INJECTION OF BRINE CONTAINING KIWI FRUIT POWDER INCREASES TENDERNESS OF PORK *M. BICEPS FEMORIS*

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Introduction

In pork, tenderness is an important quality parameter, especially in muscles containing a large amount of connective tissue. Marination of these muscles may improve tenderness if the connective tissue component of meat toughness is weakened. According to Wada et al. (2002), beef *semitendinosus* muscle immersed in kiwi fruit protease (crude actinidin) at 20ºC for 15 min resulted in decreased toughness. Disorganization of actin and myosin filaments and an increase in the solubility of α-chain collagen from achilles tendon was also observed, indicating that incubation with actinidin tenderizes beef and may affect both the myofibrillar and connective tissue component. The objective of the present study was to investigate the effect of kiwi fruit powder in brine solutions on the tenderness and eating quality of porcine *M. biceps femoris*.

Materials and Methods

From 30 female pigs *M. biceps femoris* were excised (left and right side) 24 hours post-mortem (p.m). Muscles were vacuum packed and stored at 2ºC until 48 hours p.m. and injected to 10% weight gain with a neutral marinade (maltodextrin and starch) and kiwi fruit powder to a final concentration of 0, 0.025, 0.050, 0.075 and 0.100%, respectively. Muscles were stored 48 hours at 2ºC before freezing (left sides). Right sides were divided into three pieces and stored 0, 3 or 7 days at 2ºC before freezing. *Warner-Bratzler shear force*: Right sides were thawed 24 hours at 2ºC and cooked at 75ºC for 1 hour. Four rectangular shaped blocks (1 x 1 x 5 cm) were cut and each block was sheared three times perpendicular to the muscle fibre direction. *Sensory assessment*: Left sides were thawed, placed in roasting bags and cooked in a convection oven at 100°C to a core temperature of 75°C. The roasts were cut into 10 mm-thick slices, and half a slice was served on a pre-heated plate to each assessor. Samples were evaluated by 9 trained assessors using a 15-point non-structured line anchored at the extremes (0=slight and 15= intense). The attributes were: meat flavour, warmed-over flavour, metal flavour, piggy flavour, hardness, juiciness, crumbliness, thready, chewing-time and tenderness.

Results and Discussion

Warner-Bratzler shear force. Injection of brine solution containing kiwi fruit powder decreased ($p < 0.001$) shear force by approximately 6 to 15 N (Figure 1). Already two days after injection of 0.025% kiwi fruit powder the shear force had decreased to same level as the day 9 control, indicating that ageing for more than 2 days after injection is not necessary in these products.

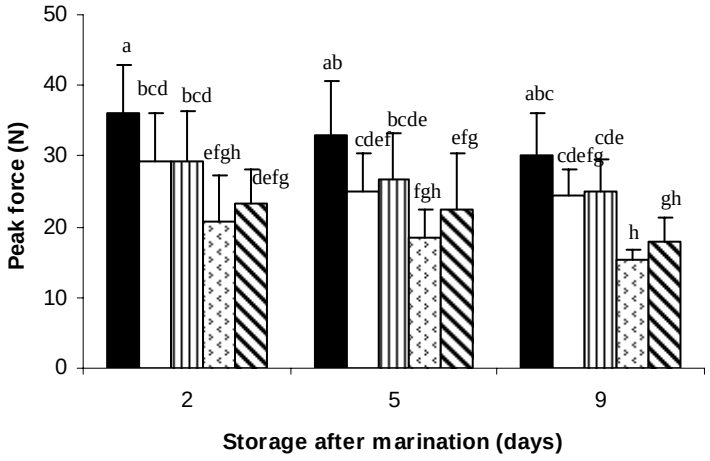

Figure 1. Influence of kiwi fruit powder on Warner-Bratzler shear force of porcine *biceps femoris*. After injection 48 hours post-mortem samples were stored for 2, 5 and 9 days. Columns represent lsmeans and error bars standard errors (n=6). Black columns: neutral marinade (control); White columns: 0.025%; Stripes: 0.050%; Dotted columns: 0.075%; Hatched columns: 0.100% kiwi fruit powder, respectively.

