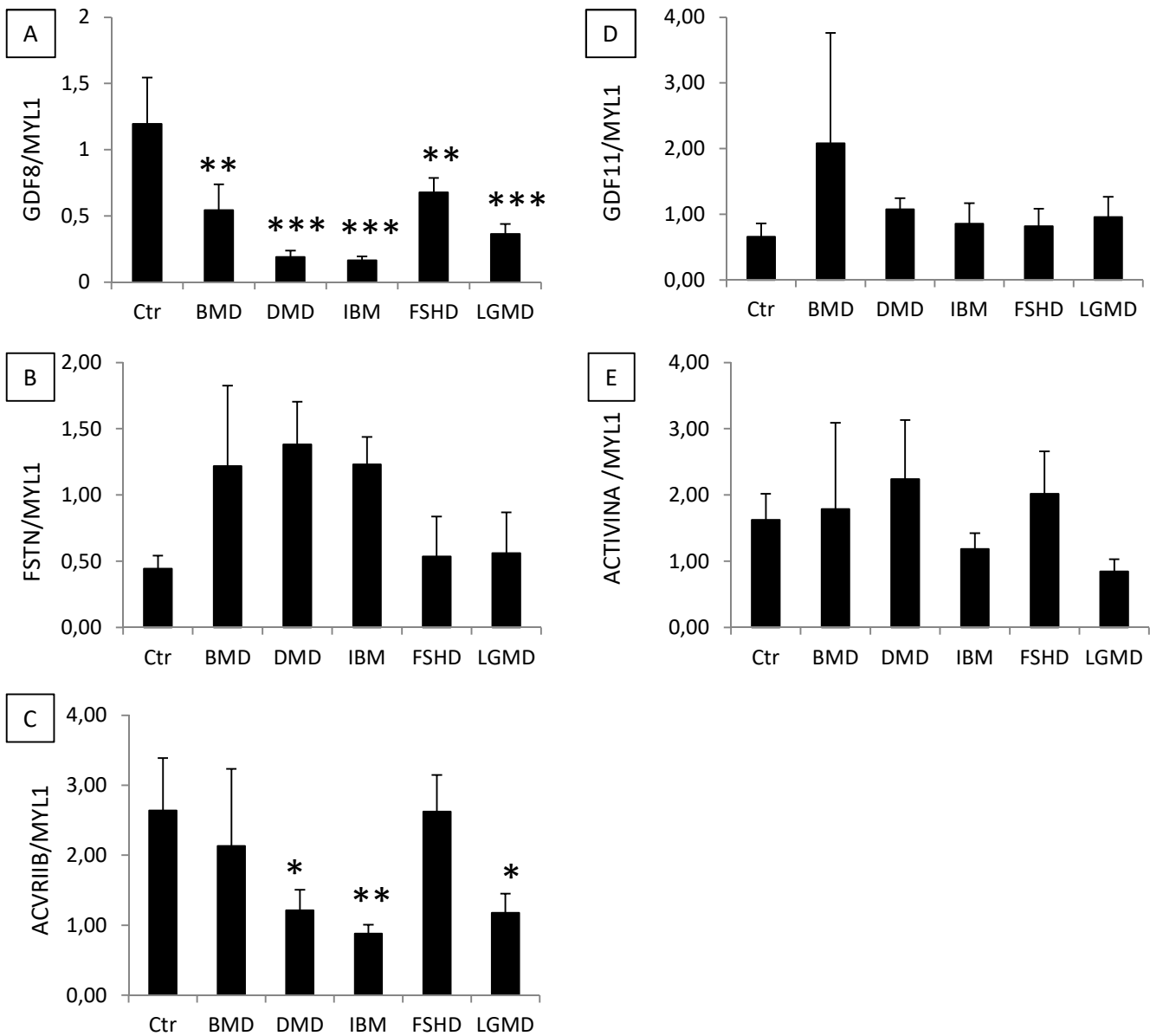
Supplementary figure 2: mRNA levels of either *MSTN (A), FSTN (B), ACVRIIB (C), GDF11 (D)* and *ACTIVIN A (E)* were measured by RT-qPCR and normalized by the expression of the MLC-3fast myosin heavy chain (*MYL1*), in healthy controls (Ctrl, N=9), BMD (N=6), DMD (N=17), IBM (N=17), FSHD (N=13) and LGMD (N=11) patients. All graphs represent mean ± SD. A one-way ANOVA, followed by the Fisher's Least Significant Difference multiple comparison test was performed. p *< 0.05; **<0.01; ***<0.001
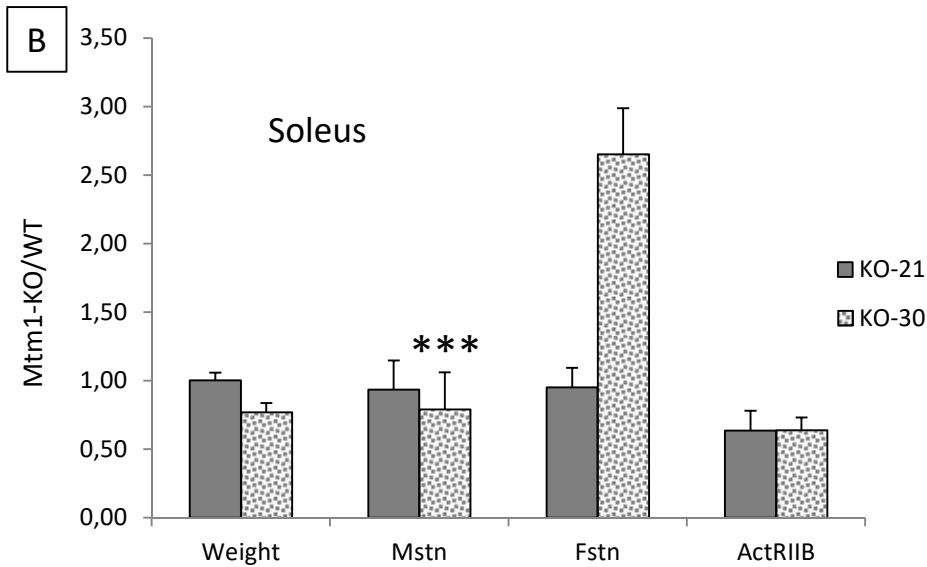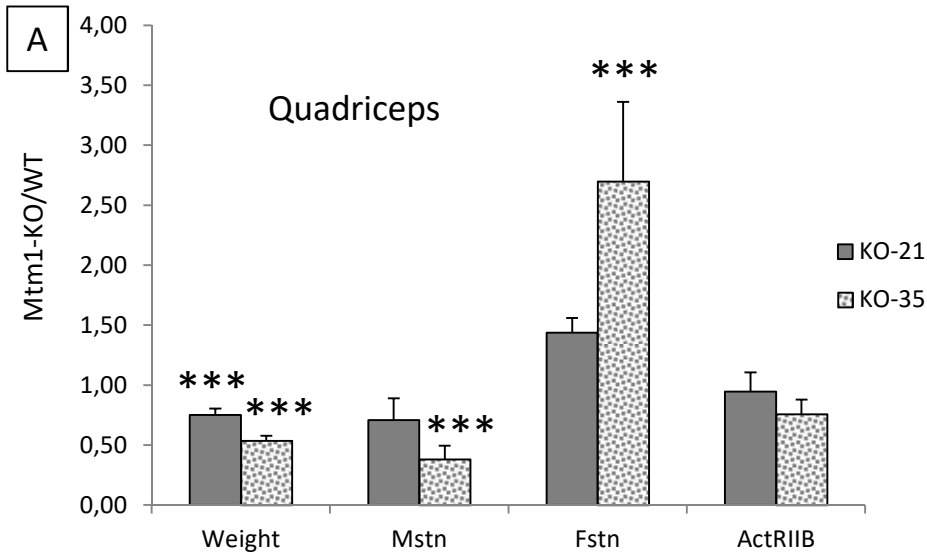
