

A hydrogel drug delivery system combined with BAIBA to treat sarcopenia

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Background:

Sarcopenia is an age-related skeletal muscle disease. Physical exercise is recommended to treat and prevent sarcopenia. However, physical exercises for older adults are not easily tolerated, especially in the long term and in frail older adults. Previous studies show that the serum concentration of β -aminoisobutyric acid (BAIBA) will increase significantly during and after exercise and it was shown to signal the beneficial effect of exercise from skeletal muscle to other tissues and organs in an endocrine manner. Meanwhile, it is postulated that the inflammatory response in the gut during aging is highly related to muscle impairment. Bioactive glass (BG) has been shown to decrease gastrointestinal inflammation. The objective of this study was to formulate a hydrogel containing BAIBA and bio-active glass to treat sarcopenia.

Materials and Methods:

7-month-old Senescence-accelerated prone mice (SAMP8) were randomized into control (CTL), BAIBA (BA), hydrogel with BAIBA (HBA), hydrogel with BG (HBG) and combined (COM) groups and treated for 3 months.

Muscle function, mass, and muscle-fat ratio were assessed. Inflammation levels in the small intestines and serum were tested. RT-PCR and western blot were used to test mRNA and protein expression. Muscle tissue and distribution of adipose tissue were tested by oil red O staining and histology tests. In-vitro, the C2C12 cell line was treated with 5, 10, and 20 μ M BA and assessed by mRNA and protein expression.

Result:

After 3 months of intervention, the percentage lean mass of BA, HBA, and COM groups was significantly higher than the CTL group. Twitch, tetanic, tetanic forces, and specific tetanic forces of BA, HBA, HBG, and COM groups were higher. Histologically, BA, HBA, and COM presented lower oil red O area than CTL group. Type I muscle fiber in the CTL group was higher than the BA, HBA, and COM groups. Inflammation level was decreased in HBG and COM than CTL group. mRNA and protein expression levels of PGC1 α , PPAR α , UCP1, and CIDEA in BA, HBA, and COM were higher than CTL group.

Discussion and conclusion:

Our results showed that BA intervention enhanced muscle strength and decreased the percentage of fat mass and intramuscular fat. BG interventions could decrease the inflammation level in small intestines and serum. Muscle strength was enhanced and greater in combined intervention than in either treatment alone.