# Nutritional characteristics of New Zealand export lamb and functional properties of selected beef forequarter muscles

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# Abstract

Richmond Ltd. has recently undergone a change in strategy, away from the traditional commodity based meat industry, towards the modern food business. To do this, opportunities to add value to their current product range must be identified. This involves the conversion of traditionally low value commodity based products into products that demand a premium. An example of this is converting muscles that are currently used for grinding meat into a further processed convenience food (i.e. ready meals). Another method is to add further value to premium products by making them more appealing to consumers (i.e. nutritional information on labels). This work details investigations into the functional properties of selected beef forequarter muscles (low value commodity products) and the nutritional properties of selected export lamb products (premium products).

The functional properties of a number of beef forequarter muscles were measured to identify which had the best potential for further processing applications with respect to ready meals. The functional properties of tenderness, cook loss and shrinkage were measured for the Latissimus Dorsi, Pectorialis Profundus (Point End Brisket), Infraspinatus (Cross Cut Blade), Triceps Brachi Longhead (Main muscle in Bolar Shoulder Clod), Supraspinatus (Chuck Tender), Serratus Ventralis and Triceps Brachi Medialhead (Muscle in Bolar Shoulder Clod. From the tests conducted the Infraspinatus and the Triceps Brachi Longhead have been identified as having the best functional properties with respect to further processing for ready meal applications.

As well as conducting tests to identify the forequarter muscles with the best potential for further processing applications, investigations were carried out to identify cooking regimes that would optimise the functional properties. This work confirmed that there are three major chemical reactions, which determine the resultant functional properties of cooked meat. They are the denaturation and aggregation of the myofibrillar proteins and the denaturation and solubilisation of connective tissue (collagen). At around 50°C myosin (45% to 50% of the myofibrillar proteins) denatures, which results in a substantial increase in cook loss and reduction in water holding capacity. At around 60°C collagen (main connective tissue protein) denatures, which results in a substantial increase in tenderness and increase in cook loss. This is because as the collagen

denatures it loses it mechanical strength (increase in tenderness) and can no longer support its own structure, and causes it to contract. This contraction causes fluid within the meat and cook loss caused by the denaturation of myosin to be expelled from the meat by compressive forces (squeezed out). At around 70°C actomyosin (22% of the myofibrillar proteins) denatures. This results in a substantial increase in the cook loss and firming of the meat. The increase in cook loss or decrease in water holding capacity that occurs with myofibrillar protein denaturation is due to the fact that when these proteins denature and aggregate their ability to bind water is greatly reduced.

From the results of the cooking regime trials it is recommended that for functional property considerations that during the cooking of further processed meat products (i.e. ready meal applications) a meat temperature of 62°C should be aimed for, for the slowest heating region during cooking (usually the centre). This is because it has been identified that a cooking temperature of 65°C should not be exceeded otherwise detrimental effects can occur to the functional properties of the cooked meat.

For health concerns a 7D bacterial death reduction has to be achieved. This means that for a cooking temperature of 62°C the meat has to be held at this temperature for at least 5 minutes. Therefore the total cooking time would be the time needed to heat all the meat to 62°C plus 5 minutes to ensure a safe product. The heating or cooking system employed should also ensure that a minimal amount of the meat is heated above 65°C. This can be easily achieved by minimising the external cooking temperature, but long cooking times will result. An industrial cooking process will be a compromise between the cost associated with longer residence time and product functionality.

As mentioned earlier another way to add value is to supply nutritional information for selected cuts. Consequentially one of the objectives of this project was to provide some nutritional information for selected meat cuts. Though the primary objective of this part of the project was to develop a method for producing the needed information, so that Richmond N.Z. Ltd. can develop further information on an as needs basis.

The nutritional characteristics of a number of export lamb cuts from the saddle region has also been investigated and a method devised to allow further characterisation of other cuts. The method involves breaking down a standard cut into its constituent components (e.g. Frenched rack consists of loin eye, fat cap, intercostals and fatty tissue). The constituent components are tested for their nutritional properties. The frenched rack nutritional properties are calculated from the nutritional properties of the constituents components and the yield data (percentage of each constituent component within a frenched rack) for frenched racks.

This method allowed the identification of the main sources of variation for nutritional characteristics. These differences were found to be caused by the lean to fat ratio, not nutritional differences in lean tissue from the same region of lamb (i.e. loin eye and tenderloin very similar nutritionally). The difference in lean to fat ration also accounts for the variation between grades (i.e. PX grade lamb cuts have a higher fat content than YX grade lamb cuts due to PX grade cuts having a higher percentage fat tissue in their cuts).

The cuts characterised were the shortloin section (whole section or chop), rack section (whole section or chop), 75mm racks frenched 25mm, boneless loin and tenderloin for both PX and YX grade lamb. The method will be applicable to other regions of lamb (i.e. hindquarter and forequarter) for which nutritional information already exists, but for which yielding data will have to be collected. The method would also be applicable to other species such as beef and venison, but both nutritional data for constituent components and yielding data would have to be collected.

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