

# Effects of novel ultrasound technique on meat quality, sensory attributes, and microstructure of bovine semitendinosus muscle

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The effects of high-intensity ultrasound (HIU) (800 W for 60 min at the frequency of 35 kHz) followed by postmortem aging (1, 3, and 7 d aging time) at 1°C on meat quality traits, sensory attributes, and microstructure were evaluated in *Semitendinosus* muscle of Hanwoo cattle. HIU applied to *semitendinosus* muscles resulted in no significant effect on CIE L\* (lightness) and CIE a\* (redness) values over the storage period. It has been suggested that ultrasound has little effect on meat color because the heat generated is insufficient to denature proteins and color pigments (1). The water holding capacity (WHC) of HIU-assigned muscle was significantly higher as compared to the control sample. The reason might be myosin polymerization that occurred due to increased oxidation in HIU-treated muscle (2). Furthermore, the results revealed that ultrasound decreased Warner-Bratzler shear force (WBSF) during 0, 3, and 7 days of the storage period, indicating a tenderizing effect. The increased tenderness is mainly due to the destruction of myofibrillar protein structures, the disintegration of collagen macromolecules, and the movement of proteins, minerals, and other compounds within the muscle (3). On the other hand, the tenderization of meat could be influenced by the disruption of lysosomes, which consist of cathepsins, and intracellular calcium ions that stimulate the calpains activity (4), subsequently reducing the aging period (5). The myofibrillar fragmentation index (MFI) and TBARS values were significantly induced in the HIU-treated *semitendinosus* muscle. The higher MFI value represents the greater myofibrils rupture in the I band during the storage period (6). Further, it could be associated with meat tenderness and postmortem myofibril proteolysis (7). According to the sensory panel evaluation, the HIU application was perceived to have a more flavor and umami intensity in cooked meat than the control muscle sample. Additionally, the tenderness during all three storage days tended to be elevated, leading to overall higher sensory traits. We speculated that the HIU applications can have a significant impact on enzyme activity, thereby leading to proteolysis and oxidation of meat compounds. Subsequently, the changes in meat color, flavor, and aroma can emerge over the storage period (6). However, no conclusive effect was observed in fresh meat characteristics (marbling, color, texture, juiciness) due to the HIU application. The electronic tongue sensory assessment indicated a decline in bitterness in the HIU-treated *semitendinosus* muscle. The monounsaturated fatty acid content tended to increase in HIU-treated muscle during days 0 and 3. Moreover, the microstructure of sonicated meat showed a visible disintegration of connective tissues due to the cavitation effect of ultrasound. The ultrasound-induced cavitation and the collapse of bubbles create shockwaves in muscles. Consequently, the destruction of connective tissues led to changes in muscle architecture (7). Overall, HIU is a potential method for tenderizing and improving sensory attributes in Hanwoo cattle meat without negative impacts on other quality aspects. Hence, HIU is an emerging technology that could add value to indigenous breeds and provide new insight into the growing meat industry. Keywords: High-intensity ultrasound, tenderness, semitendinosus, fatty acids, sensory attributes

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**Key words:** High-intensity ultrasound, Tenderness, Semitendinosus, Fatty acids, Sensory attributes