Global Veterinaria 17 (1): 15-24, 2016
ISSN 1992-6197

DOI: 10.5829/idosi.gv.2016.17.01.104124

Causes and Associated Financial Losses of Carcass and Organ Condemnations in the SODEPA Abattoir of Yaoundé, Cameroon

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Abstract: Cattle production in Cameroon is limited by disease risks, condemnations during meat inspections and great economic losses. There is dearth in data relating to reasons for carcass condemnations and their economic implications in Cameroon. This study was, therefore, carried out to determine the causes for organs and carcasses condemnations in SODEPA abattoir of Yaoundé and their financial implications. A total of 15,659 (4.90%; 4.62-5.38%) of 319,475 cattle slaughtered from April 2006 to August 2012 warranted condemnations. The major cause was fasciolosis (4.69%; 4.45 - 5.06%), followed by tuberculosis (0.16%; 0.11-0.27%) and less than 0.1% for other causes including abscesses, pericarditis, pneumonia, congestion, mastitis and cirrhosis. However, *ante mortem* examination of 2,400 zebu cattle (Gudali, White and Red Fulani), 197 (8.21%) showed clinical signs, which were not significantly affected (P>0.05) by breed and sex, including emaciation, crusts, depilation and lacerations, presence of ticks, lameness, diarrhea, tiredness, udder inflammation, cutaneous nodules and orchitis. *Post mortem* examination showed 40.46% (38.45-42.45%) organs and carcasses condemnations with fasciolosis, tuberculosis and abscesses being the main reasons. Liver and lungs were the common organs condemned and the number of carcasses and organs seized varied significantly (P < 0.05) with breed and sex of the animals. Goudali and Red Fulani zebus were significantly affected and female than male. The liver was condemned for fasciolosis (>90%); lungs for tuberculosis (>70%), abscesses and pneumonia; heart, kidney and udder for pericarditis, abscesses and mastitis, respectively. Carcasses were seized for tuberculosis. The financial loss related to organs and carcasses condemned following slaughter meat inspection of 2400 zebu cattle and during the period of December 2013 to March 2014 in the SODEPA Yaoundé abattoir was estimated at over over 18,129,600 FCFA (approximately 27,891.69) equivalent to more than 338,914,732 FCFA / year (approximately 521,407.28 / year). Condemnations of whole carcasses and liver contributed to over 53% and 42% of the estimated financial losses, respectively. Abscesses and tuberculosis were the major causes of condemnation of whole carcasses at the SODEPA Yaoundé abattoir with enormous financial implications and fasciolosis was the most important motive for organ condemnation in the abattoir.

Key words: Cattle · Meat Inspection · Motives for Condemnation · Financial Losses · SODEPA Abattoir Yaoundé · Cameroon

INTRODUCTION

Cattle production in Cameroon is limited by many constraints including high disease risks [1] and condemnations of large quantities of meat, giblets and other animal products in the abattoir leading to enormous economic losses [2]. The release of unsafe meat and animal products into the market for human consumption can lead to serious public health risks [3]. Abattoirs worldwide and particularly in developing countries are important sources of epidemiologic surveillance and diseases prevalence data [2, 4]. *Ante mortem* examination of clinical signs in animals generally leads to withdrawal of the animals as they are judged as not fit for slaughter. While post mortem examinations of lesions would lead to partial or entire condemnations of affected carcasses.

Many carcass condemnations have been documented in abattoirs including major specific cases such as 0.18 to 4.25% due to tuberculosis in some abattoirs in Cameroon [5, 6] 26.9% due to fasciolosis in Gondar Elfora Abattoir in Ethiopia [7] and 23.41% due to fasciolosis in Zaria abattoir in Nigeria [8] as well as

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condemnations due to cysticercosis, hydatidosis and non-specifics cases of condemnations such as congestion, abscesses, emphysema, cirrhosis, pericarditis and pleuropneumonia [5, 7-9]. However, there is dearth in data relating to reasons for carcass condemnations and their economic implications in Cameroon. This study was, therefore, carried out to determine the causes for organs and whole carcasses condemnations in SODEPA slaughterhouse of Yaoundé and their financial implications.

