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RAPID GLYCOLYSIS TEST FOR DETECTION OF DC BEEF IN SLAUGHTER LINE

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INTRODUCTION

The early detection of DC beef is of great importance both in carcass grading and the most reasonable utilisation of beef, especially in connection with hot boning followed by vacuum packing /Seideman et al.1982/. High frequency of DC beef was found by Tarrant and Sherington /1980/, Puolanne /1980/, Vada et al. /1984/. For early detection of DC beef Davey and Graafhuis /1981/ and Braathen /1984/ proposed the rapid glycolysis induced by thaw-rigor and electrical stimulation. For detection of DFD porcine muscle rapid glycolysis test induced by added Ca^{2+} was suggested /Vada-Kovács, 1981/.

In this paper a new glycolysis test for beef is presented. Endogenous Ca^{2+} was released by surfactant Triton X-100. Rapid glycolysis of beef was induced also with added Ca^{2+}.

MATERIALS and METHODS

3.0 grams of sample taken from m. adductor at 50 minutes post mortem was homogenised with 3.0 ml of solution containig 0.25 - 5.0% Triton X-100 /Serva/

and 2o mM $CaCl_2$, 2o mM $MgCl_2$, loo mM KCl. Ultra-Turrax nomogeniser/IKA Werk, Staufen/ was used. Samples were minced with solutions for 5 sec at lo.ooo rpm followed by mincing for 5 sec at 2o.ooo rpm. In previous study /Vada-Kovács, 1981/ the time and intensity of mincing proved to be significant in the rate of muscle glycolysis, while the meat:solution ratio was nonsignificant /1:1 vs. 1:2/. Therefore exact weighing of muscle samples is not required for routin test.
pH of homogenates were determined after 9 minutes of incubation. Lactate content of muscle was determined by Hohorst /197o/, glucose content of muscle was estimated with Anthron reagent /Herbert et al., 1971/. Ultimate pH of muscle was measured at 3o-36 hrs post mortem in 15o mM KCl containing 5 mM iodoacatate /Bendall, 1978/. In the case of routin test ultimate pH was measured directly with meat electrode /INDU NORM, Düsseldorf/ /Vada-Kovács and Csiba, 1984/. Analysis of covariance was used for mathematical-statistical evaluation.

RESULTS and DISCUSSION

Fig. 1. shows the rate of post mortem glycolysis as influenced by concentration of surfactant Triton X-loo /o.25-5%/. Glucose and lactate content are shown as plotted against of pH of homogenates which were incubated with surfactant for 9 minutes. The pH, glucose- and lactate content of pre- and post rigor muscle /5o minutes post mortem and 36 hrs post mortem/ are also indicated.
It can be concluded from Fig. 2., that complete post mortem glycolysis was attained whithin 9 minutes by incubation with 1-5% Triton X-loo.
Fig. 2 shows the linear regression calculated from ultimate pH of muscle /x/ and pH of muscle homogenate incubated with Triton X-loo for 9 minutes /Y/. Relationship was calculated from 2 sets of data /2 populations/. 1.5 % Triton X-loo in dist. water was used for rapid glycolysis test. There was no significant differences between parameters of 2 regression equations. Therefore ultimate pH of muscle can be estimated with common regression equation, which slightly but significantly differs from line y=x /$P < 5\%$/.
Rapid glycolysis test was carried out under similar conditions with added Ca^{2+} /2o mM $CaCl_2$, 2o mM $MgCl_2$, loo mM KCl/ and relationship with ultimate pH was calculated /3 populations/ /Fig. 3./