Sensory evaluation of eating quality. The PC 1 explains 95.5% of the variation and is distended by textural attributes, with tenderness and crumbliness to the left and hardness, thready and chewing-time to the right (Figure 2). Only 2.3% of the variation is explained by PC 2, which is distended by some minor variation in taste and flavour. The samples were divided into three groups (on PC1) depending on the kiwi fruit powder concentration. Placed furthest to the right, control samples constitute the group characterized by hard and thready texture with the longest chewing-time. Placed further to the left, samples with 0.025% and 0.050% kiwi fruit powder constitute another group characterized by a more tender and crumbly texture compared to controls. The third group is samples 4 and 5, which were injected with 0.075% and 0.100%.. These samples are characterized by a significantly more tender and crumbly texture. An analysis of variance indicated that attributes affected were: hardness (***), thready (***), crumbly (***), tenderness (***) and chewing-time (***).

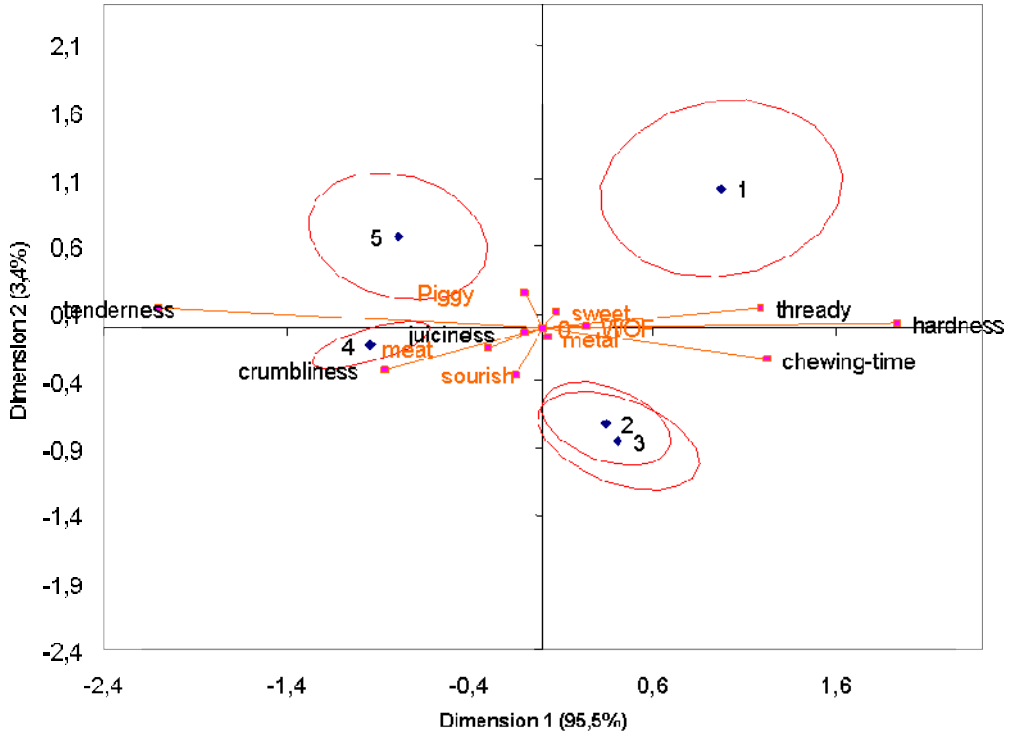

Figure 2. PCA-plot showing kiwi fruit powder level and sensory attributes. Levels: 1 = control, 2 = 0.025%, 3 = 0.050%, 4 = 0.075%, 5 =0.100% kiwi fruit powder; sensory attributes: sourish, sweet taste, piggy flavour, meat flavour, warmed-over flavour, metal flavour, piggy flavour, hardness, juiciness, crumbliness, thready, chewing-time and tenderness.

These results show that injection of brine containing kiwi fruit powder has a tenderizing effect on pork *M. biceps femoris*. However, it remains to be elucidated which components of meat toughness (i.e. myofibrils or connective tissue) are weakened by the proteolytic enzymes in kiwi fruit powder. Currently, investigations are being conducted to increase the understanding of this issue.

Conclusions

Injection of brine solution containing kiwi fruit powder reduced Warner-Bratzler shear force and improved sensory assessed tenderness and crumbliness of pork *biceps femoris*.

References

1. Wada, M., Suzuki, T., Yaguti, Y., and Hasegawa, T. (2002). The effects of pressure treatments with kiwi fruit protease on adult cattle semitendinosus muscle. *Food Chemistry*, *78*, 167-171.