

IV. RESULTS

4.1. Descriptive data

4.1.1. Results of the questionnaire survey

Results of the questionnaire survey are shown in table 6. These results refer to the distribution of selected factors related to meat shops including the shop per se and its owner as well.

It was found that 131 (45.9 %) out of 290 shops were selling other meat product(s) apart from pork. In all shops, meat was not wrapped. A great majority (245 out of 290 or 84.5 %) of the shops obtained meat from small household abattoirs, and the rest 15.5 % were supplied by municipal slaughterhouses.

Relating to the origin of meat, meat in most shops (238 out of 290 or 82.1 %) originated from Hanoi itself including urban and sub-urban areas, meat transported from the surrounding provinces such as Bac Ninh, Hai Duong, Ha Tay, etc. accounting for as low as 17.9 % of the shops.

Size of a shop was defined based on its daily sold amount from up-to 50 kg/day to greater than 250 kg/day. The results show that a majority (174 out of 290 or 60 %) of shops sold an average amount ranging from greater than 50 to 100 kg/day each followed by the number of shops that sold up-to 50 kg/day with 78 shops or 26.9 %. There were few shops having greater sold amount of than 150 kg daily, particularly 1 %, 0.7 % and 0.7 % for average amount per day of >150 – 200, >200 – 250 , and >250, respectively.

Table 6. Distribution of selected factors related to meat shops

Factors		No. of shops selected (n)	%
Product(s) offered	Pork only	159	54.10
	Pork and other(s)	131	45.90
Wrapping	Wrapped	0	0
	Non-wrapped	290	100
Type of abattoir	Municipal	45	15.50
	Household	245	84.50
Origin of meat	Hanoi	238	82.10
	Other provinces	52	17.90
Daily sold amount (kg)	Up to 50	78	26.90
	>50 – 100	174	60
	>100 – 150	31	10.70
	>150 – 200	3	1
	>200 – 250	2	0.70
	>250	2	0.70
Residence of owner	Urban Hanoi	111	38.30
	Suburban Hanoi	170	58.60
	Other provinces	9	3.10
Education attainment of owner	Primary	125	43.10
	Junior secondary	132	45.50
	Senior secondary	33	11.40
	Professional	0	0
Sex	Male	8	2.76
	Female	282	97.24
Age (year)	Up to 30	41	14.14
	>30 – 40	139	47.93
	>40 – 50	95	32.76
	>50	15	5.17
Experience (year)	Up to 3	26	8.97
	>3 – 10	158	54.48
	>10	106	36.55

With regard to the owners, the individual profiles such as residence, education attainment, sex, age, and experience years were taken into account. Results in table 6 show that most (170 out of 290 or 58.6 %) shop owners resided in suburban areas of the city, only 9 or 3.1 % came from other provinces, and 111 or 38.3 % had residence in urban areas of Hanoi. Results on the education attainment of the owners indicate that none of the shop owners had experienced a professional training course on meat

and food hygiene or any other professional courses or higher education. All of them attained a highest education level at primary school (43.1 %), junior secondary school (45.5 %), or senior secondary school (11.4 %). Most of the shop owners were female accounting for 282 out of 290 or 97.24 %. Number of owners aging from >30 – 40 years old was highest occupying 139 out of 290 or 47.93 %, followed by groups of >40 – 50 and up-to 30 with 32.76 % and 14 %, respectively. There were few (15 out of 290 or 5.17 %) persons older than 50. In terms of number of experience years or seniority, most (54.48 %) of the owners had from more than three to ten years experience in their job. A minority (8.97 %) of them had little experience with not more than three years in their job.

