Results

PCR detection of class 1 integrons

Prevalence of class 1 integrons in *E. coli* isolated from pigs, pig farmers and non-farmers is shown in Table 1. Class 1 integrons, as indicated by the presence of *intI1*, were detected in 392 isolates (63.5%). Simultaneous presence of all three conserved genes (*qacEΔ1*, *intI1*, and *sul1)* was found in 71 (11.5%) of the 617 isolates. Two hundred and twenty-five isolates (36.5%) were class 1 integron negative. Integron-positive isolates were found in all groups of samples, including piglets, market pigs, sows, pig farmers and non-farm volunteers. The prevalence of integrons was found to be associated with isolate origin (P<0.05). Integrons were more prevalent in isolates from healthy swine (84.7%), diarrheal piglets (83.9%), and sows (79.7%) compared to isolates from market pigs (56.8%), pig farmers, (45.2%), and non-farmers (35.7%). Among healthy swine groups, integrons were more prevalent in isolates from sows and piglets, compared to those from market pigs, and integron prevalence was greater in pigs from larger commercial farms compared to pigs from smaller farms, (P<0.05) (Table 2).

Prevalence of class 1 integron in *E. coli* isolated from retail pork is shown in Table 3. Fifty-seven out of 147 isolates (38.8%) were class 1 integron positive. Simultaneous presence of all three conserved genes (*qacEΔ1*, *intI1*, and *sul1)* was found in 3 isolates (2.0%).

Table 1. Prevalence of integrons and integron component genes in *E. coli* from pigs and humans with and without exposure to pig farms

	Healthy Swine			Diarrheal	Pig	Non-	Total
	sows	market pigs	piglets	piglets	farmers	farmers	
No. isolates	123	132	59	118	42	143	617
No.(%) carrying:							
All three conserved genes (q,i,s)	4(3.3) ^{a}	11(8.3) ^{ab}	8(13.6) ^{b}	17(14.4) ^{b}	7(16.7) ^{b}	24(16.8) ^{b}	71(11.5)
IntI1 (i)	98(79.7) ^{a}	75(56.8) ^{b}	50(84.7) ^{a}	99(83.9) ^{a}	19(45.2) ^{bc}	51(35.7) ^{c}	392(63.5)
None	25(20.3) ^{a}	57(43.2) ^{b}	9(15.3) ^{a}	19(16.1) ^{a}	23(54.8) ^{bc}	92(64.3) ^{c}	225(36.5)

Data are number and percentages ( ) of swine- and human-derived *E. coli* carrying integrons and genes associated with integrons, as determined by multi-plex PCR.

q= *qacEΔ1*, i = *intI1*, s = *sul1*

^{a,b,c} Values within row with different superscripts differ significantly ($P<0.05$)

Table 2. Prevalence of integron-positive and integron-negative *E. coli* from pigs versus farm size.

	Commercial farms[a] (>500 pigs)	Small farms[b] (<100 pigs)	Total
Integron+	179(86.5)[c]	153(68.0)[d]	332(76.9)
Integron-	28(13.5)[c]	72(32.0)[d]	100(23.1)
Total	207	225	432

Data are number and percentages ( ) of swine-derived *E. coli* isolates carrying or lacking integrons, as determined by presence of *intI1*

[a]Data from 3 farms

[b]Data from 10 farms

[c,d] Values within row with different superscripts differ significantly ($P<0.05$)

Table 3. Prevalence of integrons and integron component genes in *E. coli* from retail pork

	Retail pork
No. isolates	147
No.(%) carrying:	
All three conserved genes (q,i,s)	3(2.0)
IntI1 (i)	57(38.8)
None	90(61.2)

Data are number and percentages ( ) of pork-derived *E. coli* carrying integrons and genes associated with integrons, as determined by multi-plex PCR.