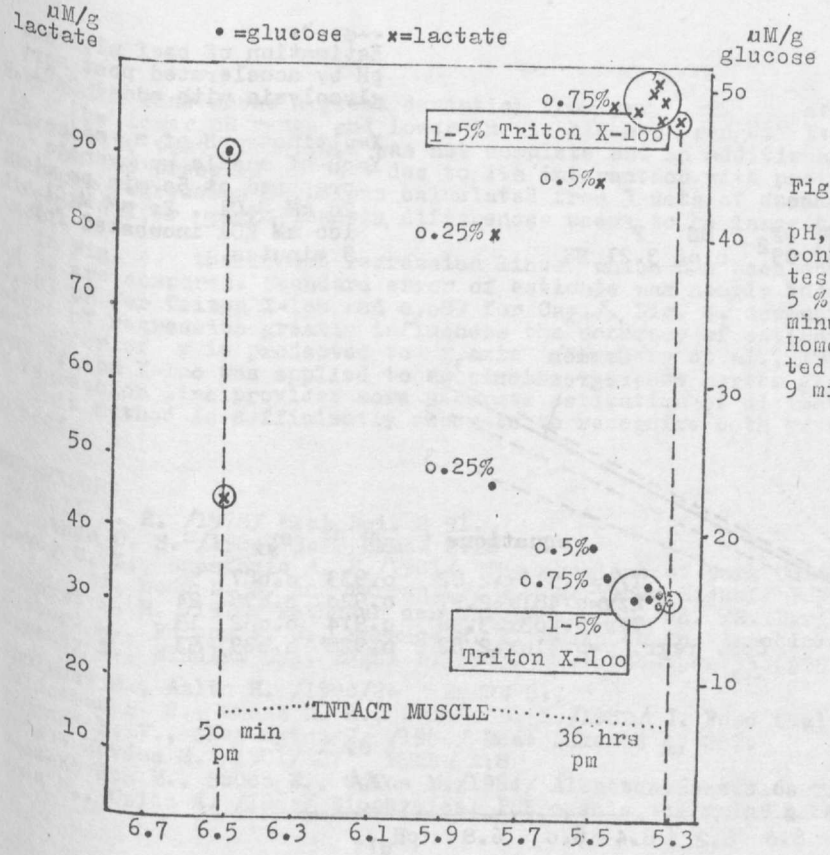

Fig. 1.

pH, glucose- and lactat content of beef homogenates prepared with o.25-5 % Triton X-loo at 5o minutes post mortem. Homogenates were incubated with surfactant for 9 minutes.

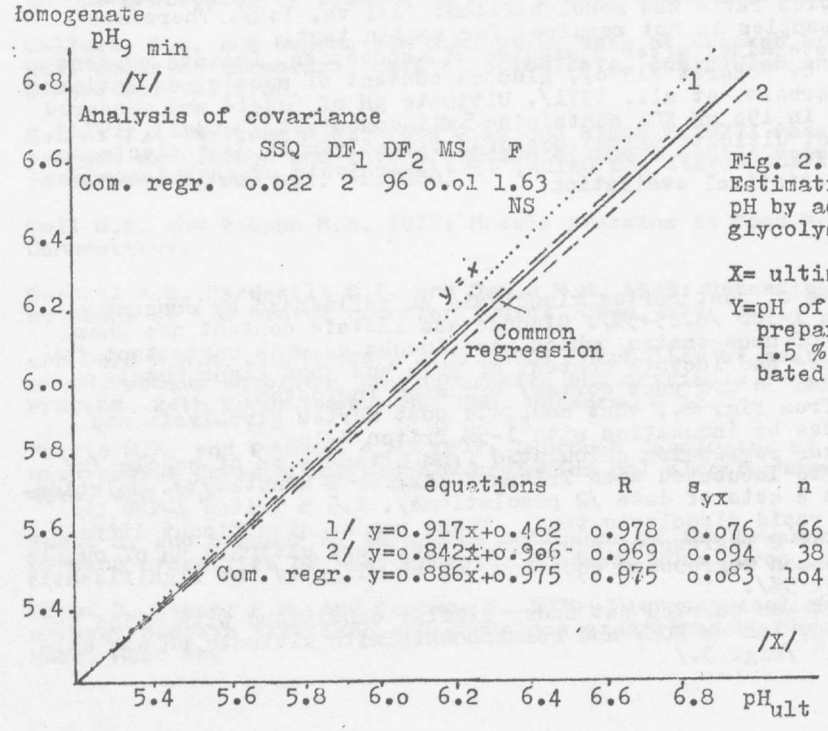

Fig. 2.
Estimation of beef ultimate pH by accelerated post mortem glycolysis with surfactant

X= ultimate pH of m. adductor

Y=pH of muscle homogenates prepared at 5o min pm with 1.5 % Triton X-1oo and incubated for 9 minutes

