

Microbiological investigation of halal butchery products and butchers' premises

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Summary: *Halal butchers' premises were investigated as they had not been represented in a recent study of butchery products and butchers' premises conducted by the Local Authorities Coordinating Body on Food and Trading Standards and the PHLS. This study examined 183 raw prepared meats and 212 environmental samples from 105 halal butcher premises. Only raw meats were prepared on 97 of the premises visited; and the types of meat prepared on the remaining eight premises was not specified. Four halal butchers sold cooked meats prepared elsewhere. Salmonella spp. and Campylobacter spp. were detected in 12 (7%) and 52 (28%) of the 183 raw meat products, respectively. Five raw prepared meats (3%) contained both salmonella and campylobacter. Vero cytotoxin producing Escherichia coli O157 was isolated from a raw meat product that also contained campylobacter. No cooked meat products were available for collection. The physical separation of raw and unwrapped cooked meat products in premises that prepared raw and sold cooked meats was not recorded. Apron cloths were the most heavily contaminated environmental samples examined; hygiene indicator microorganisms indicated an increased risk of cross contamination. Managers in 85 premises had received no food hygiene training and 88 premises had no hazard analysis system in place. Improvements are needed to reduce the risk of cross contamination.*

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Introduction

Halal meat is meat that has been slaughtered according to Islamic law, in which the animal is killed by a transverse cut to the throat, rather than by the usual European method of rendering the animal unconscious by stunning and then killing it by bleeding¹. Genuine halal meat is sold from registered shops² and is often eaten within 24 hours of slaughter. Little information is available about the microbiological quality of meat and meat products from halal butchers. They were poorly represented in a recent study of butchery products and butchers' premises conducted by the

Coordinated Food Liaison Group of the Local Authorities Coordinating Body on Food and Trading Standards (LACOTS) and the PHLS³. The LACOTS/PHLS study focused on premises that handle both raw and cooked meats; halal butchers usually prepare raw meats only². Contaminated meats bought from halal butchers have been linked to outbreaks and sporadic cases of food poisoning^{4,5}, including an outbreak of *Salmonella wangata* infection in England in 1992, which affected 210 people, eight of whom were admitted to hospital (PHLS Communicable Disease Surveillance Centre (CDSC), unpublished data). The source of infection was found to be chicken prepared by a halal butcher who sold raw and cooked meats. The same butcher had been implicated in an outbreak of *S. ealing* infection, linked to halal meats in 1982 (CDSC, unpublished data).

For comparison the protocol and parameters examined were the same as those used in the LACOTS/PHLS study³. Two raw and two cooked meat products (if available) and up to five environmental samples were collected from each premises. Raw meat samples were examined for the presence of *Escherichia coli* O157, *Salmonella* spp., and *Campylobacter* spp., and *E. coli* were enumerated.

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TABLE 1 Incidence of foodborne pathogens in raw meat products from halal butchers' premises

Raw meat type	Product number	Salmonella sp (%)	Campylobacter sp (%)	Verocytotoxin-producing <i>Escherichia coli</i>	
				O157 (%) [†]	non-O157 (%) [‡]
Mince	89	4 (4)	20 (22)	1	–
Chopped/diced	63	6 (10)	21 (33)	–	–
Other*	15	2 (13)	8 (53)	–	–
Not specified	16	–	3 (19)	–	1 (6)
Total	183	12 (7)	52 (28)	1 (1)	1 (1)

* whole chickens, chicken thighs and/or breasts, giblets

[†] *E. coli* O157 VT2 PT2

[‡] *E. coli* O156 VT1

Cooked meat samples were examined for these parameters and, in addition, coliforms, *Staphylococcus aureus*, and the aerobic plate count (APC) were determined to indicate hygiene and levels of contamination. The presence of *E. coli* O157 and the enumeration of coliforms, *E. coli*, and *S. aureus* in environmental samples were used to indicate hygiene and levels of contamination.

Methods

Sample collection

This study took place in April and May 1998 and involved local authorities and laboratories in England and Scotland. A standardised protocol and reporting system was used. All samples were collected by staff from local environmental health departments in accordance with the *Food Safety Act 1990, Code of Practice No 7*⁶. Butchery products (approximately 150g) included raw meat, minced or diced, prepared on the premises and, if available, cooked meat sliced on the premises. Environmental areas sampled on the premises included chopping surfaces for raw and for cooked meats, weighing balances used for raw and/or cooked meats, blades used to slice cooked meat, and apron cloths (used for wiping surfaces, equipment, and utensils). Surfaces were sampled and the samples were processed as described previously³. All environmental sampling materials were supplied by Technical Services Consultants Ltd (Heywood, United Kingdom).