q= *qacEΔ1*, i = *intI1*, s = *sul1*

Antimicrobial susceptibility

The antimicrobial susceptibility of integron-positive *E. coli* isolates from healthy and diarrheal swine and pig farmers is shown in Table 4. All isolates were resistant to at least three antimicrobial agents. Overall, the highest percentage of resistance was found to sulphamethoxazole (100%), tetracycline (97.1%), ampicillin (92.8%), streptomycin (89.9%), trimethoprim-sulphamethoxazole (88.4%), nalidixic acid (60.9%) chloramphenicol (58.0%), kanamycin (55.1%), cephalothin (44.9%), gentamicin (39.1%), and ciprofloxacin (33.3%). Only 2.9, 5.8, and 8.7% of isolates were resistant to amikacin, amoxicillin-clavulanic acid, and cefoxitin, respectively. All isolates were susceptible to ceftiofur and ceftriaxone. Resistance to chloramphenicol, kanamycin and streptomycin was significantly more common ($P<0.05$) in isolates from both healthy and diarrheal pigs compared to those from pig farmers. Resistance to nalidixic acid was significantly more common ($P<0.001$) in isolates from diarrheal pigs than in isolates from healthy pigs and from pig farmers. Although resistance to ciprofloxacin in isolates from pig farmers was not different from healthy pigs, it was significantly less common than in isolates from diarrheal piglets. Isolates from diarrheal pigs were resistant to five to twelve antimicrobials. Isolates from healthy pigs and pig farmers were resistant to four to ten and three to nine antimicrobials, respectively. Isolates from non-farmers were resistant to one to eight antimicrobials (Fig 2).

Ninety-seven out of 143 isolates (67.8%) of isolates from non-farmers were resistant to at least one antimicrobial and 74.2% of those resistant isolates were multidrug resistant. The levels of resistance were 72.2% for tetracycline, 61.8% for sulphamethoxazole, 56.7% for streptomycin, 50.5% for ampicillin, 42.3% for trimethoprim-sulphamethoxazole, 17.5% for nalidixic acid, 13.4% for ciprofloxacin, 10.3% for streptomycin, 4.1% for amoxicillin-clavulanic acid, 3.1% for gentamicin, and 1.0% for amikacin, with all being lower than those from swine isolates (data not shown).

A comparison of antibiotic susceptibility between integron-positive and integron negative isolates from swine and pig farmers shows that a similar percentage on integron-positive and integron-negative isolates were resistant to all test antibiotics, except for ampicillin and chloramphenicol, to which fewer integron-negative isolates were resistant (Table 5).

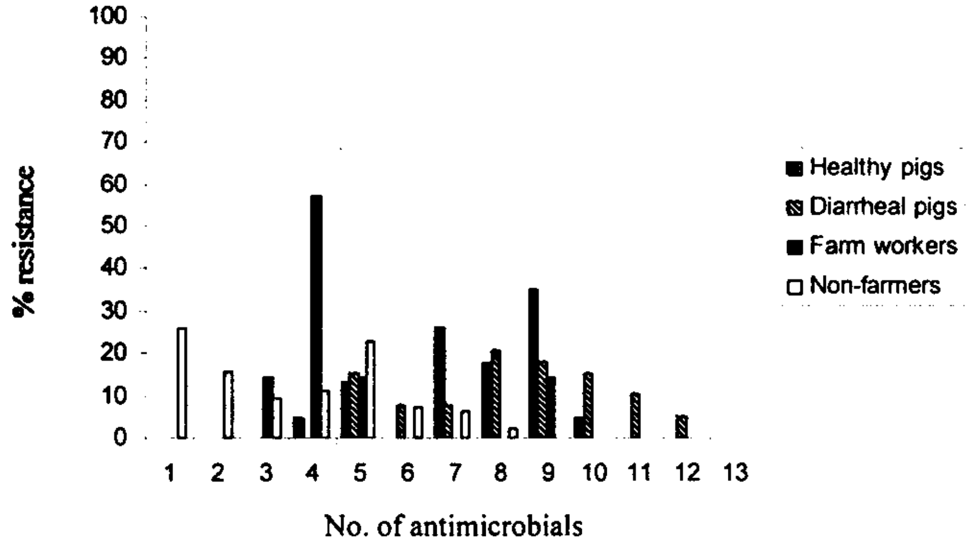

Fig. 2. Multiple antimicrobial resistance of integron-positive *E. coli* isolated from pigs, pig farmers and non-farmers.

