A role for polyunsaturated C18 free fatty acids in the toughness of cooked beef

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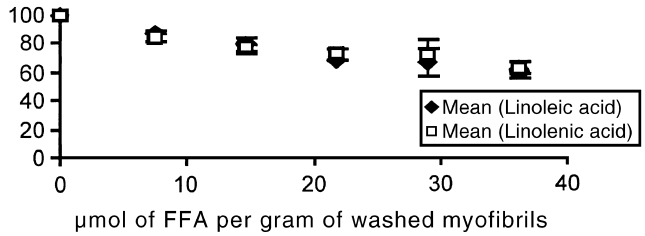
As part of a project investigating chemical effects associated with cooking beef steaks, free fatty acids (FFAs) were studied for their potential interaction with myofibrillar protein during the cooking process.

Fast/slow and slow/fast heat-loading protocols known to generate different levels of toughness (with slow/fast leading to tougher steaks) were assessed in terms of their FFA profile. Significant differences in the concentrations of the polyunsaturated linoleic and linolenic acids were found between the treatments. Specifically, the (tougher) slow/fast treatment was found to result in increased concentrations of these acids. Linoleic and linolenic acids were thus chosen for further study within beef myofibrillar protein model systems.

The acids were shown to interact with myofibrillar protein causing insolubility across a wide pH range. Most importantly, the acids were shown to cause significant insolubility at pH 5.5 similar to the ultimate pH of beef encountered *in vivo*.

The results of the model system were used to clarify aspects of the mechanism of interaction. A mechanism which involves a combination of ionic interactions and hydrophobic interactions at typical *in vivo* pH provided the best explanation for the results of model systems.



Effect of linolenic and linoleic acids on salt soluble protein in a pH 5.5 model system.

The influence of physical state of the acid was also shown to be important with only those acids present as oils able to interact within the model. The results of this study support the hypothesis that FFAs interact with myofibrillar protein during cooking. This observation is novel in light of the current literature in relation to beef toughness.