# STUDIES ON THE HARDNESS OF BEEF FAT USING THE SLIDING PIN CONSISTOMETER

K.R. Davey, CSIRO, Division of Food Processing, Meat Research Laboratory, P.O. Box 12, Cannon Hill, Queensland 4170, Australia

## SUMMARY

The need within the Australian meat industry for an objective measurement of the hardness (= cutability) of fat on sides of chilled beef has led to the development of an instrument for this purpose. Details of the instrument a Sliding Pin Consistometer (SPC) are presented. SPC readings determined from *in situ* measurements on hanging sides of beef in commercial chillers were strongly linearly related with subjective hardness ratings of the fat by experienced boning room personnel acting as judges. Results also demonstrate the non-systematic variation in the present subjective hardness ratings of the judges. Some selected results of factors affecting fat hardness together with results from investigations in which the SPC is being used to objectively assess the influence of chilling regime on fat hardness are also presented.

The SPC is shown to be an objective and simple, rapid and portable instrument for the measurement of the hardness of beef fat in abattoir boning rooms.

Application of the SPC to a wide range of other plastic fats (butters, margarines and cheeses) is also discussed briefly.

## INTRODUCTION

Often commercial instruments are unavailable or simply unsuited to the technological needs of the meat industry. Because of this, the needs of the industry are likely to be best met from developments by researchers in the field. One recent example of such a development is the Sliding Pin Consistometer (SPC) for the measurement of the hardness (= cutability) of the fat on the sides of chilled beef and for a range of other plastic fat products.

When sides of beef are chilled following slaughter and dressing the subcutaneous adipose tissue (fat) may become hard and impede boning operations as it is difficult to cut. The hardness of fat on beef sides entering boning rooms has often led to industrial disputes in Australian abattoirs, with consequent loss in production. Hard fat can be a hazard as it both increases the dangers of knife work and is thought to aggravate tenosynovitis (Davey 1983). The problem of fat hardness is important to Australia where vast quantities of carcass beef are boned manually.

Fat hardness is presently determined subjectively, usually on the basis of thumb or hand pressure, by nominated work's judges or "hard fat men". Objective measurements of fat hardness would obviously be preferable to subjective ratings as these leave less room for dispute as to the acceptability of sides for boning.

Fat hardness is not a precise rheological property (Davey 1983). The temperature of the fat might be expected to influence both the subjective and objective measurements of hardness. However temperature was found to be an unsatisfactory indicator of the hardness of fat as experienced in boning sides. This is probably due to the chemical composition of the fat as yellow fats can remain subjectively soft at temperature as low as 1°C, whilst white fats are sometimes rated hard at temperatures as high as 13.5°C.

## EXPERIMENTAL METHODS

Davey (1983) described and successfully tested a specially developed instrument (Patents pending) that fulfilled the following necessary conditions for acceptance in the work environment. These included that it:

1. produces readings that relate to subjective hardness ratings of experienced boners
2. is portable and can be used *in situ* on hanging sides
3. is rapid and easy to operate
4. is precise in the temperature range 0°C to 15°C
5. can be used in fat with a depth of between 5 mm and 50 mm
6. can withstand the harsh environment of an abattoir.

The instrument is shown diagrammatical in Fig. 1. The small diameter (0.97 mm) cylindrical cutting pin (3.76 mm long) is inserted perpendicular to the surface of the fat and is moved by a pretensioned spring in a direction parallel to the fat surface. Four spikes on the baseplate stick into the carcass surface to prevent relative movement between the beef side and the instrument during measurement. The movement of the pin is actuated by a trigger mechanism, the driving force being supplied by the manually pretensioned spring. A cylindrical cutting pin was selected because, provided it remains perpendicular to the fat surface during measurement, it presents the same projected cutting area. A cylindrical pin is also easy to manufacture to standard dimensions and is not prone to change in shape due to wear. The pin is made from stainless steel and its diameter of 0.97 mm is the lower limit consistent with the need for sufficient strength to resist deformation. Inbuilt

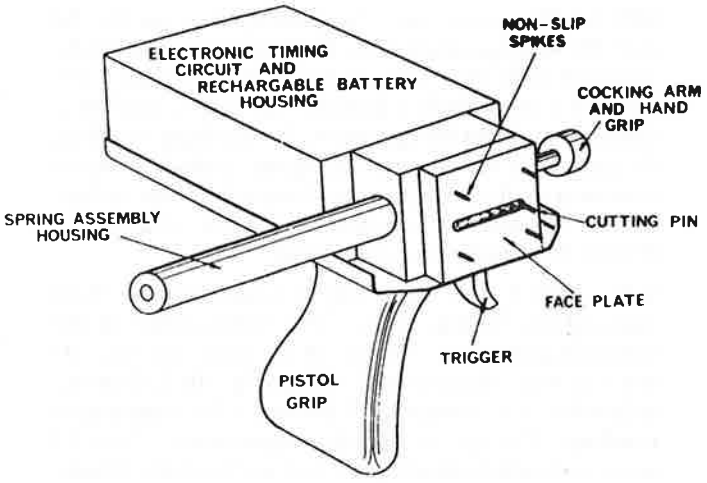


Fig.1 Prototype Sliding Pin Consistometer (sometimes call a Fat Hardness Gun) (Davey 1983).