Table 6 provides a comparison of resistance patterns for integron-positive and integron-negative isolates from swine. A total of 47 different resistance patterns were observed among 69 integron-positive isolates. The most frequent pattern was TET-CIP-GEN-NAL-SUL-SXT-KAN-AMP-STR (10.1%), which was found in isolates from diarrheal and healthy pigs. Isolates with resistance to CHL-TET-NAL-SUL-SXT-AMP-STR were also found in both diarrheal and healthy pigs. Two isolates from diarrheal pigs exhibited resistance to the highest number of antimicrobials (12) with those being FOX-CHL-TET-AMC-CIP-GEN-NAL-SUL-SXT-CEF-AMP-STR and FOX-CHL-TET-AMC-CIP-NAL-SUL-SXT-CEF-KAN-AMP-STR.

As with integron-positive isolates, all 25 integron-negative isolates demonstrated resistance to multiple antibiotics (resistance to four to eleven antimicrobials). However, only 6 patterns were shared between integron-positive and integron-negative isolates.

Table 7 provides information regarding resistance patterns of integron-positive isolates from diarrheal and healthy pigs and pig farmers on the same farm. Multiple resistances were observed for all isolates from both classes of swine and from pig farmers, with all *E coli* demonstrating resistance to at least three antimicrobials. Only one resistance pattern, TET-CIP-GEN-NAL-SUL-SXT-KAN-AMP-STR, was found in both diarrheal and healthy pigs. There were no common resistance patterns observed between pigs and pig farmers.

The antimicrobial susceptibility of *E. coli* isolates from retail pork is shown in Table 8. Overall, the highest percentage of resistance was found to sulphamethoxazole (100%), tetracycline (76.9%), ampicillin (69.2%), streptomycin (64.1%), trimethoprim-sulphamethoxazole (59.0%), cephalothin (51.3%), Chloramphenicol (48.7%), amoxicillin-clavulanic acid (33.3%), nalidixic acid (30.8%), kanamycin (23.1%), and gentamicin (12.8%). Only 2.6, 2.6 and 5.1% of isolates were resistant to ceftriaxone, imipenem and ciprofloxacin, respectively. All isolates were susceptible to amikacin. Resistance to ampicillin, amoxicillin-clavulanic acid, chloramphenicol, tetracycline, and trimethoprim-sulphamethoxazole was significantly more common ($P<0.05$) in integron-positive isolates than in integron-negative isolates. All isolates were resistant to one to eleven antimicrobial agents. Multidrug resistance was found in 90% of the isolates (Fig. 3).

Table 9 provides resistance patterns found in *E. coli* from retail pork. Nineteen patterns was found among 22 integron-positive isolates while integron-negative isolates had 12 patterns. Only one resistance pattern (SUL) was found in both groups.

Table 4. Frequency of resistance to 16 antimicrobials in integron- positive *E. coli* from various swine groups and pig farmers