Observations and responses to enquiries were recorded on a standard form that included details on the Inspection Rating Category of the premises, Confidence in Management score (*Food Safety Act 1990, Code of Practice No. 9*)⁷, manufacturing activities on the premises, documentation of a hazard analysis system, food hygiene training received by staff, and - if applicable - the degree of physical separation of raw meat and unwrapped cooked meat products and other ready-to-eat foods.

Sample examination

Samples were examined as described previously³. All isolates of salmonella, campylobacter, and *E. coli* O157 were sent to the PHLS Laboratory of Enteric Pathogens (LEP) for further characterisation.

Results

Samples were submitted by 20 local authority food liaison groups (17 in England and three in Scotland), representing 32 local authorities, for examination by 12 laboratories (see Acknowledgements). A total of 395 butchery products and environmental samples were collected and examined from 105 halal butchers' premises.

Microorganisms isolated from halal butchery products and premises

Raw meat products

A total of 183 raw meat products were examined; 89 (49%) raw minced meat, 63 (34%) raw chopped/diced meat, 15 (8%) other raw meat products (whole chickens, chicken thighs and/or breasts, giblets), and 16 (9%) unspecified raw meats. Most of the raw meat samples were of lamb (70; 38%), mutton (56; 31%), or chicken (42; 23%). Raw meat products containing salmonella or campylobacter were collected from 40 of the 105 butchers' premises. Five raw meat products (chicken, mutton) obtained from four different premises contained both salmonella and campylobacter. *E. coli* O157 vero cytotoxin (VT) 2 phage type 2 (PT2) was detected in one sample of raw minced lamb that also contained campylobacter. *E. coli* O156 VT 1 was detected in one raw mutton product (table 1).

Salmonellas were detected in 12 raw meat products (table 1) – raw lamb/mutton (6), raw chicken (5), and raw beef (1). Five different serotypes were isolated from the 12 positive samples. The commonest isolates were *S. enteritidis* phage type (PT) 4 (4) and *S. heidelberg* (4). One raw chicken sample contained *S. hadar* and *S. virchow*. *S. typhimurium* definitive phage type (DT) 104 isolated from a raw mutton sample was the current epidemic strain, resistant to ampicillin, chloramphenicol, streptomycin, sulphonamides, and tetracyclines (R-type: ACSSuT). Two *S. virchow* PT47 isolates were resistant to ampicillin, chloramphenicol, sulphonamides, tetracyclines, trimethoprim, and furazolidone (R-type ACSuTTmFu).

Campylobacter spp. were detected in 52 raw meat products (table 1), most in raw chicken (50%; 21/42) or raw lamb/mutton (23%; 29/126). Thirty of the 52

campylobacters isolated from raw meat samples were further characterised, 21 of which were *C. jejuni* and nine *C. coli*. A wider range of serotypes of *C. jejuni* were identified than of *C. coli* (table 2). About a third (11/30) were untypable, however, of which there were six different phage types (table 2).

Cooked meat products

None of the 105 premises visited prepared cooked meats on the premises. Four sold cooked meats on the premises, but no samples were available at the time of collection.

Environmental samples

A total of 212 environmental samples were examined – 103 from raw meat chopping surfaces, 50 from weighing balances used for raw meats, 29 apron cloths, 14 from bandsaws (used exclusively for cutting raw meats), seven from other raw meat surfaces (display cabinet, refrigerator shelf, mincer, cloth for skinning chickens), four from raw meat slicer blades, three from cooked meat slicer blades, and two from cooked meat chopping surfaces.

None of the 212 environmental samples yielded *E. coli* O157. Apron cloths were the most heavily contaminated with coliforms, *E. coli*, and *S. aureus*, indicating a reservoir of bacteria and a cross contamination hazard. *S. aureus* was found in two of the 29 apron cloth samples, with counts $\geq 10^4$ cfu/mL cloth eluent. Coliforms and *E. coli* were present at counts $\geq 10^4$ cfu/mL cloth eluent in nine and seven apron cloths samples, respectively. Only one other sample, from a raw meat chopping surface, yielded a high level of coliforms ($\geq 10^4$ cfu/cm²) (table 3).