Supplementary figure 3: weigth and mRNA levels of either *Mstn, Fstn, AcvrIIb* were measured by RT-qPCR in the quadriceps (A) or the soleus (B) of either 21, 30 or 25 day old Mtm1-KO mice.. n, number of mice used for each analysis: for the quadriceps, n = 9 and 8 at day 21, 8 and 8 at day 35 for WT and KO-Mtm1 mice respectively; for the soleus, n = 8 and 7 at day 21, 9 and 9 at day 35 for WT and KO-Mtm1 mice respectively. All graphs represent mean ± SD. A one-way ANOVA, followed by the Fisher's Least Significant Difference multiple comparison test was performed. p *< 0.05; **<0.01; ***<0.001
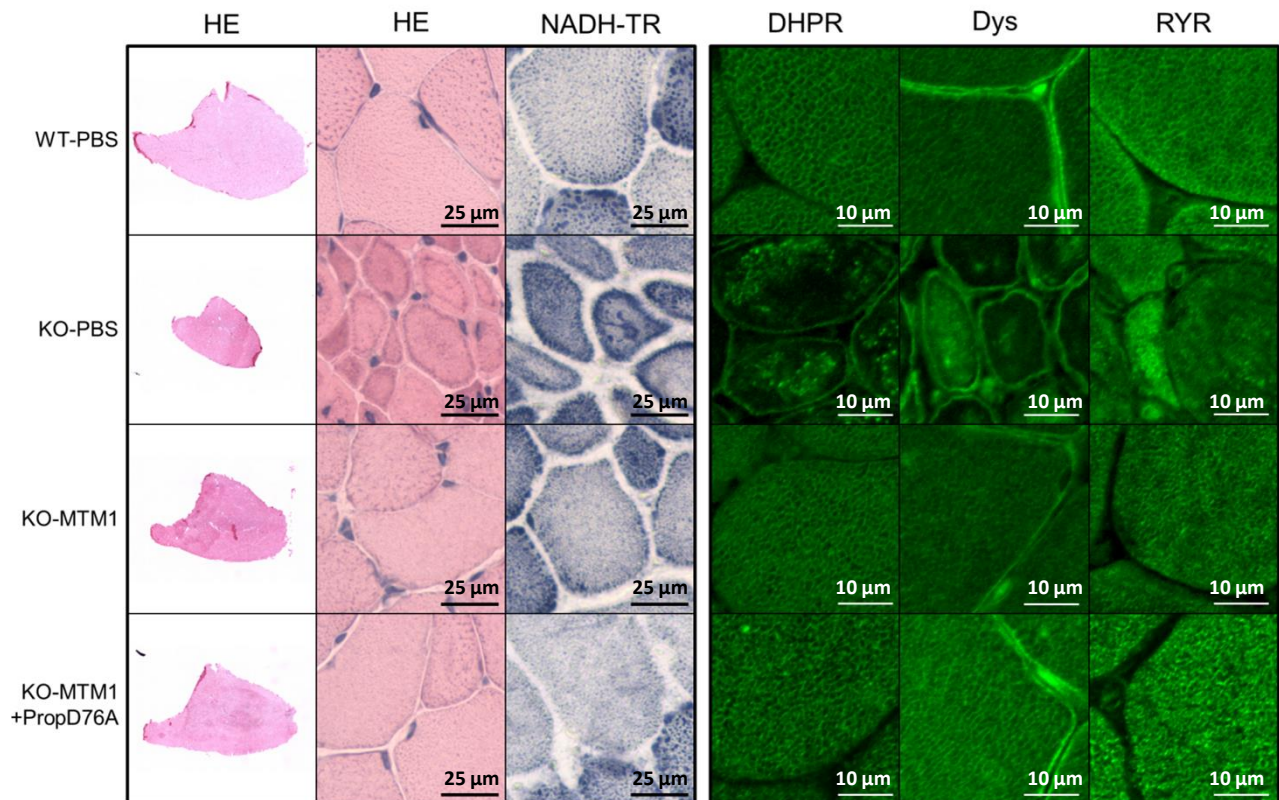
Supplementary figure 4: Effect of Mtm1-rescue and mSeAP-PropD76A co-injection on muscle morphological features after 2 weeks of rAAV transduction in the Tibialis anterior (TA) in knockout mouse model. Histological aspect of PBS-treated WT and KO muscle and after injection of a rAAV2/1-Des-Mtm1 and rAAV2/1-CMV-mSeAP-PropD76A. Musclular fiber of TA cross-sections were stained on left panel with hematoxilin and eosin (HE) (magnification × 40 and × 100), mitochondria and endoplasmic reticulum were stained with nicotimanide adenine dinucleotide tetrazolium reductase (NADH-TR) (magnification × 100), and on right panel dihydropyridine receptor (DHPR), dysferlin (Dys) and ryanodine receptor (RYR) were detected by immunofluorescence (magnification × 1200).