4.1.2. Results of the qualitative analysis

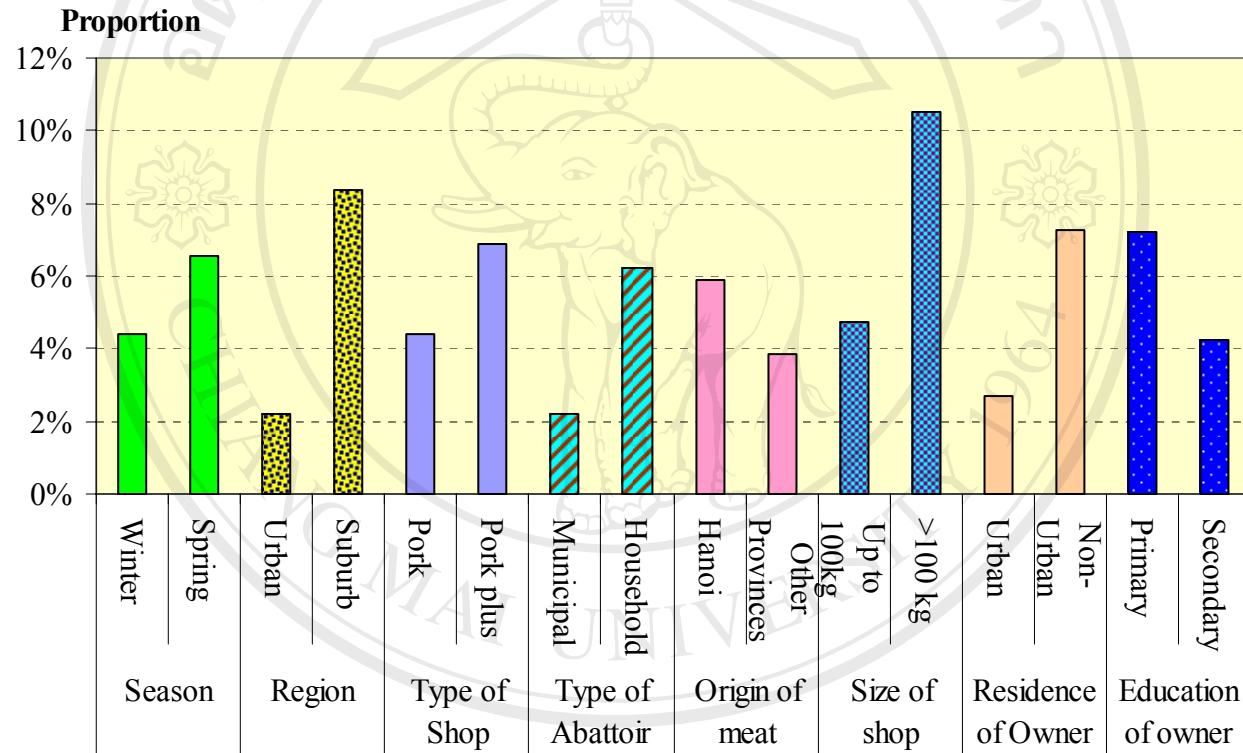
Fifteen samples were positive, and 16 samples were inconclusive for tetracycline residues in the qualitative assay. Of the 16 inconclusive samples, one was confirmed by HPLC. These fifteen positive samples in the qualitative assay and one sample confirmed by HPLC were all defined as positive samples in qualitative analysis to calculate the proportion of tetracycline residues in pork.

The results in table 7 show that 16 samples positive to tetracycline antibiotic residues, or (5.52%) out of total 290 analyzed samples, were detected. The proportion of positive results separated into season, geographical region, type of shop identified by kind of product(s) offered, type of abattoir, origin of meat, daily sold amount or size of shop, owner's residence and education attainment are shown in figure 1.