Antimicrobials	Number of resistant strains (%)							
	Healthy pigs (n=23)		Diarrheal pigs (n= 39)		Pig farmers (n=7)		Total (n=69)	
	R	I	R	I	R	I	R	I
β-Lactams								
Ampicillin	23(100.0)[a]	0(0.0)	34(87.2)[a]	0(0.0)	7(100.0)[a]	0(0.0)	64(92.8)	0(0.0)
Amoxicillin+clavulanic acid	0(0.0)[a]	2(8.7)	3(7.7)[a]	4(10.3)	1(14.3)[a]	0(0.0)	4(5.8)	6(8.7)
Cephalothin	11(47.8)[a]	7(30.4)	19(48.7)[a]	13(33.3)	1(14.3)[a]	6(85.7)	31(44.9)	26(37.7)
Ceftiofur	0(0.0)[a]	0(0.0)	0(0.0)[a]	0(0.0)	0(0.0)[a]	0(0.0)	0(0.0)	0(0.0)
Cefoxitin	0(0.0)[a]	5(21.7)	5(12.8)[a]	2(5.1)	1(14.3)[a]	0(0.0)	6(8.7)	7(10.7)
Ceftriaxone	0(0.0)[a]	0(0.0)	0(0.0)[a]	3(7.7)	0(0.0)[a]	0(0.0)	0(0.0)	3(4.3)
Chloramphenicol	15(65.2)[a]	0(0.0)	24(61.5)[a]	4(10.3)	1(14.3)[b]	0(0.0)	40(58.0)	4(5.8)
Tetracycline	22(95.7)[a]	0(0.0)	39(100.0)[a]	0(0.0)	6(85.7)[a]	0(0.0)	67(97.1)	0(0.0)
Aminoglycosides								
Amikacin	2(8.7)[a]	0(0.0)	0(0.0)[a]	0(0.0)	0(0.0)[a]	0(0.0)	2(2.9)	0(0.0)
Gentamicin	10(43.5)[a]	0(0.0)	17(43.6)[a]	0(0.0)	0(0.0)[b]	0(0.0)	27(39.1)	0(0.0)
Kanamycin	11(47.8)[a]	2(8.7)	26(66.7)[a]	4(10.3)	1(14.3)[b]	0(0.0)	38(55.1)	6(8.7)
Streptomycin	22(95.7)[a]	0(0.0)	37(94.9)[a]	0(0.0)	3(42.9)[b]	0(0.0)	62(89.9)	0(0.0)
Sulphonamides								
Sulphamethoxazole	23(100.0)[a]	0(0.0)	39(100.0)[a]	0(0.0)	7(100.0)[a]	0(0.0)	69(100.0)	0(0.0)
Trimethoprim+sulphamethoxazole	21(91.3)[a]	0(0.0)	34(87.2)[a]	0(0.0)	6(85.7)[a]	0(0.0)	61(88.4)	0(0.0)
Quinolones								
Nalidixic acid	11(47.8)[a]	2(8.7)	31(79.5)[b]	0(0.0)	0(0.0)[c]	0(0.0)	42(60.9)	3(4.3)
Ciprofloxacin	6(26.1)[ab]	1(4.3)	17(43.6)[a]	0(0.0)	0(0.0)[b]	0(0.0)	23(33.3)	1(1.4)

R, resistant; I, intermediate susceptible, [a,b,c] Values within row with different superscripts differ significantly ($P<0.05$)

Table 5. Comparison of frequency (%) of resistance to 16 antimicrobials in integron-positive and integron-negative *E. coli* from swine

Antimicrobials	Integron-positive (n=69)		Integron-negative (n=25)	
	R	I	R	I
β-Lactams				
Ampicillin	64(92.8)[a]	0(0.0)	17(68.0)[b]	1(4.0)
Amoxicillin+ clavulanic acid	4(5.8)[a]	6(8.7)	3(12.0)[a]	2(8.0)
Cephalothin	31(44.9)[a]	26(37.7)	15(60.0)[a]	7(28.0)
Ceftiofur	0(0.0)[a]	0(0.0)	0(0.0)[a]	0(0.0)
Cefoxitin	6(8.7)[a]	7(10.7)	0(0.0)[a]	0(0.0)
Ceftriaxone	0(0.0)[a]	3(4.3)	1(4.0)[a]	5(20.0)
Chloramphenicol	40(58.0)[a]	4(5.8)	7(28.0)[b]	9(36.0)
Tetracycline	67(97.1)[a]	0(0.0)	25(100.0)[a]	0(0.0)
Aminoglycosides				
Amikacin	2(2.9)[a]	0(0.0)	1(4.0)[a]	0(0.0)
Gentamicin	27(39.1)[a]	0(0.0)	7(28.0)[a]	1(4.0)
Kanamycin	38(55.1)[a]	6(8.7)	14(56.0)[a]	3(12.0)
Streptomycin	62(89.9)[a]	0(0.0)	19(76.0)[a]	0(0.0)
Sulphonamides				
Sulphamethoxazole	69(100.0)[a]	0(0.0)	25(100.0)[a]	0(0.0)
Trimethoprim+ sulphamethoxazole	61(88.1)[a]	0(0.0)	25(100.0)[a]	0(0.0)
Quinolones				
Nalidixic acid	42(60.9)[a]	3(4.3)	16(64.0)[a]	0(0.0)
Ciprofloxacin	23(33.3)[a]	1(1.4)	7(28.0)[a]	0(0.0)