MATERIAL AND METHODS

Study Population and Sampling Procedure: A total of 2,400 *Bos indicus* zebus cattle judged as fit for slaughter at the SODEPA slaughterhouse in Yaoundé [3° 45' & 3° 59' latitude North and 10° 94' &11° 58' longitude East] were used in the study. The animals originated from the North, Adamawa and Eastern regions of Cameroon and were transported by train or trucks. However, the minimum sample size for the study was calculated according to Thrusfield [10] based on an expected prevalence of carcass condemnations of 53% [11]. Briefly, at the rhythm of 3 days per week, from December 2013 to March 2014, the first 50 animals brought for slaughter were randomly selected and subjected to strict *ante*- and *post*- mortem examinations. For *ante mortem* examination, animals brought for slaughter were clinically examined carefully in the liarage of the abattoir. The breed, sex, behaviour, health condition, gait and attitude of the animals were recorded. At the end of the examination, animals intended to slaughter were selected. Following slaughter, the carcasses and organs were examined for abnormalities and certified as good for human consumption or condemned in accordance with standard meat inspection recommendations [3,12].

However, retrospective study of abattoir records to determine causes of carcass condemnation as well as the parts condemned was done for the period of April 2006 to August 2012.

Assessment of Economic Losses: For the assessment of economic loss during the period April 2006 and August 2012, the analysis was based on annual slaughter capacity of the SODEPA abattoir Yaoundé, average market price of each organ in Yaoundé town within the period and condemnation rate of carcasses and organs. The average market price was determined by interviewing butchers and consulting with officials of the Chamber of Trade and Commerce of Cameroon. The economic loss due to condemnation was estimated as previously described by Ogunrinade and Ogunrinade and Ogunrinde [13] as follows:

$$EL = \blacktriangleleft srx \times Coy \times Roz$$

where: EL = Annual economic loss estimated due to organ condemnation; ◂ srx = Annual number of cattle slaughtered at the abattoir; Coy = Average cost of each liver/lung/heart/kidney; Roz = Condemnation rate of each liver/ lung/ heart/ kidney

However, for the estimation of the immediate financial losses, the total number and weights of whole or partially condemned carcasses and organs and costs per kilogram of whole carcass and affected carcass parts in Yaoundé were used. The mean cost per kilogram of meat, viscera and other parts were obtained through interviews with butchers and officials of the Chamber of Trade and Commerce of Cameroon. The immediate financial losses following inspection were calculated according to Mbaya *et al*. [14] as follows:

$$DFL = nW * Av.P/kg$$

where: DFL = the Direct Financial Losses; n = number of condemned carcasses and or organs; W = weight of organs and or carcasses; Av.P/kg = average price per kilogram of meat and or giblets.

Data Analysis: Collected data was analyzed in Microsoft Office Excel 2007 using descriptive statistics. The prevalence of different causes of organs and or carcass condemnations was calculated as the number of causes of organs and or carcass condemnations divided by the overall number of cattle slaughtered [15]. The Chi Square test was used to determine various degree of associations.

RESULTS AND DISCUSSION

Retrospective Assessment of Causes of Condemnation: There are no records of *ante mortem* inspections of animals destined for slaughter in the SODEPA Yaoundé abattoir for the period April 2006 to August 2012. However, there were pathologic lesions in 15,659 of 319,475 cattle slaughtered during this period that warranted condemnations (Table 1) equivalent to a rate of 4.90% (4.62-5.38%). Fasciolosis was the major cause of condemnations with a rate of 4.69% (4.45-5.06%) followed by tuberculosis at 0.16% (0.11-0.27%); while less

Table 1: Annual and seasonal prevalence rates of causes of condemnations in SODEPA Yaoundé abattoir from April 2006 to August 2012