Table 7. Proportions of Tetracycline-positive muscle samples and analysis of potential risk factors

Variables	No. of samples (n)	No. of Positive samples	% Positive samples	95% CI	Fisher's Exact Test P-value ($\alpha = 0.05$)	Odds Ratio (95% CI)
Season						
Early Winter	137	6	4.38	[1.79, 9.70]	0.294514	-
Early Spring	153	10	6.54	[3.36, 12.01]		
Region						
Urban	135	3	2.22	[0.58, 6.86]	0.018414	4.03 [1.12, 14.45]
Sub-urban	155	13	8.39	[4.72, 14.21]		
Type of shop						
Pork only	159	7	4.40	[1.94, 9.21]	0.254633	-
Pork and other(s)	131	9	6.87	[3.39, 13.01]		
Type of abattoir						
Municipal	45	1	2.22	[0.13, 14.41]	0.257001	-
Household	245	15	6.22	[3.59, 10.10]		
Origin of meat						
Hanoi	238	14	5.88	[3.38, 9.88]	0.427928	-
Other provinces	52	2	3.85	[0.67, 14.33]		
Daily sold amount						
Up to 100 kg	252	12	4.76	[2.60, 8.38]	0.142307	-
>100 kg	38	4	10.53	[3.43, 25.74]		
Residence of owner						
Urban	111	3	2.70	[0.70, 8.28]	0.078638	-
Non-urban	179	13	7.26	[4.08, 12.36]		
Education attainment of owner						
Primary	125	9	7.20	[3.55, 13.61]	0.201916	-
Secondary	165	7	4.24	[1.87, 8.89]		
Total	290	16	5.52	[3.29, 8.98]	-	-

Figure 1. Proportions of Tetracycline-positive muscle samples by selected factors



4.1.3. Content of tetracycline compounds residues in pork

Fifteen positive and sixteen inconclusive samples from the screening test were analyzed by using HPLC. Tetracycline compounds were found and quantified in only six samples. Results of HPLC confirmation and quantification of tetracycline compounds in pork are shown in table 8 and illustrated in figure 2.

Table 8. Concentration of tetracycline compounds in pork quantified by HPLC

ID No.	Season		Region		Concentration (ppb)			Total	>MRL (100 ppb)
	Win	Spr	Urb	Sub	OTC	TC	CTC		
42	X			X	167.40	-	-	167.40	X
46	X			X	-	63.41	-	63.41	
107	X			X	97.11	-	95.15	192.26	X
15		X		X	-	59.51	-	59.51	
40		X		X	-	51.77	-	51.77	
78		X		X	-	68.14	-	68.14	
Mean					132.60	60.70	95.15	100.42	

Note:

Win: Winter

Spr: Spring

Urb: Urban

Sub: Suburban

OTC: oxytetracycline;