R = resistant; I = intermediate susceptible

[a,b]Values within row with different superscripts differ significantly ($P<0.05$)

Table 6. Antibiograms of integron-positive and selected integron-negative *E. coli* from swine

Antibiogram (no. of isolates)	
Integron-positive (n=69)	Integron-negative (n=25)
AMK-CHL-TET-NAL-SUL-SXT-AMP-STR (1)	AMK-TET-SUL-SXT (1)
AMK-CHL-TET-NAL-SUL-SXT-CEF-AMP-STR (1)	CHL-TET-AMC-GEN-NAL-SUL-SXT-CEF-KAN-AMP-STR (1)
CHL-TET-CIP-GEN-NAL-SUL-SXT-AMP-STR (1)	CHL-TET-CIP-GEN-NAL-SUL-SXT-KAN-AMP-STR (1)
CHL-TET-CIP-GEN-NAL-SUL-SXT-CEF-AMP (1)	CHL-TET-CIP-NAL-CTF-SUL-SXT-CEF-KAN-AMP (1)
CHL-TET-CIP-GEN-NAL-SUL-SXT-CEF-KAN-AMP-STR (3)	CHL-TET-NAL-SUL-SXT-CEF-AMP-STR (1)[b]
CHL-TET-SUL-SXT-CEF-AMP-STR (1)	CHL-TET-NAL-SUL-SXT-KAN-AMP (1)
CHL-TET-CIP-NAL-SUL-SXT-AMP-STR (1)	CHL-TET-SUL-SXT-AMP-STR (1)[a]
CHL-TET-CIP-NAL-SUL-SXT-CEF-AMP (1)	CHL-TET-SUL-SXT-CEF-KAN-AMP-STR (1)[c]
CHL-TET-CIP-NAL-SUL-SXT-CEF-KAN-AMP-STR (2)	FOX-TET-NAL-SUL-SXT-CEF-AMP-STR (1)
CHL-TET-GEN-NAL-SUL-SXT-AMP-STR (1)	TET-AMC-CIP-GEN-NAL-SUL-SXT-CEF-KAN-AMP-STR (1)
CHL-TET-GEN-NAL-SUL-SXT-CEF-KAN-AMP (1)	TET-AMC-CIP-GEN-NAL-SUL-SXT-KAN (1)
CHL-TET-GEN-NAL-SUL-SXT-CEF-KAN-AMP-STR (2)	TET-CIP-GEN-NAL-SUL-SXT-CEF-KAN-AMP-STR (2)[d]
CHL-TET-GEN-NAL-SUL-SXT-KAN-AMP-STR (1)	TET-CIP-NAL-SUL-SXT-CEF-AMP-STR (1)
CHL-TET-GEN-NAL-SUL-SXT-KAN-STR (1)	TET-GEN-NAL-SUL-SXT-KAN-AMP-STR (1)
CHL-TET-GEN-SUL-SXT-AMP-STR (1)	TET-NAL-SUL-KAN-AMP-STR (1)
CHL-TET-GEN-SUL-SXT-CEF-KAN-AMP-STR (2)	TET-NAL-SUL-SXT-CEF-AMP-STR (1)
CHL-TET-NAL-SUL-SXT-AMP-STR (2)	TET-NAL-SUL-SXT-CEF-KAN-STR (1)
CHL-TET-NAL-SUL-SXT-STR (1)	TET-NAL-SUL-SXT-KAN-STR (1)
CHL-TET-SUL-SXT-AMP-STR (1)[a]	TET-SUL-SXT-AMP (1)[e]
CHL-TET-NAL-SUL-SXT-KAN-AMP-STR (2)	TET-SUL-SXT-CEF (1)
CHL-TET-NAL-SUL-SXT-CEF-AMP-STR (1)[b]	TET-SUL-SXT-CEF-AMP-STR (1)[f]
CHL-TET-SUL-SXT-CEF-KAN-AMP-STR (1)[c]	TET-SUL-SXT-CEF-KAN-STR (1)
CHL-TET-GEN-SUL-SXT-KAN-AMP-STR (1)	TET-SUL-SXT-CEF-STR (1)
CHL-TET-SUL-AMP-STR (1)	TET-SUL-SXT-STR (1)
CHL-TET-SUL-SXT-KAN-AMP-STR (2)	
CHL-TET-SUL-SXT-STR (2)	
FOX-CHL-TET-AMC-CIP-GEN-NAL-SUL-SXT-CEF-AMP-STR (1)	
FOX-CHL-TET-AMC-CIP-NAL-SUL-SXT-CEF-KAN-AMP-STR(1)	
FOX-CHL-TET-AMC-SUL-SXT-KAN-AMP-STR (1)	
FOX-CHL-TET-CIP-NAL-SUL-SXT-CEF-KAN-AMP-STR(1)	
FOX-CHL-TET-SUL-SXT-AMP-STR(1)	
SUL-CEF-AMP-STR (1)	
SUL-SXT-AMP-STR (1)	

