

EDIBLE SURFACE COATINGS TO REDUCE WEIGHT LOSSES FROM CHILLED CARCASSES

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SUMMARY

Spraying of beef, sheep or pig carcasses with dilute emulsions of cetyl alcohol reduced their weight loss considerably during chilling (40 to 88%) or holding at refrigeration temperatures (22 to 51%). Treated carcasses had a better appearance than those sprayed with water only (controls). Microbial growth on the treated and control carcasses was similar. The spray only influenced the flavour of the product when higher (3%) concentrations were used.

INTRODUCTION

Although washing carcasses at the end of a slaughter line increases their weight by 0.3% (sheep) or 1% (cattle) they

TABLE 1: Application rates (litres) and cetyl alcohol concentrations (percentage, v/v) used for weight loss, bacteriological and organoleptic assessments of calf, lamb, sheep, beef, and pig sides, or carcasses (light calves³)

Experiment No.	Animals	No. of carcasses	Chiller temperature (°C)	Volume	Concentration
<u>Weight loss</u>					
1	Sheep	6	0	0.5	0.1
2	Calves	10	3-5	1.0	0.1
3	Light calves	18 ³	3-5	1.0	0.1
4	Beef	4 ¹	0	2.0	0.1
5	Beef	4 ²	0	2.0	0.1
6	Pigs	10	3-5	1.0	0.5
<u>Bacteriological</u>					
7	Calves	4	0-5	0.5	0.5
8	Calves	4	5	0.5	0.5
<u>Sensory</u>					
9	Sheep	3	3	0.5	0.1, 0.5, 1.0
10	Lamb	3	3	0.5	0.5, 1.0, 3.0

- 1 fat depth at 12th rib = 2 mm;
2 fat depth at 12th rib = 6 mm;
3 carcasses and not sides used.

TABLE 2: Mean percentage¹ weight losses of sides, or carcasses, of calves, lambs, sheep, cattle and pigs after the application of water (Control) or cetyl alcohol (C-alc) emulsions, chilling and holding at refrigeration temperatures

Experiment	Animals	Hot weight of side/carcass ² (kg)		Loss at 24 h		Loss at 168 h	
		Control	C-alc	Control	C-alc	Control	C-alc
1	Sheep	8.4	8.3(S)	1.1	0.04*	3.9	1.9*
2	Calves	38.2	38.8(S)	1.7	0.8*	-	-
3	Calves	40.3	38.5(C)	2.5	1.5*	-	-
4	Beef	103	99(S)	2.7	0.7*	3.8	2.3*
5	Beef	117	117(S)	1.5	0.6	3.2	2.5
6	Pigs	47.6	47.4(S)	1.1	0.3*	-	-

1 Calculated as a percentage of hot, dry, weight

2 (S) = side; (C) = carcass

* Differences between control and cetyl alcohol-treatments differ significantly ($P < 0.05$) within weighing times.

lose this and, additional water, quickly. Weight loss during carcass chilling ("chiller shrink") is variable, averaging approximately 2% for beef and 3% for sheep carcasses. This dehydration, as well as reducing product mass, adversely alters the appearance of the meat and fat surfaces of the carcass; these effects are intensified with increasing weight loss with time.

To reduce weight losses during chilling very fast rates of chilling have been used (pig carcasses) or carcasses (beef) have been misted with chlorinated water during chilling. Long chain fatty alcohol, or fatty acid (Anderson 1960), or alginate (Lazarus et al. 1975) coatings have been applied to carcasses to reduce moisture loss.

Long chain fatty alcohols are relatively inexpensive and are generally-recognised-as-safe (GRAS). The use of one of these as a carcass coating and its effects on weight losses, carcass appearance and shelf life, and organoleptic acceptability of meats is described in this paper.

MATERIALS AND METHODS

0.1 to 3% aqueous emulsions of cetyl alcohol were prepared, with Tween 60 as an emulsifier, and sprayed on to sides, or carcasses, at the rates indicated in Table 1; control sides, or carcasses, were sprayed with an equivalent volume of potable water. Weight losses were calculated as a percentage of hot, dry, carcass weight. To determine the influence of the cetyl alcohol treatment on bacterial growth, 4 x 5 cm² samples of surface tissue were collected aseptically from each side before and 24 and 168 h after spraying, (Table 1). Total aerobic plate counts (Tryptone-Soya-Yeast-Glucose (TSYG) agar) were recorded, after 3 days at 25°C. Organoleptic effects of cetyl alcohol spraying were assessed using minces of loins of lamb and sheep sides, mutton chops, and roast legs of lamb. Minces with a lean to separable fat ratio of 9:1 were simmered with an equal volume of water for 20 min before being tasted (hot). The leg chops (and legs of lamb) were cooked in an oven at 205°C and tasted (hot) by a 19-member trained taste panel in duo-trio and flavour and aroma intensity-rating tests.

RESULTS

Dilute aqueous emulsions of cetyl alcohol sprayed on to calf, lamb, beef, sheep or pig carcasses considerably reduced weight loss during chilling and holding at refrigerated temperatures (Table 2). Similar results have been recently obtained using stearyl, or mixtures of cetyl and stearyl, alcohol (Powell, unpublished). This reduction in dehydration produced sides with a better appearance than that of control sides.

The cetyl alcohol spray had no significant effect on the total aerobic plate counts (TAPC) of calf sides held at 3°C for 24 h or sides of mutton after 24 or 168 h at 5°C (Table 3).

There were no significant differences in the flavour of mutton cuts from treated (0.1, 0.5, 1.0% cetyl alcohol) sides, whether the cuts were evaluated in duo-trio or rating tests. However, when lamb sides were treated with a greater concentration (3%) of cetyl alcohol a significant ($P < 0.05$) increase in non-meat or "other" aroma scores was detected by the panel (Table 4).

TABLE 3: Total aerobic plate counts of sheep sides held at 5°C

Sampling time (h)	Control	Cetyl alcohol
0	8.3 x 10 ⁴	6.6 x 10 ⁴
24	7.6 x 10 ⁴	4.7 x 10 ⁴
168	4.4 x 10 ⁶	6.0 x 10 ⁶

TABLE 4: Mean panel scores for flavour¹ and aroma¹ of boiled minces from lamb sides sprayed with cetyl alcohol emulsions of varying concentrations

Cetyl alcohol concentration (2)	Meat aroma ¹	Meat flavour ¹	Other aroma ¹	Other flavour ¹	Acceptability
0	3.63	3.54	1.00	1.10	4.79
0.5	3.49	3.45	1.00	1.12	4.65
1.0	3.49	3.49	0.99	1.09	4.76
3.0	3.65	3.61	1.14*	1.22	4.71

* = significantly different from other 'other aroma' means
 1 = intensity was scored 1 = very faint to 9 = very strong
 2 = acceptability was scored 0 = very poor to 8 = very good

DISCUSSION

A simple, inexpensive, process, using (GRAS) ingredients, which considerably reduces weight losses occurring during chilling and improves the appearance

of the chilled product has been described. The application of cetyl alcohol did not influence bacterial growth on carcasses or, provided the concentration did not exceed 1%, the flavour or aroma of their meat. The cost of the ingredients of the spray are, approximately, 7 cents (Australian) for beef carcasses and less than 1 cent for lamb carcasses. Spraying can be automated. The notional net savings would approximate \$A 3.50 per beef carcass (carcass value \$2 kg⁻¹) and 30¢ per lamb carcass (\$1.5 kg⁻¹).

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