

ORGANS CONDEMNATION AND ECONOMIC LOSS AT MEKELLE MUNICIPAL ABATTOIR, ETHIOPIA

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ABSTRACT

The present study was conducted to identify the major causes of condemnation of edible organs of 1022 cattle slaughtered at Mekelle municipal abattoir, Mekelle, Ethiopia and to estimate annual economic loss. Localized swelling (2.05%), lameness (1.46%) and branding (0.58%) were the major abnormal conditions encountered during ante-mortem inspection. Post-mortem examination revealed that 51.95% livers, 29.54% lungs, 5.77% kidneys, 3.71% hearts and 0.88% tongues were rejected due to gross abnormalities. Fascioliasis (35.22%), hydatidosis (32.28%), cysticercosis (7.33%), nephritis (3.91%), pericarditis (1.17%) and actinobacillosis (0.68%) were the major disease conditions responsible for the rejection of edible organs. A significant difference was observed in the rejection rate of liver ($p < 0.0001$), lung ($p = 0.0045$), kidney ($p < 0.0454$) and heart ($p < 0.0001$) between different body conditions of slaughtered animals. Similarly, there was statistically significant difference in the rejection rate of liver ($p < 0.0001$) and lung ($\chi^2 = 8.079$, $p = 0.0045$) of cattle originating from highlands and lowlands. Annual economic loss of 233,501.94 Ethiopian birr (approximately 11, 67,509.70 INR) was estimated due to condemnation of affected organs.

Key words: Abattoir, cattle, inspection, edible organ, condemnation, Mekelle

Beef is one of the main components of human diet in Ethiopia. Available beef should, therefore, be clean and safe from diseases of the public health importance and it should be economically produced. In the meat industry, a significant loss results from inferior weight gain, condemnation of edible organs and carcasses at slaughter and death of animals. Information that is available from municipal abattoirs in Ethiopia reveals that there are several causes of organ condemnation. The production loss to the livestock industry due to these reasons is estimated at more than 900 million USD annually (Abebe, 1995, Jobre *et al.*, 1996).

Keeping in view the economic and public health significance of organs condemnation, the present study was undertaken to identify the major causes of organ condemnation of cattle slaughtered at Mekelle municipal abattoir and the magnitude of direct economic loss attributed to condemned organs.

MATERIALS AND METHODS

During this study, three visits per week were made for ante-mortem and post-mortem inspection. On

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every visit, each animal was identified by enumerated marks on its body tag before slaughter, body condition was assessed and origin of animal was recorded. Animals with poor body condition were scored as 1, medium 2 and good 3. Animal origin was also recorded as highland and lowland animals. Body scores and origin of animals were used as the major variables to determine the rejection rates of the organs mainly affected by different conditions.

On post-mortem inspection, liver, lungs, heart, kidneys and tongue in each carcass were thoroughly examined by visual inspection, palpation and systemic incisions, if necessary, for the presence of cysts, adult parasites and pathological lesions. These areas were identified and recorded. The judgments as per regulations and passed by the meat inspectors were adopted.

In assessing the economic losses, the direct economic loss due to total rejection of the edible organs was considered. The analysis was based on annual slaughter capacity of the abattoir considering market demand, average local market prices of the organs in the Mekelle town and the rejection rates of specific organs and carcasses. The annual slaughter rates were

estimated from retrospective abattoir record of the past three years. Average market prices of each organ and carcass was determined from interviews made with personnel of the abattoir and local butcher house. Information obtained was subjected to mathematical computation by the formula of Ogunrinade *et al.* (1980) as given below:

$$EL = \Sigma Srx \times Coy \times Roz$$

where, EL- Estimated annual economic loss due to organ/carcass condemnation from international/domestic market, Srx- Annual cattle slaughter rate of the abattoir, Coy- Average cost of each liver/lung/heart/kidney/tongue, Roz- Condemnation rates of liver/lung/heart/kidney/tongue

Data obtained from ante-mortem and postmortem inspection was recorded and descriptive statistics was used to summarize the data. The variations between condemnation rates, origin of slaughtered animals and body scores were evaluated by Pearson's Chi-square (χ^2) and differences were recorded statistically significant if P-value was less than 0.05.