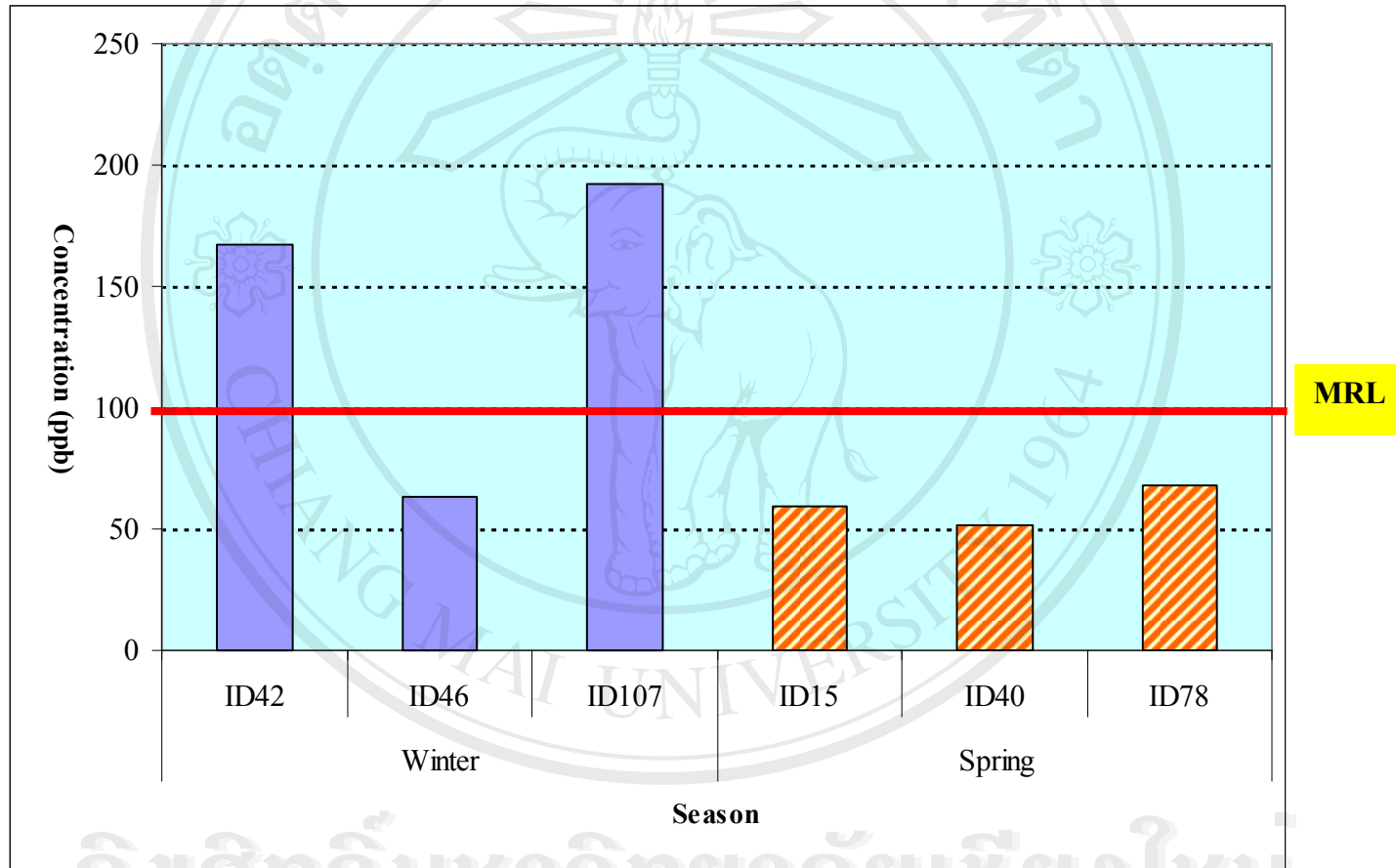
TC: tetracycline;

CTC: chlortetracycline;

X: yes;

- : not detected.

Figure 2. Total concentration of tetracycline compounds corresponding to the MRL



The results indicate that six samples (three in the winter time and the other three in the spring time) were detected containing at least one compound of the tetracycline group with concentrations ranging from 51.77 to 167.40 $\mu\text{g}/\text{kg}$. Particularly, oxytetracycline was identified in two samples with concentrations of 167.40 and 97.11 $\mu\text{g}/\text{kg}$; tetracycline ranging from 51.77 to 68.14 $\mu\text{g}/\text{kg}$ in four samples; and chlortetracycline found in only one sample with a concentration of 95.15 $\mu\text{g}/\text{kg}$. Among the six samples, one contained two compounds of tetracycline group namely oxytetracycline and chlortetracycline with 97.11 and 95.15 $\mu\text{g}/\text{kg}$, respectively. Total of these two compounds as 192.26 $\mu\text{g}/\text{kg}$ exceeds the MRL for pig muscle. Another one alone contained oxytetracycline alone at concentration of 167.40 $\mu\text{g}/\text{kg}$ exceeding the MRL. Thus two out of six samples, in which tetracyclines were found, contained an amount of these substances in combination exceeding the MRL.

4.2. Inferential analysis

Table 7 demonstrates that most differences, except the one between urban and suburban markets, are not significantly associated with antibiotic residue. The significant difference in the antibiotic residue proportions between the two areas – urban and suburban is shown. An odds ratio of 4.03 in this study indicated that raw pork offered on the suburban markets was about four times more likely in being contaminated by antibiotics at detectable levels than those sold on the urban markets.