Halal butchers' premises in relation to food hygiene practice and the Pennington Group report recommendations

The survey found the following:

- Premises were classified according to the *Food Safety Act 1990* (Code of Practice No.9)⁷. Premises that pose a greater risk to the consumer are inspected more frequently than those with a lesser risk. Six of the 105 premises sampled had an inspection rating category A (minimum frequency of inspection every six months), 27 B (every year), 52 C (every 18 months), three D (every two years), zero E (every three years), one F (every five years), and no category was recorded for 16.
- The food hygiene performance of the management was scored using the Confidence in Management/Control Systems scoring system described in the *Food Safety Act 1990* (Code of Practice 9)⁷. One of the premises achieved a score of zero, which indicates a high degree of confidence, one scored five (moderate confidence), 47 scored ten (some confidence), 24 scored 20 (little confidence), and nine scored 30 (no confidence). At 23 premises the sampling officer did not record the scores.
- Ninety-seven of the premises did not require approval under the *Meat Product (Hygiene)*

TABLE 2 Sero- and phage types of *Campylobacter* isolated from raw meat products

<i>Campylobacter</i> sp	Serotype	Phage type (number of isolates)
<i>C. jejuni</i>	HS2	1 (2)
	HS5	1 (1), 44 (1)
	HS11	1 (2), 18 (1), 39 (1)
	HS18	2 (2)
	HS45	1 (1)
	HS50	35 (1)
	HS60	2 (1)
	HS rough	35 (1)
	Untypable	6 (1), 33 (2), 34 (1), 35 (1), 44 (2)
<i>C. coli</i>	HS9	44 (1)
	HS24	1 (1)
	HS56	7 (1), 44 (2)

* RDNC, reacted with the phage set but did not conform to a recognised phage type

*Regulations 1994*⁸ as they were used for the preparation of raw meats only. The approval status of the eight remaining premises was not recorded as the report did not specify whether raw meat products only or both raw and cooked meat products were prepared.

- Five out of the 105 premises, as well as preparing and selling raw meats, sold cooked meats or other ready-to-eat foods (salami, cheese) supplied from elsewhere. Additional comments from sampling officers indicated that seven premises also sold unwrapped fresh produce, herbs, and spices. The degree of physical separation of raw meat and unwrapped cooked meat products, the use of display cabinets, refrigerators, equipment, utensils, staff, and method of serving in these premises was not recorded.
- Meats stored on the counter or in displays were kept at temperatures of $\leq 8^\circ\text{C}$ in 66 premises, 8°C in 12, and in 27 the temperature was not recorded.
- Managers in 85 premises had not received food hygiene training; in 19 he/she had received training, and in one this information was not given. Fourteen of those with training had attended a basic six hour course in food hygiene training; the type of training for the remaining five was not specified. The Pennington Group Report recommends that all staff of premises handling both raw and cooked meats should have received basic training in food hygiene and that at least one person in each butchers' business should be trained to intermediate level⁹. Only one of the managers from the four premises that sold both raw and cooked meats had received food hygiene training (basic six hour course).
- The Pennington Group report recommends documentation of hazard analysis as a requirement of licensing arrangements pending hazard analysis and critical control points (HACCP) implementation⁹. Three of the 105 premises had a documented hazard analysis system in place, and

TABLE 3 Microbiological results of 212 environmental samples from halal butchers' premises

	Not detected	Detected						
		<10 ²	10 ² -<10 ³	10 ³ -<10 ⁴	10 ⁴ -<10 ⁵	10 ⁵ -<10 ⁶	10 ⁶ -<10 ⁷	≥10 ⁷
Raw meat chopping surfaces (n=103)^a								
<i>S. aureus</i>	81 [†]	20	2					
Coliforms	58 [‡]	30	8	6	1			
<i>E. coli</i>	65 [‡]	26	7	5				
<i>E. coli</i> O157	103							
Raw meat slicer blade/bandsaw (n=18)^b								
<i>S. aureus</i>	18 [†]							
Coliforms	13 [‡]	5						
<i>E. coli</i>	16 [‡]	1	1					
<i>E. coli</i> O157	18							
Weighing balance used for raw meats (n=50)^a								
<i>S. aureus</i>	42 [†]	7	1					
Coliforms	33 [‡]	12	5					
<i>E. coli</i>	38 [‡]	7	5					
<i>E. coli</i> O157	50							
Other raw meat surfaces (display cabinet, refrigerator shelf, mincer, cloth for skinning chickens, n=6)^a								
<i>S. aureus</i>	6 [†]		1					
Coliforms	2 [‡]	1	2	2				
<i>E. coli</i>	6 [‡]			1				
<i>E. coli</i> O157	7							
Cooked meat chopping surface (n=2)^a								
<i>S. aureus</i>	1 [†]	1						
Coliforms	1 [‡]	1						
<i>E. coli</i>	1 [‡]	1						
<i>E. coli</i> O157	2							
Cooked meat slicer blade (n=3)^b								
<i>S. aureus</i>	3 [†]							
Coliforms	2 [‡]	1						
<i>E. coli</i>	2 [‡]	1						
<i>E. coli</i> O157	3							
Apron cloth (n=29)^c								
<i>S. aureus</i>	20 [†]	3	2	2	2			
Coliforms	4 [‡]	5	3	8	2	4	1	2
<i>E. coli</i>	6 [‡]	6	5	5	2	3	1	1
<i>E. coli</i> O157	29							