RESULTS AND DISCUSSION

All the cattle presented for slaughter at Mekelle municipal abattoir were indigenous zebu, male, adult and old cattle. Out of the total 1022 cattle examined, 601 (58.80%) were originated from highland and 421 (41.19%) originated from lowland of the region. On ante-mortem inspection, abnormalities were detected in 42 (4.10%) cattle which comprised lameness, local swellings and poor body conditions (Table 1). However, these animals were passed for slaughter with caution of thorough postmortem examination by the meat

inspector. Postmortem inspection of the carcasses of animals with local swelling and lameness revealed that the swellings were localized and the lameness were due to the damage while driven to market places and transported to the abattoir by inappropriate vehicles.

Out of 1022 cattle slaughtered, livers of 531 (51.95%) were totally condemned for gross abnormalities. Major causes of condemnation were fascioliasis (35.22%), hydatidosis (11.83%) and cysticercosis (6.26%) (Table 2). Statistical analysis indicated that there was a significant difference in the rejection rates of liver between the origins of the animals (χ^2 , 42.9, $P < 0.0001$) and it was higher in lowland animals. Significant difference (χ^2 , 98.29, $P < 0.0001$) was also recorded between body conditions of the animals. Cattle with poor body condition were affected more (Table 2). In Ethiopia, bovine fascioliasis exist in almost all regions (Gemetchu and Mamo, 1979), However, the prevalence and epidemiology of fascioliasis varied mainly due to variation in the climate and ecological conditions such as altitude, rainfall, temperature, irrigation, ponds, dams and livestock management systems. Sirak (1991), Takele (1995) and Andualem (2007) reported rejection rates of livers due to fascioliasis as 58%, 26% and 43.7% at Bahirdar, Mekelle and Kombolcha abattoirs respectively. Comparing these reports, 35.22% condemnation due to bovine fascioliasis obtained in the current study seems to be relatively lower than the report by Andualem (2007) and Sirak (1991) but slightly higher than by Takele (1995).

Lungs of 302 (29.54%) cattle were condemned for gross abnormalities. Hydatidosis, pneumonia, emphysema, hemorrhage, trauma, tuberculosis, abscess and cysticercosis were the causes of lungs rejection

Table 1
Abnormalities encountered in cattle during ante-mortem examination

Disease conditions	Animals as per their origin			Animals as per body scores			
	High land	Low land	Total	Score 1	Score 2	Score 3	Total
	601	421	1022	169	645	208	1022
Lameness	6 (0.99)	9 (2.13)	15 (1.46)	7 (4.14)	6 (0.93)	2 (0.96)	15 (1.46)
Body lesion/branded	4 (0.66)	2 (0.47)	6 (0.58)	2 (1.18)	3 (0.46)	1 (0.48)	6 (0.58)
Local swelling	12 (1.99)	9 (2.13)	21 (2.05)	11 (6.50)	6 (0.93)	4 (1.92)	21 (2.05)
Total	22 (3.66)	20 (4.75)	42 (4.10)	20 (11.83)	15 (2.32)	7 (3.36)	42 (4.10)