Table 6. (cont.)

Antibiogram (no. of isolates)	
Integron-positive (n=69)	Integron-negative (n=25)
SUL-SXT-CEF-AMP-STR (3)	
TET-CIP-GEN-NAL-SUL-SXT-CEF-KAN-AMP-STR(3)[d]	
TET-CIP-GEN-NAL-SUL-SXT-KAN-AMP-STR (7)	
TET-CIP-NAL-SUL-KAN-AMP-STR (1)	
TET-GEN-NAL-SUL-CEF-KAN-AMP-STR (1)	
TET-NAL-SUL-KAN-STR (1)	
TET-NAL-SUL-SXT-CEF-KAN-AMP-STR (1)	
TET-NAL-SUL-SXT-KAN-AMP-STR (1)	
TET-SUL-AMP (1)	
TET-SUL-KAN-AMP-STR (2)	
TET-SUL-SXT-AMP (3)[e]	
TET-SUL-SXT-AMP-STR (1)	
TET-SUL-SXT-CEF-AMP-STR (1)	
TET-SUL-SXT-CEF-AMP-STR (1)[f]	

AMP = ampicillin; AMC = amoxicillin-clavulanic acid; CEF = cephalothin; FOX = cefoxitin; CTF = ceftiofur; CRO = ceftriaxone; CHL = chloramphenicol; TET = tetracycline; AMK = amikacin; GEN = gentamicin; KAN = kanamycin; STR = streptomycin; SUL = sulphamethoxazole, SXT = trimethoprim-sulphamethoxazole; NAL = nalidixic acid; CIP = ciprofloxacin

[a,b,c,d,e,f] resistance patterns found in both integron-positive and integron-negative isolates

Table 7. Antibiograms of integron-positive isolates from diarrheal and healthy pigs and pig farmers on the same farm

Antibiogram (nos. of isolates)		
Diarrheal pigs	Healthy pigs	Pig farmers
CHL-TET-CIP-GEN-NAL-SUL-SXT-CEF-KAN-AMP-STR	CHL-TET-CIP-GEN-NAL-SUL-SXT-CEF-AMP	FOX-CHL-TET-AMC-SUL-SXT-KAN-AMP-STR
CHL-TET-CIP-NAL-SUL-SXT-CEF-KAN-AMP-STR	CHL-TET-CIP-NAL-SUL-SXT-AMP-STR	SUL-SXT-AMP-STR
TET-CIP-GEN-NAL-SUL-SXT-CEF-KAN-AMP-STR	CHL-TET-GEN-NAL-SUL-SXT-KAN-AMP-STR	TET-SUL-AMP
TET-CIP-GEN-NAL-SUL-SXT-KAN-AMP-STR[a]	SUL-CEF-AMP-STR	TET-SUL-SXT-AMP
	TET-CIP-GEN-NAL-SUL-SXT-KAN-AMP-STR[a]	TET-SUL-SXT-AMP-STR
	TET-CIP-NAL-SUL-KAN-AMP-STR	