		Number and prevalence rate (%) [95% CI] of pathologies								
Duration	Number of animals (%)	Fasciolosis	Tuberculosis	Abscess	Pericarditis	Pneumonia	Congestion	Mastitis	Cirrhosis	Total
Year										
2006	31582	2200 (6.97)^{a}	259 (0.82)^{a}	35 (0.11)^{a}	17 (0.05)^{a}	0 (0.0)	1 (0.003)^{a}	4 (0.01)^{a}	2 (0.006)^{a}	2518 (7.97)^{a}
	(9.9)	[6.67-7.27]	[0.40-1.38]	[0.06-0.16]	[0.02-0.10]	-	[0.00-0.01]	[0.0-0.03]	[0.0-0.016]	[7,67-8,27]
2007	45039	2132 (4.73)^{b}	126 (0.28)^{b}	23 (0.05)^{b}	6 (0.01)^{b}	4 (0.009)^{a}	1 (0.002)^{a}	3 (0.007)^{ab}	1 (0.002)^{ab}	2296 (5.10)^{b}
	(14.1)	[4.53-4.93]	[0.20-0.39]	[0.03-0.07]	[0.0-0.03]	[0.0-0.02]	[0.0-0.006]	[0.0-0.02]	[0.0-0.008]	[4.90-5.30]
2008	46644	1604 (3.44)^{c}	75 (0.16)^{bc}	15 (0.03)^{b}	4 (0.008)^{b}	1 (0.002)^{a}	1 (0.002)^{a}	0 (0.0)	0 (0.0)	1700 (3.65)^{c}
	(14.6)	[3.23-3.65]	[0.11-0.21]	[0.01-0.06]	[0.0-0.016]	[0.0-0.007]	[0.0-0.007]	-	-	[3,44-3,85]
2009	49476	1800 (3.69)^{c}	31 (0.06)^{c}	1 (0.002)^{c}	5 (0.010)^{b}	5 (0.010)^{ab}	0 (0.0)	1 (0.002)^{ab}	0 (0.0)	1843 (3.73)^{c}
	(15.5)	[3.52-3.75]	[0.03-0.09]	[0.0-0.007]	[0.0-0.019]	[0.0-0.021]	-	[0.0-0.007]	-	[3.59-3.84]
2010	50946	2505 (4.92)^{b}	22 (0.043)^{c}	8 (0.016)^{c}	2 (0.004)^{b}	12 (0.023)^{b}	0 (0.0)	0 (0.0)	0 (0.0)	2549 (5.00)^{b}
	(15.9)	[4.58-5.16]	[0.004-0.074]	[0.0-0.031]	[0.0-0.009]	[0.008-0.035]	-	-	-	[4.63-5.27]
2011	56290	2756 (4.90)^{b}	9 (0.016)^{c}	0 (0.0)	3 (0.005)^{b}	3 (0.005)^{a}	1 (0.002)^{a}	0 (0.0)	0 (0.0)	2772 (4.92)^{b}
	(17.6)	[4.60-5.30]	[0.0-0.028]	-	[0.0-0.011]	[0.0-0.013]	[0.0-0.005]	-	-	[4.63-5.27]
2012	39498	1977 (5.00)^{b}	2 (0.005)^{c}	1 (0.002)^{c}	1 (0.002)^{b}	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1981 (5.04)^{b}
	(12.4)	[4.83-5.19]	[0.0-0.017]	[0.0-0.008]	[0.0-0.008]	-	-	-	-	[4.84-5.20]
Season										
Rainy	160488	7533 (4.69)^{d}	272 (0.17)^{d}	51 (0.03)^{d}	19 (0.012)^{c}	13 (0.008)^{c}	1 (0.001)^{b}	7 (0.004)^{c}	2 (0.001)^{c}	7898 (4.92)^{d}
	(50.2)	[4.30-5.29]	[0.08-0.34]	[0.02-0.06]	[0.004-0.025]	[0.003-0.013]	[0.0-0.002]	[0.0-0.010]	[0.0-0.004]	[4.44-5.70]
Dry	158987	7411 (4.68)^{d}	252 (0.158)^{d}	32 (0.020)^{d}	19 (0.012)^{c}	12 (0.007)^{c}	3 (0.009)^{b}	1 (0.001)^{c}	1 (0.001)^{c}	7761 (4.88)^{d}
	(49.8)	[4.34-5.08]	[0.084-0.269]	[0.012-0.033]	[0.004-0.021]	[0.003-0.011]	[0.0-0.010]	[0.0-0.002]	[0.0-0.002]	[4.49-5.37]
Total	319475	14974 (4.69)	524 (0.164)	83 (0.026)	38 (0.012)	25 (0.008)	4 (0.001)	8 (0.002)	3 (0,001)	15659 (4.90)
		[4.45-5.06]	[0.114-0.272]	[0.019-0.040]	[0.007-0.020]	[0.004-0.011]	[0.0-0.003]	[0.0-0.004]	[0.0-0.002]	[4.62-5.38]

a, b, c, d : values in the same column for same category with the same superscript are not significantly different (P>0.05).

than 0.1% of condemnations was due to other pathologies such as abscesses, pericarditis, pneumonia, congestion, mastitis and cirrhosis. Though more condemnations due to pathologies occurred in the rainy season, particularly during the periods April to June, there was no significant differences (P>0.05) between seasons. Also, the liver (96.66%) was mostly condemned part followed by the lungs (3.0%) while the other condemned organs together were less than 1.0% (Table 2). While fasciolosis was the main motive for high condemnations of the liver, condemnations of the lungs, entire carcasses and to a moderate extend the udders was due to tuberculosis.

