



# FSA Project M01027: A practical investigation into the hygienic production of 'skin-on' sheep carcasses and cattle and sheep feet

## Duration

1st November 2003 - 31st March 2006

## Project Partners:

Division of Food Animal Science (DFAS), University of Bristol

Food Refrigeration and Process Engineering Research Centre (FRPERC), University of Bristol

## Background

There is a demand in the United Kingdom, for sheep meat with the 'skin-on', emanating primarily from consumers of African origin whose native culture embraces, as a desirable food, singed and smoked carcasses of a range of mammalian species. To satisfy this demand, sheep carcasses, whose wool has been burned off as part of the dressing process, are produced illegally in the UK or are imported. Current EU and UK legislation does not allow the production of sheep carcasses with the skin on; this has led to the illegal production of skin-on sheep meat in unlicensed premises that are not subject to official inspections and hence there is concern about the hygienic status of meat originating from such sources. The aims of this project were:

1. To devise a HACCP-based production process for skin-on sheep meat that resulted in acceptable microbiological levels.
2. To ensure that this process resulted in a product that was acceptable to accustomed customers of such products.
3. To conduct a survey in a commercial abattoir to establish the frequency of occurrence of conditions and lesions, on older sheep particularly, that might pose a problem of detection in skin-on carcasses.

## Research Summary

### Wool Removal

Three methods (hot water scalding, hot air singeing, gas flame singeing) to remove the wool from sheep carcasses were explored. Singeing using a naked gas flame emerged as the

best option, the wool burning quickly and the underlying skin also being singed to give a light brown colour. It was clear from these explorative studies that (a) the fleece needs to be shorn prior to slaughter to give a wool length of about 5mm in order to effect adequate singeing and (b) the carcass needs to be washed after singeing in order to remove charred wool residues.

A bespoke singeing rig was designed and built to enable a consistent singe operation in subsequent project tasks. This took the form of an octagonal ring, carrying eight gas burners, that moved vertically over a stationary and suspended carcass. The degree of singeing required was attained using three down-up cycles of the burners. Following singeing the carcass was washed using a pressure washer with water at 60°C.

### **Microbiology**

The optimal sequence of steps based around the gas singeing/washing procedures was established by comparing Enterobacteriaceae and Total Viable Counts (TVC) on carcasses produced according to two alternative methods for each step. For practical reasons it is preferable to eviscerate after singeing/washing as the body cavities are intact during these procedures and thus prevent entry of water (plus contaminants) and there is no exposed meat that might partially cook. However, evisceration poses a risk of bacterial contamination of the carcass through increased handling and it was shown that a final single cycle of the burners ('toasting') after evisceration dramatically reduced counts of both groups of organisms (by 4 or 5 log). Similarly, splitting the carcass (to remove the spinal cord in older sheep) and routine carcass inspection before applying the Health Mark were both shown to increase counts of TVC (but not Enterobacteriaceae) if conducted after toasting. Toasting did not obscure the dye-based Health Mark. Comparison of skin-on carcasses, produced according to the best protocol, with carcasses dressed conventionally in the same abattoir showed a clear microbial reduction on the former. As an example, of the total possible number of 55 counts (10 carcasses x six sites) of Enterobacteriaceae, 97% were below the detectable limit on the skin-on carcasses compared with 57% on the conventional ones.

Chilling carcasses generally produced different and opposite results in conventional and skin-on carcasses, decreasing microbial counts on the former but increasing counts on the latter. This was probably due to the very low initial counts on the skin-on carcasses and thus no competitive flora to inhibit introduced contaminants.

### **Shelf-life studies**

The shelf life of meat was determined by changes in muscle colour, lipid oxidation and proliferation of spoilage organisms. There was no significant difference between skin-on and conventional meat in colour or rancidity. The same groups of spoilage organisms were present on both types of carcasses and those monitored were lactic acid bacteria, *Pseudomonas* spp., yeasts and moulds, and TVC. The growth of spoilage organisms was complicated as there were several significant interactions between the factors (carcass type, days on display, carcass joint). Overall, there were indications that counts were higher on the skin-on meat but this was clearly significant only for yeasts and moulds. This was presumed to have arisen from the handling involved in removing and packaging the samples and the low initial microbial loading on the skin-on meat.

### **Customer acceptability**

Skin-on carcass and meat appearance, and the aroma of skin-on meat during cooking, were assessed by a panel of men of Nigerian and Ghanaian origin, all of whom had prior experience of this type of product. Overall, carcasses and the resultant meat produced according to the evolved protocol were judged to be typical and acceptable. The conclusion from this project is that skin-on sheep carcasses that meet consumer requirements can be produced to an acceptable hygienic status using the described methods.

## Carcass inspection survey

A survey of predominant lesions that might pose difficulty of detection in skin-on carcasses was conducted in a commercial abattoir slaughtering substantial numbers of older sheep (primarily cull ewes). The three most frequently occurring conditions noted throughout the year were, in decreasing order, abscesses, bruising and emaciation with observed total numbers of carcasses affected being 726, 42 and 28, respectively, out of a total of 10,245 slaughtered. The number of carcasses exhibiting arthritis was actually greater than those that were emaciated, with a total of 34 but the observations were not as evenly spread across months. There was only one case of *Cysticercus ovis* detected, located in the flank, and two carcasses showing hydatidosis.

Abscesses exceeded 90% of all the conditions recorded in some months and the lowest value was more than 65%. It is likely that many of these would be detectable in a skin-on carcass but there is no objective basis to qualify this statement. Abscesses are removed by localised trimming unless they are numerous enough to require condemnation of the carcass. They are not of public health concern but are clearly of consumer concern and cannot be allowed to enter the food chain. The two other relatively commonly occurring conditions, arthritis and emaciation, would be readily detectable in skin-on carcasses. It is suggested that the Meat Hygiene Service considers the implications, for the meat inspection procedure, of leaving the skin on and whether there need to be any new measures stipulated for this type of carcass.

## Implications

In conjunction with this work, another related study (FSA Project ZMO112) is being carried out to look at the issue of veterinary medicines in relation to 'skin-on' sheep meat. The findings from both of these studies need to be fully evaluated before the Agency will be in a position to approach the EU to have the law changed in order to permit the production of 'skin-on' sheep carcasses in approved slaughterhouses in the UK.

## Some Publications from this Project

### **The production and microbial quality of skin-on sheep carcasses.**

Fisher A.V., Wilkin C.-A., Purnell G., Howell M. (2006). 52nd International Conference on Meat Science and Technology (ICoMST), Dublin, August 13-18th 2006. [FRPERC Biblio Ref: 850]

### **The production and microbiological status of skin-on sheep carcasses.**

Fisher, A., Wilkin, C-A., & Purnell, G. . Meat Science. in Press doi:10.1016/j.meatsci.2007.04.020. [FRPERC Biblio Ref: 108881 (iris)]

## Contacts

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