Values in parenthesis are percentages

Table 2
Disease conditions of liver and lungs and their condemnation rates

Disease conditions	No. of condemned organs						
	Animals as per their origin			Animals as per body scores			
	High land 601	Low land 421	Total 1022	Score 1 169	Score 2 645	Score 3 208	Total 1022
Liver							
Fascioliasis	151 (25.12)	136 (32.30)	287 (28.08)	84 (49.70)	148 (22.94)	55 (26.44)	287 (28.08)
Hydatidosis	31 (5.15)	17 (4.03)	48 (4.69)	6 (3.55)	26 (4.03)	16 (7.69)	48 (4.69)
Fascioliasis & hydatidosis	38 (6.32)	35 (8.31)	73 (7.14)	15 (8.87)	50 (7.75)	8 (3.84)	73 (7.14)
Cysticercosis	30 (4.99)	34 (8.07)	64 (6.26)	15 (8.87)	33 (5.11)	16 (7.69)	64 (6.26)
Abscess	6 (0.99)	9 (2.13)	15 (1.46)	9 (5.32)	4 (0.62)	2 (0.96)	15 (1.46)
Hepatitis	4 (0.66)	14 (3.32)	18 (1.76)	7 (4.14)	9 (1.39)	2 (0.96)	18 (1.76)
Telangiectasis	1 (0.16)	4 (0.95)	5 (0.48)	1 (0.59)	2 (0.31)	2 (0.96)	5 (0.48)
Melanosis	2 (0.33)	1 (0.23)	3 (0.29)	2 (1.18)	1 (0.15)	-	3 (0.29)
Tuberculosis	-	2 (0.47)	2 (0.19)	1 (0.59)	1 (0.15)	-	2 (0.19)
Cirrhosis	6 (0.99)	10 (2.37)	16 (1.56)	6 (3.55)	8 (1.24)	2 (0.96)	16 (1.56)
Total	269 (44.75)	262 (62.23)	531 (51.95)	146 (86.39)	282 (43.72)	103 (49.51)	531 (51.95)
	$\chi^2, 42.9$	$(P < 0.0001)$		$\chi^2, 98.29$	$(P < 0.0001)$		
Lungs							
Hydatidosis	130 (21.63)	68 (16.15)	198 (19.37)	70 (41.42)	108 (16.74)	20 (9.61)	198 (19.37)
Emphysema	13 (2.16)	9 (2.13)	22 (2.15)	2 (1.18)	14 (2.17)	6 (0.58)	22 (2.15)
Pneumonia	8 (1.33)	21 (4.98)	29 (2.83)	11 (6.50)	15 (2.32)	3 (1.44)	29 (2.83)
Hemorrhage	18 (2.99)	3 (0.71)	21 (2.05)	5 (2.95)	12 (1.86)	4 (1.92)	21 (2.05)
Trauma	13 (2.16)	0	13 (1.27)	1 (0.59)	8 (1.24)	4 (1.92)	13 (1.27)
Tuberculosis	0	2 (0.47)	2 (0.19)	-	2 (0.31)	-	2 (0.19)
Abscess	15 (2.49)	1 (0.23)	16 (1.56)	10 (5.91)	4 (0.62)	2 (0.96)	16 (1.56)
Cysticercosis	1 (0.16)	0	1 (0.09)	1 (0.59)	-	-	1 (0.09)
Total	198 (32.94)	104 (24.70)	302 (29.54)	100 (59.17)	163 (25.27)	39 (18.75)	302 (29.54)
	$\chi^2, 8.079$	$(P < 0.0045)$		$\chi^2, 88.55$	$(P < 0.0001)$		

Values in parenthesis are percentages

(Table 2). The possible reasons for diseases causing lung condemnation could be poor management system, inefficiency of stunning and slaughtering procedure, lack of disposal of infected organs, epidemiological and environmental factors and distribution of stray dogs. Hydatidosis (19.37%) was the major cause while the rejection due to other causes varied from 0.09% to 2.83%. Hydatidosis is an important disease of major economic and public health significance in many countries of the world. The overall prevalence rate of hydatidosis (32.28%) in this study was higher as compared to Jobre *et al.*, (1996) from Gonder (24.3%) and southern part (23.3%) of Ethiopia while lower from the prevalence rates of 38.85% and 46.85% reported by Yilkal (1989) and Andualem (2007) from Kombolacha and 46.5% by Jobre, *et al.* (1996) from Debre Zeit. This could be due to the prevalence of hydatidosis in a given locality and may be associated

with prevailing specific social, cultural, religious, environmental and epidemiological situations of the study area (Macpherson, 1985). Condemnation rate of lungs varied significantly ($\chi^2, 8.079, P, 0.0045$) between origin of the animals and it was higher in lowland animals. Significant difference ($\chi^2, 88.557, P < 0.0001$) was also recorded between body conditions of the slaughtered animals.

In the current study, kidneys of 59 (5.77%) cattle were condemned for gross abnormalities. Nephritis 40 (3.91%) followed by necrosis 8 (0.78%) were the major causes of kidney condemnation (Table 3). Body condition affected significantly the kidney rejection rate ($\chi^2, 6.18, P, 0.0454$), the rejection rate was higher in animals with body score of 1 (9.40%) than that of body scores of 2 (5.11%) and 3 (4.80%). However, such variation among animals of highland and lowland was not statistically significant ($\chi^2, 0.540, P, 0.4626$). The

Table 3
Disease conditions of heart, kidneys and tongues and their condemnation rates