Table 2: Distribution of organ condemnation in SODEPA Yaoundé abattoir between April 2006 and August 2012

	Number and percentage (%)[95% CI] of condemned organs (n=15,659)						
Year	Whole carcass	Liver	Lungs	Heart	Kidney	Udder	Total
2006	2 (0.08)	2286 (90.79)	204 (8.10)	17 (0.67)	1 (0.04)	8 (0.32)	2518 (100)
	[0-0.26]	[88.54-93.87]	[5.59-9.98]	[0.24-1.01]	[0-0.01]	[0-0.55]	
2007	0	2169 (94.47)	118 (5.14)	6 (0.26)	0	3 (0.13)	2296 (100)
	-	[93.22-95.75]	[3.91-6.33]	[0.00-0.55]	-	[0.00-0.44]	
2008	0	1627 (95.70)	69 (4.06)	4 (0.23)	0	0	1700 (100)
	-	[94.31-97.07]	[2.73-5.41]	[0.01-0.44]	-	-	
2009	0	1806 (97.99)	31 (1.68)	5 (0.27)	0	1 (0.05)	1843 (100)
	-	[97.08-99.07]	[0.79-2.44]	[0.00-0.53]	-	[0.00-0.18]	
2010	0	2514 (98.63)	33 (1.29)	2 (0.08)	0	0	2549 (100)
	-	[98.06-99.55]	[0.37-1.86]	[0.00-0.19]	-	-	
2011	0	2756 (99.42)	13 (0.47)	3 (0.11)	0	0	2772 (100)
	-	[99.09-99.83]	[0.12-0.76]	[0.00-0.22]	-	-	
2012	0	1978 (99.85)	2 (0.10)	1 (0.05)	0	0	1981 (100)
	-	[99.60-100]	[0.00-0.33]	[0.00-0.17]	-	-	
Total	2 (0.01)	15136 (96.66)	470 (3.00)	38 (0.24)	1 (0.01)	12 (0.08)	15659 (100)
	[0.00-0.03]	[96.11-97.61]	[2.17-3.52]	[0.14-0.31]	[0.00-0.02]	[0.01-0.12]	

Table 3: Distribution of clinical signs recorded during *ante mortem* examination cattle according to breed and sex in the SODEPA Yaoundé abattoir from December 2013 to March 2014

	Number and percentage (%) of cattle showing clinical signs (n = 2400)											
Animals	Emaciation	Crusts on skin	Ticks	Alopecia	Skin laceration	Lameness	Diarrhoea	Tiredness	Inflammation of udder	Cutaneous nodules	Orchitis	Total
Breeds [$x^2$2 = 17. 884 ; p = 0.595]												
Goudali	33 (1.37)	9 (0.37)	6 (0.25)	8 (0.33)	3 (0.12)	4 (0.17)	4 (0.17)	1 (0.04)	5 (0.21)	2 (0.08)	2 (0.08)	77 (3.21)
White Fulani	19 (0.79)	6 (0.25)	5 (0.21)	5 (0.21)	7 (0.29)	7 (0.29)	4 (0.17)	5 (0.21)	1 (0.04)	1 (0.04)	0 (0.00)	60 (2.5)
Red Fulani	23 (0.96)	8 (0.33)	7 (0.29)	3 (0.12)	5 (0.21)	3 (0.12)	3 (0.12)	4 (0.17)	2 (0.08)	2 (0.08)	0 (0.00)	60 (2.5)
Sex [x2 = 12. 355; p = 0.260]												
Male	26 (1.08)	9 (0.38)	7 (0.29)	7 (0.29)	8 (0.33)	5 (0.21)	2 (0.08)	3 (0.13)	0 (0.00)	2 (0.08)	2 (0.08)	71 (2.95)
Female	49 (2.04)	14 (0.58)	11 (0.46)	9 (0.38)	7 (0.29)	9 (0.38)	9 (0.38)	7 (0.29)	8 (0.33)	3 (0.12)	0 (0.00)	126 (5.25)
Total	75 (3.12)	23 (0.96)	18 (0.75)	16 (0.67)	15 (0.63)	14 (0.58)	11 (0.46)	10 (0.42)	8 (0.33)	5 (0.21)	2 (0.08)	197 (8.21)

Table 4: Percentage, type and causes of condemnation of carcasses and organs from December 2013 to March 2014 in SODEPA Yaoundé abattoir

