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THE FILTER-PAPER PRESS AS METHOD FOR MEASURING WATER HOLDING CAPACITY OF RABBIT MEAT

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ABSTRACT

Some variations of the filter-paper press method were applied to 120 samples of rabbit meat for measuring its water-holding capacity (WHC). Determination of WHC as meat/total ratio between areas is preferable that WHC as percentage of released water when applying free load. For measuring those areas the method of drawing in a plastic sheet, cutting them and weighing the cut plastics, is an easier and less time-consuming procedure that the planimeter reference or reticule measures.

INTRODUCTION

Water-holding capacity, tenderness and colour are physical characteristics of meat that has lack of standard measurements in contrast to accepted methods of measuring the chemical components of meat. When researching in fundamental structures of muscle and meat, the experimental methodologies should not be constricted by reference methods, but standard measurements are necessaries when there is interest in being able to compare results between laboratories or countries (Honikel, 1998).

There is a multitude of procedures for measuring the water-holding capacity (WHC) of meat (Barton-Gade *et al.*, 1993), but for Mediterranean meat products Honikel (1997) propose the drip loss method in raw whole meat as reference method. As drip loss rabbit carcass is little, it is difficult to carry out this method with accuracy and it seems better to propose other methods. The filter-paper press method (Grau and Hamm, 1956) is well known and easy to carry out, but a number of modifications of this technique have been suggested: defining the pressure, weighing the meat sample or the filter-paper before and after pressing (Hamm, 1986), measuring non-regular areas by superposition of a grid of clear plastic (Fischmeister, 1976), calculating the meat and total areas as ellipses after measuring the axis whit a vernier caliper (Hoffman, 1982), using a reticulated dot filter-paper (Zamorano and Gambaruto, 1997).

The object of present study is to discuss the convenience of application of some variations of the filter-paper press method trying to find a methodology that could be standard for WHC in rabbit meat.

MATERIALS AND METHODS

This study included data from 120 meat samples corresponding to LD muscles of rabbits aged 9 and 11 weeks. Each meat sample was used for testing meat WHC by the Grau-Hamm filter-paper press method (Grau and Hamm, 1956), modified by Hoffman *et al.* (1982).

Meat samples were obtained 24 h *post portem* and three different portions from each sample

were analysed in duplicate applying different loads. WHC was studied weighing 300±5 mg of intact meat placed on a previous desiccated and weighed (0.0001 g accuracy) filter-paper Wathmann nº 1 of 7 cm of diameter. After weighing it, the paper with meat was placed between two plexiglas plates. Loads of 1 kg, 2.25 kg and free mechanical force were applied for 5 min. Circles of meat (M) and released juice (T) were then carefully draft on a clear plastic (mm^2 reticulated) for a permanent record and damp paper-filter was rapidly weighed after accurately removing the compressed meat. Mean of two replicates is considered as value.

WHC was first expressed as percentage of released water (PRW)

$$PRW = \frac{\text{Damp paper-filter weight} - \text{dry paper-filter weight}}{\text{Meat sample weight}} \times 100$$

Areas of meat spot (M) and total liquid infiltrated paper (T) of each plastic (720 cases) were measured using three methods: 1. Planimeter (reference method) 2. Counting the mm^2 on reticular plastic paper (R) 3. Weighing the plastics after cutting T and M draws and estimating the areas (1 mg correspond to the 7 mm^2 used plastic sheet) (A). Water holding capacity in each case P, R, A, was estimated as the ratio M/T (x100) of the areas (Hoffman *et al.,* 1982).

A preliminary ANOVA analysis determined that age and load were factors whit significant effect on each of the studied variables, so correlation coefficients between variables were separately studied in each age*load level.

RESULTS AND DISCUSSION

Least square means and s.e. of the studied variables in function of the age of animals and load are shown in table 1. Values of WHC as M/T ratio (x100) of 9 weeks-aged rabbit meat, compressed with free load, are similar to those found in similar rabbits (Pla *et al.,* 1998). The percentage of water weight loss (PRW) varies highly with the load used, result that agrees with those of Hoffman *et al.* (1982), so it is necessary to define exactly the pressure conditions of determination, free load being not recommendable. Furthermore it is necessary to operate quickly when using this method because of water evaporation loses from meat or from filter-paper is important and could modify the results. A very accurate separation of meat from the filter-paper is necessary because of an confusion between meat residues and released water will produce a big mistake in the result.

Meat of eleven weeks-old rabbits retains less water than meat of nine weeks-old rabbits, so PRW of rabbits of 11 weeks seems to be greater than PRW of rabbits of 9 weeks. Conversely, M/T ratio of 9 weeks-old rabbits is higher than M/T ratio of 11 weeks old rabbits. When free load was applied to meat pressuring (that correspond roughly to a pressure with 40 kg as Hoffman *et al.,*1982 noted), no differences between different aged rabbits meat were found.

Table 1

Means and s.e. of percentage of released water (PRW) and M/T ratio (x100) when Planimeter (P), Reticula (R) or Weight of plastic sheet (A) were used for measuring the Meat (M) and Total wet (T) areas.

Load	Variable	9 weeks		11 weeks		p. tail
		m	s.e.	m	s.e.	
1 kg	PRW	22.67	0.46	23.99	0.46	0.0794
	M/T P	37.37	0.65	34.97	0.65	0.0425
	M/T R	37.47	0.65	35.15	0.65	0.0542
	M/T A	37.88	0.66	35.52	0.66	0.0543
2.25 kg	PRW	26.83	0.46	28.26	0.46	0.0281
	M/T P	34.26	0.65	32.24	0.65	0.0167
	M/T R	34.19	0.65	32.22	0.65	0.0184
	M/T A	34.74	0.66	32.81	0.66	0.0232
free	PRW	42.73	0.46	43.01	0.46	0.6040
	M/T P	34.33	0.65	33.58	0.65	0.2531
	M/T R	34.11	0.65	33.56	0.65	0.3944
	M/T A	34.51	0.66	33.79	0.66	0.2646

Correlation coefficients between PRW and M/T were negative in all the cases and its values were moderately high (table 2). When M and T areas were measured with different methods, the correlation between M/T ratios was positive and higher. Measuring M and T areas with planimeter, counting reticular dots, or weighing the cut plastic areas seems indifferent from this point of view, so it seems reasonably to propose weighing the cut plastic drafts as the method for estimating areas, because the last method is easier and less time consuming.

Table 2

Correlation coefficients between different methods of estimating WHC when applying different loads. Below the diagonals corresponds to the 9 weeks-old rabbit meat. Uper the diagonals corresponds to the 11 weeks-old rabbits meat.

Load		PRW	M/T P	M/T R	M/T A
1 kg	PRW		-.843	-.847	-.843
	M/T P	-.882		.955	.942
	M/T R	-.908	.977		.979
	M/T A	-.902	.976	.977	
2.25 kg	PRW		-.574	-.625	-.614
	M/T P	-.753		.939	.934
	M/T R	-.739	.978		.970
	M/T A	-.722	.963	.974	

	PRW		-.693	-.725	-.711
Free					
	M/T P	-.620		.979	.970
	M/T R	-.608	.956		.969
	M/T A	-.586	.952	.970	

Values of M/T ratio were similar when load was 2.25 kg or free load was applied in 9 weeks-old rabbit meat. When meat was from 11 weeks-old rabbits, M/T ratio was lesser when 2.25 kg than when free load were used; it is a rare result that need to be clarified.

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