EFFECTS OF LOW BIRTH WEIGTH ON THE MECHANICAL PROPERTIES OF THE PLANTAR FLEXOR MUSCLES IN EUTROPHIC 9-YEARS OLD CHILDREN.

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SUMMARY The aim of the present study was to quantify the force production capacities and musculo-tendinous stiffness of the triceps surae in prepubertal children born with low birth weight - a model of early malnutrition – but nowadays eutrophic. Results indicate that children born with low birth weight, but nowadays eutrophic, did not show any significant evolution of the mechanical properties of the triceps sural. These results underline the assumption that the actual nutritional status is responsible for differences in muscle mechanical properties.

INTRODUCTION

Malnutrition is still a preoccupying factor from a public health perspective and it has possibly irreversible consequences in the development of muscle function. For instance, animal [1] and human [2] experiments show alterations with regard to contractile and elastic properties in plantar flexor muscles. More precisely, experiments in stunted prepubertal children indicate opposite evolution in musculotendinous (MT) stiffness when evaluated under induced or voluntary contraction, while force production capacities are lower in stunted children [2]. The greater MT stiffness values encountered in stunted children are in favor of a delay in the maturation process of the MT structures [2]. A hypothesis underlined by the lower motor performance in stunted children [2].

METHODS

Prepubertal children with an age ranging from 102 to 115 months were classified as normal birth weight (NBW>3000g; n=15) and low birth weight (LBW1500-2500g, n=9). Anthropometric data included body mass, height and calf circumference. Biomechanical testing was conducted on children, while placed on an adjustable seat with the knee extended to 120˚ and the ankle was flexed to 90˚. Muscle strength was assessed in isometric condition and best torque was considered as maximal voluntary contraction (MVC). Musculotendinous (MT) stiffness was obtained through quick-release experiments [3], by considering the ratio between variation in dynamic torque and displacement (i.e. stiffness), related to the isometric torque initially exerted by the subject (25%, 35%, 50% or 75% of MVC). The slope of this linear relationship was defined as SI_{MT} [e.g. 4]. Moreover, electromechanical delay (EMD), as an expression of musculotendinous stiffness from induced contractions, and twitch torque (Pt) were obtained from a supramaximal electrical stimulation of the sciatic nerve. Statistical analyses included student t-test. Significance was set to $p < 0.05$.

RESULTS AND DISCUSSION

None of the measured parameters showed any significant difference between children of the NBW and the LBW group. More precisely, MVC and Pt changed by 1.7% or 6.5% ($P>0.05$), respectively. SI_{MT} and EMD showed no significant differences between the NBW and the LBW children (-11.3% and 1.7%, respectively). The results that none of the tested mechanical parameters showed any significant differences is opposite to the results obtained in stunted children [1], where MVC and Pt showed body mass related decreases. Moreover, stunted children presented a similar evolution in SI_{MT} and EMD indicating that MT stiffness evolution is opposite when obtained from voluntary or induced contractions [1].

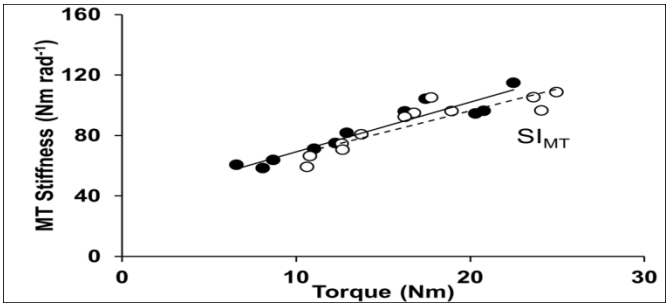

Figure1. Musculotendinous (MT) stiffness–torque relationships for a child of the LBW (●) and NBW (○) group. The slope value represents SI_{MT}, which is not different between both children

CONCLUSION

The preliminary results of the present study seem to indicate that LBW has no effect on the maturation of the mechanical properties of the plantar flexor muscles in 9-years old LBW children and that LBW has different effects when compared to stunting. Further experiments should underline these results.

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