	Distribution of slaughtered animals (n=2400) according to carcass and organs condemnations					Condemned carcasses and organs (n=971)
Organs	Cause of condemnation	Type of condemnation	Number	Total	Rate of condemnation% (95% CI)	Rate of pathology observed% (95% CI)
Liver	Fasciolosis	Whole	168	785	32.71 (30.82-34.58)	80.84 (78.34-83.34)
		Partial	617			
	Cirrhosis	Whole	13	13	0.54 (0.25-0.83)	1.34 (0.62-2.06)
	Tuberculosis	Whole	13	13	0.54 (0.25-0.83)	1.34 (0.62-2.06)
	Abscesses	Whole	5	20	0.83 (0.47-1.19)	2,05 (1,17-2,95)
		Partial	15			
	Total	Whole	199	831	34.62 (32.72-36.52)	85.58 (83.38-87.78)
		Partial	632			
Lungs	Tuberculosis	Whole	23	68	2.84 (2.14-3.46)	7.00 (5.40-8.60)
		Partial	45			
	Abscesses	Whole	3	14	0.58 (0.28-0.88)	1.44 (0.70-2.18)
		Partial	11			
	Pneumonia	Whole	8	8	0.33 (0.10-0.56)	0.82 (0.25-1.39)
	Total	Whole	34	90	3,75 (2,99-4,51)	9,27 (7,47-11,07)
		Partial	56			
Heart	Pericarditis	Whole	8	8	0.33 (0.10-0.56)	0.82 (0.25-1.39)
Kidney	Abscesses	Whole	4	4	0.17 (0.01-0.33)	0.41 (0.01-0.81)
	Tuberculosis	Whole	4			
Carcass		Partial	8	12	0.50 (0.22-0.78)	1.23 (0.53-1.93)
	Abscesses of lymph nodes	Whole	14	14	0.58 (0.28-0.88)	1.44 (0.70-2.18)
Udder	Mastitis	Total	12	12	0.50 (0.22-0.78)	1.23 (0.53-1.93)
Total			971	971	40.46 (38.45-42.45)	100

Table 5: Distribution of causes of carcass and organ condemnations based on breed and sex in SODEPA Yaoundé abattoir

Condemned carcasses and organs / Cause of condemnation	Number and percentage (%) of lesions in condemned carcasses and organs (n = 971)					
	Breed			Sex		
	Goudali	White Fulani	Red Fulani	Male	Female	Total
Condemned carcasses and organs						
Whole carcass	1 (0.10)	3 (0.31)	8 (0.82)	5 (0.51)	7 (0.72)	12 (1.24)
Liver	432 (44.49)	177 (18.23)	222 (22.86)	398 (40.99)	433 (44.59)	831 (85.58)
Lungs	13 (1.34)	30 (3.09)	47 (4.84)	39 (4.02)	51 (5.25)	90 (9.27)
Heart	3 (0.31)	3 (0.31)	2 (0.21)	3 (0.31)	5 (0.51)	8 (0.82)
Kidney	1 (0.10)	1 (0.10)	2 (0.21)	2 (0.21)	2 (0.21)	4 (0.41)
Udder	6 (0.62)	2 (0.21)	4 (0.41)	0 (0.00)	12 (1.24)	12 (1.24)
Lymphatic nodes	2 (0.21)	4 (0.41)	8 (0.82)	4 (0.41)	10 (1.03)	14 (1.44)
Total	458 (47.17)	220 (22.66)	293 (30.18)	451 (46.45)	520 (53.55)	971 (100)
	$x^2 = 40.707$; $p = 0.000$			$x^2 = 13.644$; $p = 0.033$		
Cause of condemnation						
Fasciolosis	411 (42.33)	170 (17.51)	204 (21.01)	381 (39.24)	404 (41.61)	785 (80.84)
Tuberculosis	10 (1.03)	31 (3.19)	52 (5.36)	41 (4.22)	52 (5.36)	93 (9.58)
Abscesses	16 (1.65)	14 (1.44)	22 (2.27)	20 (2.06)	32 (3.30)	52 (5.36)
Pericarditis	3 (0.31)	3 (0.31)	2 (0.21)	3 (0.31)	5 (0.51)	8 (0.82)
Pneumonia	2 (0.21)	2 (0.21)	4 (0.41)	3 (0.31)	5 (0.51)	8 (0.82)
Cirrhosis	8 (0.82)	2 (0.21)	3 (0.31)	4 (0.41)	9 (0.93)	13 (1.34)
Mastitis	6 (0.62)	2 (0.21)	4 (0.41)	0 (0.00)	12 (1.24)	12 (1.24)
Total	456 (46.96)	224 (23.07)	291 (29.97)	452 (46.55)	519 (53.45)	971 (100)
	$x^2 = 48.504$; $p = 0.000$			$x^2 = 15.116$; $p = 0.019$		