AMP = ampicillin; AMC = amoxicillin-clavulanic acid; CEF = cephalothin; FOX = cefoxitin; CHL = chloramphenicol; TET = tetracycline; GEN = gentamicin; KAN = kanamycin; STR = streptomycin; SUL = sulphamethoxazole, SXT = trimethoprim-sulphamethoxazole; NAL = nalidixic acid; CIP = ciprofloxacin

[a] resistance patterns found in both

Table 8 Comparison of frequency (%) of resistance to 15 antimicrobials in integron-positive and integron-negative *E. coli* from retail pork

Antimicrobials	Number of resistant strains (%)					
	Integron-positive (n=22)		Integron-negative (n= 17)		Total (n=39)	
	R	I	R	I	R	I
β-Lactams						
Ampicillin	19(86.4)^{a}	0(0.00	8(47.1)^{b}	1(5.9)	27(69.2)	1(2.6)
Amoxicillin+ clavulanic acid	11(50.0)^{a}	6(27.3)	2(11.8)^{b}	3(17.6)	13(33.3)	9(23.1)
Cephalothin	11(50.0)^{a}	6(27.3)	9(52.9)^{a}	1(5.9)	20(51.3)	7(17.9)
Ceftriaxone	0(0.0)^{a}	3(13.6)	1(5.9)^{a}	1(5.9)	1(2.6)	4(10.3)
Imipenem	0(0.0)^{a}	0(0.0)	1(5.9)^{a}	0(0.0)	1(2.6)	0(0.0)
Chloramphenicol	16(72.7)^{a}	0(0.0)	3(17.6)^{b}	0(0.0)	19(48.7)	0(0.0)
Tetracycline	20(90.9)^{a}	0(0.0)	10(58.8)^{b}	2(11.8)	30(76.9)	2(5.1)
Aminoglycosides						
Amikacin	0(0.0)^{a}	0(0.0)	0(0.0)^{a}	0(0.0)	0(0.0)	0(0.0)
Gentamicin	2(9.1)^{a}	0(0.0)	3(17.6)^{a}	0(0.0)	5(12.8)	0(0.0)
Kanamycin	6(27.3)^{a}	8(36.4)	3(17.6)^{a}	3(17.6)	9(23.1)	11(28.2)
Streptomycin	15(68.2)^{a}	6(27.3)	10(58.8)^{a}	7(41.2)	25(64.1)	13(33.3)
Sulphonamides						
Sulphamethoxazole	22(100.0)^{a}	0(0.0)	17(100.0)^{a}	0(0.0)	39(100.0)	0(0.0)
Trimethoprim+ sulphamethoxazole	18(81.8)^{a}	0(0.0)	5(29.4)^{b}	2(11.8)	23(59.0)	2(5.1)
Quinolones						
Nalidixic acid	8(36.4)^{a}	2(9.1)	4(23.5)^{a}	1(5.9)	12(30.8)	3(7.7)
Ciprofloxacin	1(4.5)^{a}	2(9.1)	1(5.9)^{a}	0(0.0)	2(5.1)	2(5.1)

R = resistant; I = intermediate susceptible

^{a,b}Values within row with different superscripts differ significantly ($P<0.05$)