a cfu/cm²

b cfu/swab

c cfu/mL

† lower limit of detection 20 cfu/cm², swab or mL‡ lower limit of detection 3 cfu/cm², swab or mL

a further 10 had a hazard analysis system that was undocumented. Eighty-eight premises had no system for hazard analysis, and for four this information was not given. One of the four premises that sold raw and cooked meats had a documented hazard analysis system.

- Adequate safety procedures were in place to ensure food safety in 68 of the 105 premises, as judged by the sampling officer, in 23 premises they were not, and in 14 this was not recorded. Significantly more raw meat products collected from premises judged not to have adequate safety procedures in place were contaminated with *Campylobacter* spp. (14/33) than from those with safety procedures in place (33/126) ($p < 0.01$).

Discussion

Campylobacters and salmonellas are the commonest pathogens implicated in food poisoning in the United Kingdom¹⁰. Vero cytotoxin producing *E. coli* O157 (VTEC O157) is less common but has emerged as an important pathogen because of its virulence and low infectious dose¹¹. All three pathogens are known to colonise the intestines of farm animals and may contaminate meat of cattle, sheep, and poultry at the time of slaughter¹⁰⁻¹³. Pathogenic microorganisms are therefore inherent constituents of raw meat and its products. Subsequent handling and processing of raw meat products such as comminution may spread contamination¹⁴⁻¹⁶. Over a quarter of raw meat products collected from halal butchers premises were

contaminated with campylobacter and 7% with salmonella. One sample of raw meat yielded VTEC O157 and another VTEC O156. Not all VTEC isolates are enterohaemorrhagic, and many VTEC strains isolated from animal species - for example, *E. coli* O156 - appear not to cause human disease^{17,18}. The percentages of raw meat samples contaminated with salmonella (7%), campylobacter (28%), and VTEC O157 (0.6%) reported here are considerably higher than in the previous study, in which halal butchers' premises were not represented (4%, 0.6%, 0.1%, respectively)³. The large numbers of campylobacters and salmonellas in these raw prepared meats could reflect contaminated supply, cross contamination, and/or poor hygiene practices. Legal action brought against slaughterhouse businesses is published monthly by the Ministry of Agriculture, Fisheries and Food (MAFF)¹⁹.

The Pennington Group report recommends that hazard analysis procedures should be documented, staff trained in food hygiene, and raw meat and unwrapped cooked meat products physically separated and wherever possible handled by separate staff⁹. Most of the halal butchers visited during this study prepared and sold raw meat only, but some also sold cooked meats and/or unwrapped fresh produce, herbs, and spices. Two thirds of the premises had adequate temperature controls for displaying meats. Only one of the five premises that sold both raw and cooked meats had a documented hazard analysis system, and its manager was the only one to have received formal training in food hygiene. Hazard analysis and food hygiene training are areas that require improvement to reduce the risk of cross contamination with foodborne pathogens in halal butchers' premises. Overall, halal butchers' premises were classified as posing a lower risk to the consumer⁷ than premises in the previous study³, as most handled raw meats only, and were therefore inspected less frequently. Confidence in management scores for halal butchers' premises were less favourable than in the previous study, indicating the need for more frequent inspections⁹.

The results from this study suggest that raw meat products from halal butchers' premises could be a potential source of human infection. It is therefore vital that meat producers, slaughterhouses, butchers', retails, and consumers apply the basic rules of hygiene to prevent these (like other raw meats) from contaminating other foods, minimise bacterial growth (by proper refrigeration), and ensure that any bacterial pathogens present are destroyed (by thorough cooking) before the meat is eaten.

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