Table 6: Annual rate of organ condemnation, direct financial losses and economic losses analysis of carcasses and organs condemnations in SODEPA Yaoundé abattoir

Organs and carcasses	Condemnation causes	Type of condemnation	Number condemned	Condemnation rates (%)	Weight# (Kg)	Cost per kg (FCFA)	Direct financial loss* (FCFA)	Annual economic loss (FCFA)
Liver	Fasciolosis	Whole	168	32.71	3.5	2500	1 470 000	37 330 288
		Partial	617		246.8	2500	617 000	
	Cirrhosis	Whole	13	0.54	3.5	2500	113 750	616 275
	Tuberculosis	Whole	13	0.54	3.5	2500	113 750	616 275
	Abscesses	Whole	5	0.83	3.5	2500	43 750	947 238
		Partial	15		6	2500	15 000	
	Total	Whole	199	34.62	3.5	2500	1 741 250	39 510 075
		Partial	632		252.8	2500	632 000	
Lungs	Tuberculosis	Whole	23	2.84	2.2	1500	75 900	1 944 690
		Partial	45		14.4	1500	21 600	
	Abscesses	Whole	3	0.58	2.2	1500	9 900	397 155
		Partial	11		3.5	1500	5 250	
	Pneumonia	Whole	8	0.33	2.2	1500	26 400	225 968
	Total	Whole	34	3.75	2.2	1500	112 200	2 567 813
		Partial	56		17.9	1500	26 850	
Heart	Pericarditis	Whole	8	0.33	1.3	2500	26 000	376 613
Kidney	Abscesses	Whole	4	0.17	/	1000	4 000	77 605
Carcasses	Tuberculosis	Whole	12	0.50	200	2500	6 000 000	136 950 000
	Abscesses of lymph nodes	Whole	14	0.58	200	2500	7 000 000	158 862 000
Udder	Mastitis	Whole	12	0.50	2.5	2500	75 000	570 625
	Grand Total cost	971	40.46			18 129 600	338 914 732	

: for whole = average weight per affected whole carcass or organ; for partial = sum of weights of all the affected part of carcass or organ

*Calculation of Direct financial loss: For Whole = [number of carcasses or organs condemned] x [average weight of whole carcass or organ] x [cost per kg of meat or affected organ]; For Partial = [sum of weights of all the affected part of carcass or organ / average weight per affected whole carcass or organ] x [average weight of whole carcass or organ] x [cost per kg of meat or affected organ]

Assessment of Causes of Condemnation for the Period December 2013 to March 2014

***Ante mortem* Examination:** During *ante mortem* examination, 197 (8.21%) of 2400 randomly selected cattle (Gudali, White and Red Fulani) destined for slaughter showed clinical signs such as emaciation, crusts, alopecia and lacerations, presence of ticks, lameness, diarrhoea, tiredness, udder inflammation, cutaneous nodules and orchitis (Table 3). However, breed ($x^2 = 17.884$; $p = 0.595$) and sex ($x^2 = 12.\ 355$; $p = 0.262$) of the animal did not significantly influence the signs recorded.

Post Mortem Examination: In this study, whole and partially condemned carcasses and organs due to various causes were recorded from a total of 971 of the 2400 slaughtered cattle after *post mortem* examinations. This was equivalent to a rate of 40.46% (38.45 - 42.45) with fasciolosis, tuberculosis and abscesses being the main motives for condemnation (Table 4). Also, the liver and lungs were the most condemned organs. While the liver was mostly condemned due to fasciolosis (over 90%) and the lungs due to tuberculosis (More than 70%), abscesses and pneumonia, the heart, kidney and udder were condemned due to pericarditis, abscesses and mastitis respectively. Tuberculosis was the motive for whole carcass condemnations. The number of carcasses and organs seized varied significantly ($P < 0.05$) with breed ($x^2 = 40.707$; $p = 0.000$) and sex ($x^2 = 13.644$; $p = 0.033$) of the animals. Goudali and Red Fulani zebus as well as female animals were most significantly affected (Table 5).