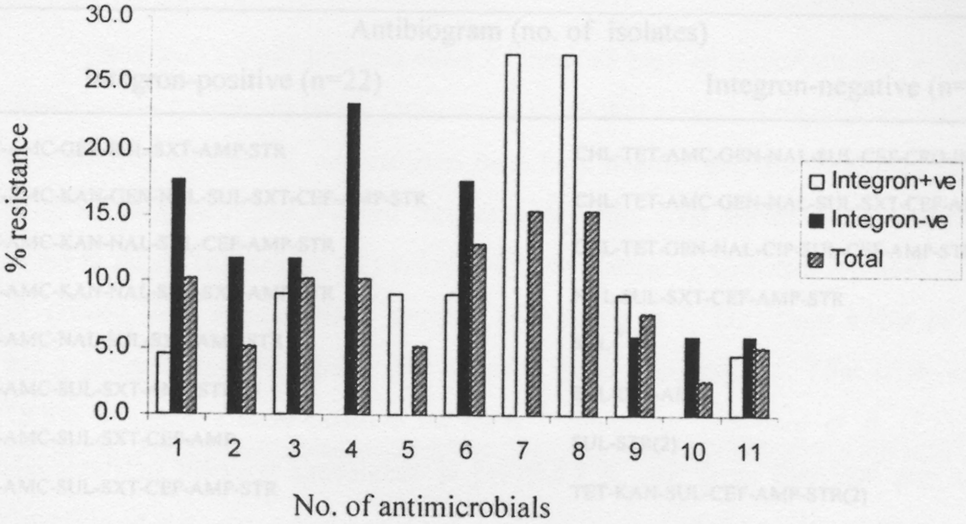

Fig. 3 Multiple antimicrobial resistance of integron-positive and integron-negative *E. coli* isolated from retail pork.

Table 9. Antibiograms of integron-positive and integron-negative *E. coli* from retail pork

Antibiogram (no. of isolates)	
Integron-positive (n=22)	Integron-negative (n=17)
CHL-TET-AMC-GEN-SUL-SXT-AMP-STR	CHL-TET-AMC-GEN-NAL-SUL-CEF-CRO-IMP-AMP-STR
CHL-TET-AMC-KAN-GEN-NAL-SUL-SXT-CEF-AMP-STR	CHL-TET-AMC-GEN-NAL-SUL-SXT-CEF-AMP-STR
CHL-TET-AMC-KAN-NAL-SUL-CEF-AMP-STR	CHL-TET-GEN-NAL-CIP-SUL-CEF-AMP-STR
CHL-TET-AMC-KAN-NAL-SUL-SXT-AMP-STR	NAL-SUL-SXT-CEF-AMP-STR
CHL-TET-AMC-NAL-SUL-SXT-AMP-STR	SUL [a] (3)
CHL-TET-AMC-SUL-SXT-AMP-STR(2)	SUL-CEF-AMP
CHL-TET-AMC-SUL-SXT-CEF-AMP	SUL-STR(2)
CHL-TET-AMC-SUL-SXT-CEF-AMP-STR	TET-KAN-SUL-CEF-AMP-STR(2)
CHL-TET-KAN-SUL-SXT-CEF-AMP	TET-KAN-SUL-STR
CHL-TET-NAL-SUL-SXT	TET-SUL-AMP-STR
CHL-TET-SUL-CEF-AMP	TET-SUL-SXT
CHL-TET-SUL-SXT-AMP-STR(2)	TET-SUL-SXT-CEF(2)
CHL-TET-SUL-SXT-CEF-AMP-STR	
SUL [a]	
SUL-CEF-AMP	
TET-AMC-NAL-SUL-SXT-CEF-AMP-STR(2)	
TET-CIP-KAN-NAL-SUL-SXT-AMP-STR	
TET-KAN-SUL-SXT-CEF-AMP-STR	
TET-SUL-SXT	

AMP = ampicillin; AMC = amoxicillin-clavulanic acid; CEF = cephalothin; CRO, ceftriaxone; CHL = chloramphenicol; TET = tetracycline; GEN = gentamicin; KAN = kanamycin; STR = streptomycin; SUL = sulphamethoxazole, SXT = trimethoprim-sulphamethoxazole; NAL = nalidixic acid; CIP = ciprofloxacin; IMP, imipenem

[a] resistance patterns found in both