Impact of Klf10 deletion in muscle fibers elasticity as a function of age

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aging; elastic properties; *Klf*10; skeletal muscle fiber; knockout mice

Introduction

*Klf*10, a Krüppel-like transcription factor, was originally discovered in human osteoblasts as a TGFβ inducible early gene [1]. Since 2004, our group has characterized the role of *Klf*10 in the musculo-skeletal system, including bone, tendon and muscle tissues. The role of *Klf*10 in relationship to age has only been investigated in tendon tissue at both the tendon fiber [2] and the tenocyte level [3]. An important role of *Klf*10 in the aging process of tendon has been demonstrated. Based on recent discoveries about the influence of *Klf*10 in the transversal and longitudinal elasticities of muscle fiber, it was of interest to further elucidate the impact of *Klf*10 in the aging process of muscle fiber.

Methods

62 *Klf*10 KO (knockout) slow and fast twitch fibers were extracted from soleus (slow muscle) and EDL (fast muscle) of 3 month (N_{soleus} = 16, N_{EDL} = 14) and 21 month (N_{soleus} = 18, N_{EDL} = 14) old female *Klf10* knockout mice. The fibers were immersed in a bath which was filled with a relaxing solution. Preconditioning tests and two passive mechanical tests (ramp stretch and relaxation) were performed on single fibers attached at both extremities to a force transducer (5 mN) and to a motor. Both mechanical tests applied a stretch of 50% of the original fiber length, corresponding to an elongation of about 1 mm. The ramp stretch and the relaxation tests were performed with a velocity of 2.10^{-4} $m.s^{-1}$ and 2.10^{-2} $m.s^{-1}$, respectively. The dynamic (σ_d) and static (σ_s) stresses were estimated by dividing the force by the cross-sectional area [4].

Results

The normalized hysteresis area values showed that all aged fibers decrease less rapidly, demonstrating the differences of preconditioning between young and aged fibers. The elastic properties of the slow fiber showed a significant decrease as a function of age while the fast fiber revealed a stabilization of the elastic properties from 3 months to 21 months (Fig1).

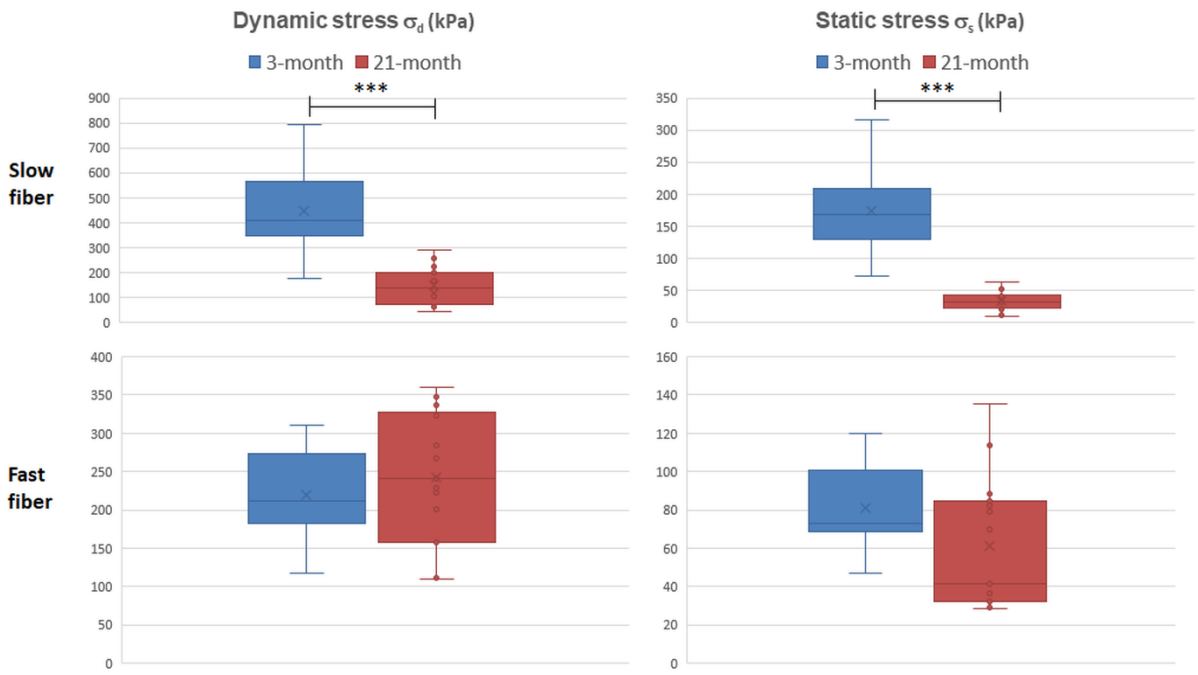

Fig.1: Elastic properties of slow and fast twitch fibers as a function of age. *** P < 0.001 (Mann-Whitney test)

Discussion

Analyzing the effects of aging on tissues is difficult due to the risk of the mortality of the mice before the age point and due to the expensive cost of longitudinal studies. Another limitation to our study is the lack of data for aged wild-type mice. However, this preliminary project has demonstrated age-dependent changes in the elasticity of slow twitch muscle fibers which may relate to loss of *Klf10* expression for which additional studies are required to support this possibility. Regardless, our finding provides the first insights into the potential roles of *Klf10* during the aging process in muscle tissue.

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