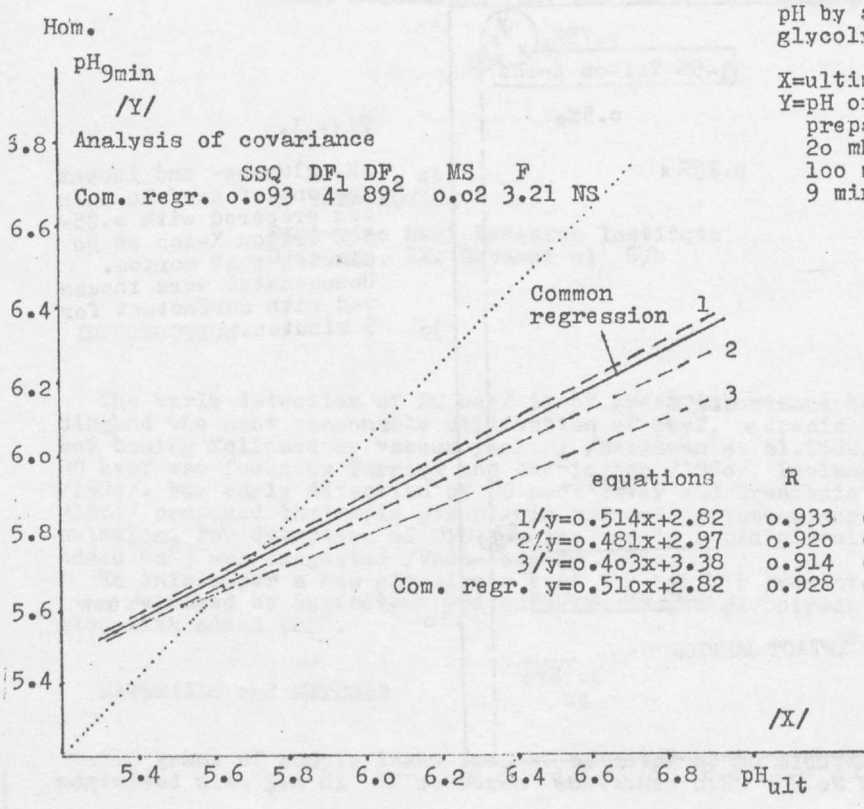

Fig. 3.
Estimation of beef ultimate pH by accelerated post mort glycolysis with added Ca^{2+}

X=ultimate pH of m. adductor
Y=pH of muscle homogenate prepared at 5o min pm with 2o mM $CaCl_2$, 2o mM $MgCl_2$, 1oo mM KCl incubated for 9 minutes

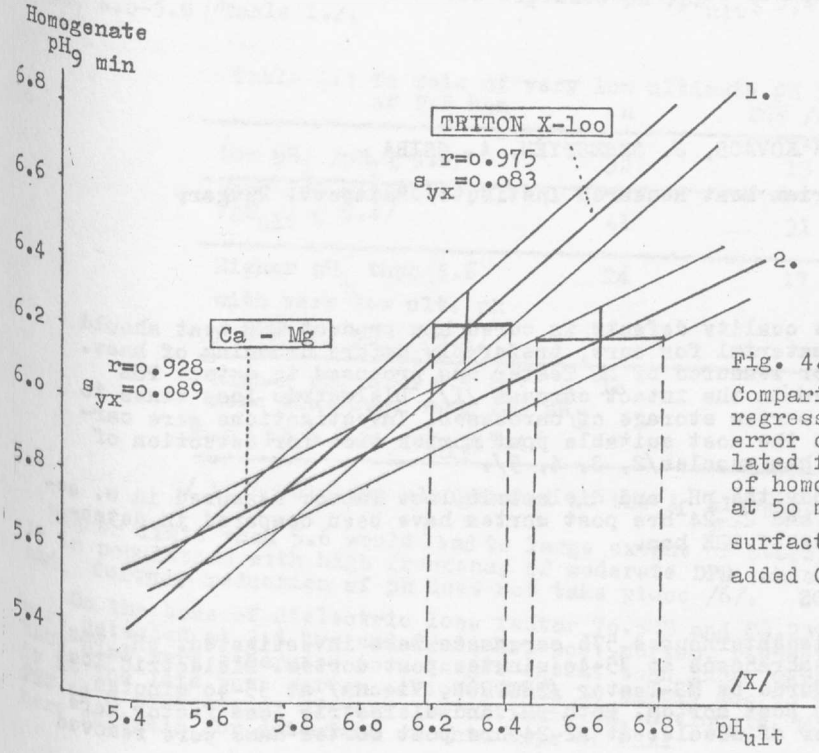

Fig. 4.
Comparison of linear regressions and standard error of estimate calculated from ultimate pH of homogenates prepared at 5o min post mortem with surfactant Triton X-loo /1/ added Ca^{2+} /2/

Regression line shows a great deviation from y=x. pH_9 min of homogenate is higher in the lower pH range and lower in the higer pH range. It is concluded from this result, that glycolysis was not complete and an additional pH reduction occurred in the presence of Ca^{2+} due to its interaction with protein.
Although regression equations calculated from 3 sets of data /3 populations/ did not differ significantly, differences seems to be large between regression lines.

In Fig. 4. the common regression lines which has been shown in Fig. 2. and Fig 3. are compared. Standard error of estimate was nearly identical of 2 lines /o.o83 pH for Triton X-loo and o.o89 for Ca^{2+}/. Fig. 4. demonstrate, that the slope of regression greatly influences the accuracy of estimation since standard error of y is projected to x axis /Körmendy et al., 1983/. When surfactant Triton X-loo was applied to accelerate the post mortem glycolysis the slope of regression line provides more accurate estimation of ultimate pH.
This method is sufficiently accurate to recognise both extreme and moderate DC beef.

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