Financial Losses: The annual slaughter rate of the abattoir was estimated to be 45,650 cattle based on data of retrospective study of the abattoir. The annual estimated economic loss for the period April 2006 to August 2012 was found to be 338,914,732 FCFA per annum year (Approximately 521,407.28 at an estimated rate of 1 = 650 FCFA) (Table 6). The annual estimated economic losses due to organ condemnation alone were 43,102,732 FCFA. However, direct money losses associated to carcasses and organs condemnations for the December 2013 to March 2014 study period was estimated at over 18,129,600 FCFA (Approximately 27,891.69) (Table 6). Direct losses due to organ condemnation alone were 5,129,600 FCFA. Abscesses (39.04%), tuberculosis (34.26%) and fasciolosis (11.51%) were the main pathologies responsible for the financial losses recorded, while whole carcass (Over 87.28%) condemnations took the highest proportion of all the losses followed by the livers (11.66%) and lungs (0.76%).

DISCUSSION

Ante mortem inspection of zebu cattle destined for slaughter in the SODEPA Yaoundé abattoir showed many clinical signs including emaciation, crusts, alopecia and lacerations, ticks infestation, lameness, diarrhoea, fatigue, mastitis, cutaneous nodules and orchitis. However, breed and sex of the animal did not significantly influence the signs recorded. Emaciation was the main clinical sign in *ante mortem* examination followed by various skin abnormities and the other pathologies. This finding is similar to that reported in Gondar and Elfora abattoirs in Ethiopia [4, 16] but different from results obtained by Amene *et al*. [2] and Bawe *et al*. [17] who reported that tick infections and traumatisms were the main clinical signs in Jimma, Ethiopia and SODEPA Yaoundé abattoirs, Cameroon. Overpopulation of animals in inappropriate carrying vehicles or trucks, poor loading and unloading techniques of the animals, long-distance transportation without rest-refreshing intervals for the animals from livestock markets and production sites, poor weather, other stressful conditions including physical trauma, diseases and insufficiency in food and drinking water were responsible for the higher rate of emaciation and signs shown by animals in the SODEPA Yaoundé abattoir. Indeed, diseases such as tuberculosis and fasciolosis which induce weight losses, fatigue and others signs of poor condition are widespread in cattle producing areas of Cameroon [17, 18]. However, overpopulation and poor transportation conditions could explain skin disorders such as lacerations and lamenesses while tick infestation, alopecia and crusts could be associated to insufficient hygiene measures in cattle farms and environments.

Retrospective study of records and recent slaughter meat inspection of the SODEPA Yaoundé abattoir revealed that whole carcasses, liver, lungs, heart, kidney and udder were condemned for various types of lesions. The rate of liver condemnation in this study was highest followed by lungs, whole carcasses and other organs while fasciolosis was the most common cause for condemnation followed by tuberculosis, abscesses and other lesions such as pericarditis, pneumonia, congestion, mastitis and cirrhosis. The causes and rates of condemnations were not significantly influenced by season. The findings of this study are similar to those of Amene *et al*., [2] who reported condemnation of identical organs and similar pathologies as motives for the condemnations.

From the retrospective study, the overall rate of condemnations for various causes was 4.90%. This result is about 4 times higher than that reported by Awah-Ndukum *et al*. [5, 6] for the SODEPA Douala abattoir. Also, fasciolosis was largely the main motive for condemnation contrary to the works of Awah-Ndukum *et al*. [6] who reported that tuberculosis was the major cause of condemnations in abattoirs in littoral and the western highland regions of Cameroon.

The higher rate of fasciolosis in this study was due to the presence of important *Limnea* shelters. Indeed, *Limnea* are known to be intermediate hosts of *Fasciola gigantica* habituate rivers banks and marshy pasturages and cattle slaughtered in SODEPA Yaoundé abattoir originate from the Adamawa, North and Eastern regions [17] where the agro-ecological conditions are suitable for the intermediaries hosts as well as favour endemic occurrence and transmission of the disease. Also, routine deworming is not practiced by many farmers in these areas [19].

In the study, the prevalence of tuberculosis lesions was less than 0.20% and lower than those recorded by Awah-Ndukum *et al*. [6] in abattoirs in littoral and highland regions of Cameroon, Aylate *et al*. [20] in Woldiya Ethiopia, Danbirni *et al*. [21] in Makurdi and Adamawa State Nigeria and Ejeh *et al.* [22] in some slaughterhouses in Nigeria. Though the prevalence of tuberculosis decreased from 2006 to a minimum rate in 2012 similar to the finding of Opara [23] in Nigeria, Ejeh *et al.* [22] noticed a gradual increase from 2008 to 2012. While Awah-Ndukum *et al*. [6] recorded fluctuating evolutions in the Douala SODEPA and Bamenda municipal abattoirs. The prevalence of other causes of condemnation such as abscesses, pericarditis, pneumonia, congestion, mastitis and cirrhosis were low.

The rate of liver condemnation was the highest and the predominant motive was fasciolosis. Also, the liver condemnation (64.44%) was most common of organ condemnations at post mortem inspection at the Jimma Municipal Abattoir, Ethiopia and fasciolosis (46.7%) was the main cause of the abnormalities [2]. The finding is similar to previous reports in Zaria, Nigeria [8] Arusha, Tanzania [24] Bahir Dar and Gondar, Ethiopia [16,25] who also indicated that fasciolosis was the most common cause of organ condemnation. The prevalence of fasciolosis is higher than those recorded in Soddo abattoir, Ethiopia [26] and in the SODEPA Yaoundé Abattoir, Cameroon [17]. However, Phiri [27], Tadelle and Worku [28] and Berhe *et al*. [29] found lower fasciolosis prevalences in Kafue (Zambia), Jimma and Mekelle (Ethiopia) abattoirs, respectively.

Similarly to the result obtained by Bawe *et al*. [17] in Yaounde-Cameroon, tuberculosis was the main cause of whole carcasses condemnation. Tuberculosis prevalence is lower than that reported in Chad [30] and in Nigeria [31] while fasciolosis was the main cause of carcasses condemnation recorded in Jimma and Gondar abattoirs in Ethiopia [2, 16].

Pneumonia (0.33%) was the main cause of lungs condemnation, with prevalence 1 to 3 times lower than that observed in Bahir Dar [25] Jimma (1.11%) [2] and Gondar [7] abattoirs in Ethiopia and Akwa Ibom State abattoir in Nigeria [23]. Much higher condemnation rates have been reported for slaughtered cattle in Tanzania (3.33%) [32] and Nigeria (31.02%) [33]. While improper bleeding methods was linked to the lung condemnation in this study, pneumonia could have been due to exposure of the cattle to infections of bacterial or viral origin and stressor factors such as dust and starvation. Also, penetration of lung by foreign body, adverse weather condition and accidental inhalation of liquid can cause pneumonia [33].

As reported by Bawe *et al*. [17] kidney and lymph nodes were mostly condemned due to abscesses. Nephritis, hydronephrosis and renal calculi have been reported elsewhere as the main causes of kidney condemnation [2, 32]. While Yifat *et al*. [7] and Amene *et al*. [2] have reported hydronephrosis as the main cause of condemnation of the kidney.

Pericarditis was the main reason of heart condemnation. This result is similar to those obtained by Yifat *et al*. [7], Raji *et al.* [8], Genet *et al*. [16] and BawebHigh condemnation due to pericarditis have been reported in Tanzania (36%) [32]. Other common causes of heart condemnation include hydatid cyst and *Cysticercus bovis* [2].

The study revealed, enormous direct money losses for about 4 months (December 2013 to March 2014) was 18,129,600 FCFA and annual economic losses analysis for a 7 year period (2006 to 2012) was 338,914,732 FCFA induced by carcass and organ condemnations and the various causes of condemnation. However, excluding analysis of condemnations of whole carcasses for these periods, the direct financial losses due to organ condemnations alone were 5,129,600 FCFA and the annual estimated economic losses due to organ condemnations

alone were 43,102,732 FCFA. Similar direct money loss abattoirs related to organ condemnations only in Ethiopia ranging from US$9,093.88-US$13,508.16 [equivalent to 4,546,940 FCFA-6,754,080 FCFA at US$1 = 500 FCFA] have been estimated [2,26,35]. However, according to Regassa *et al.* [36] annual economic losses due to hydatidosis was estimated to be about US$ 108,583.39 [Equivalent to 54,291,700 FCFA]. The results showed financial losses about 4 to 5 times higher than the findings of Amene *et al.* [2] and Yifat *et al.* [7] in South-Western and Northern regions of Ethiopia respectively and about 31 times lower than what Genet *et al*. [16] reported in North-Western region of Ethiopia.

The formula and technique used in direct financial and annual economic losses analysis could be responsible for the difference in the estimates obtained. Tuberculosis and fasciolosis are the main diseases that have important economic implications on livestock production in Africa. The aetiolgic agents of the abscesses observed in this study are not known. As a matter of fact, tuberculosis has been estimated to singly induce financial losses estimated at 10 million USD / year [37, 38] with public health consequences through consumption of contaminated fresh milk and meat [6, 39]. Losses due to fasciolosis have been estimated at about 200 million USD / year with more than 600 million animals infected [40].

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