Disease conditions	No. of condemned organs						
	Animals as per their origin			Animals as per body scores			
	High land 601	Low land 421	Total 1022	Score 1 169	Score 2 645	Score 3 208	Total 1022
Heart							
Cysticercosis	6 (0.99)	2 (0.47)	8 (0.78)	1 (0.59)	3 (0.46)	4 (1.92)	8 (0.78)
Hydatidosis	4 (0.66)	4 (0.95)	8 (0.78)	4 (2.36)	2 (0.31)	2 (0.96)	8 (0.78)
Fibrous pericarditis	7 (1.16)	5 (1.18)	12 (1.17)	6 (3.55)	4 (0.62)	2 (0.96)	12 (1.17)
Abscess	6 (0.99)	4 (0.95)	10 (0.97)	7 (4.14)	3 (0.46)	-	10 (0.97)
Total	23 (3.82)	15 (3.56)	38 (3.71)	18 (10.65)	12 (1.86)	8 (3.84)	38 (3.71)
	χ^2 0.048 (P < 0.8262)		χ^2 34.138	(P < 0.0001)			
Tongue							
Actinobacillosis	6 (0.99)	1 (0.23)	7 (0.68)	3 (1.77)	3 (0.46)	1 (0.48)	7 (0.68)
Cysticercosis	-	1 (0.23)	1 (0.09)	-	1 (0.15)	-	1 (0.09)
Trauma	-	1 (0.23)	1 (0.09)	-	1 (0.15)	-	1 (0.09)
Total	6 (0.99)	3 (0.77)	9 (0.88)	3 (1.77)	5 (0.77)	1 (0.48)	9 (0.88)
	χ^2 0.232	(P < 0.6303)		χ^2 2.313	(P < 0.3145)		
Kidney							
Nephritis	23 (3.82)	17 (4.03)	40 (3.91)	13 (7.69)	21 (3.25)	6 (2.88)	40 (3.91)
Necrosis	6 (0.99)	2 (0.47)	8 (0.78)	1 (0.59)	5 (0.77)	2 (0.96)	8 (0.78)
Atrophy	1 (0.16)	2 (0.47)	3 (0.29)	-	2 (0.31)	1 (0.48)	3 (0.29)
Hydatidosis	-	3 (0.77)	3 (0.29)	-	2 (0.31)	1 (0.48)	3 (0.29)
Stone (calculi)	-	1 (0.23)	1 (0.09)	-	1 (0.15)	-	1 (0.09)
Congenital cyst	1 (0.16)	2 (0.47)	3 (0.29)	1 (0.59)	2 (0.31)	-	3 (0.29)
Cysticercosis	1 (0.16)	-	1 (0.09)	1 (0.59)	-	-	1 (0.09)
Total	32 (5.32)	27 (6.41)	59 (5.77)	16 (9.40)	33 (5.11)	10 (4.80)	59 (5.77)
	χ^2 0.540	(P < 0.4626)		χ^2 6.183	(P < 0.0454)		

Values in parenthesis are percentages

overall kidney condemnation rate of (5.77%) reported in this study was lower than reported by Jembrie (2002) at Nazareth abattoir (8.6%) in Ethiopia, however it was higher from the reports of 4.2% and 3.8% by Monaghan and Hannan (1983) and Amatredjo *et al.* (1976), respectively.

Condemnation rate for gross abnormalities in heart was found to be 3.71%. Pericarditis, abscesses, cysticercosis and hydatidosis were the causes of heart condemnations at the rate of 1.17%, 0.97%, 0.78% and 0.78%, respectively. Body condition had significantly (χ^2 34.138, P < .0001) influenced the heart rejection rate, which was higher in animals with poor body condition. Statistically significant difference (χ^2 , 0.048 p, 0.8262) was not observed between condemnation rate and animal origin (Table 3). Rejection rates of 2.7% and 0.9% had earlier been reported from other abattoirs in Ethiopia by Mezgebu (2003). Out of the 1022 slaughtered cattle, tongue of 9 (0.9%) cattle were

condemned for gross abnormalities which included actinobacillosis, cysticercosis and trauma. Neither body score nor origin of animal showed any significant difference on the rejection rate of tongues. (Table 3).

Condemnation rates of livers (51.95%) and lungs (29.54%) were much higher than that of kidneys (5.77%), hearts (3.71%), and tongue (0.88%). Hydatidosis and fascioliasis were major causes of rejection of these two organs. The former resulted in condemnation of both liver and lung at a rate of 31.21 % (liver 121, lung 198) while the later condemned 35.22% liver. Cysticercosis was another important infection making the condemnation of livers and lungs at a rate of 6.36 %. In agreement to the current study, many researchers had reported that liver and lung were the most commonly affected organs by hydatidosis (Soulsby, 1982, Gracey, 1986, Sirak, 1991, Jobre *et al.*, 1996). The reasons as explained by Gracey (1986) is that the lung and liver contain the highest capillary bed

in the body and therefore, the majority of the onchospheres are filtered out and trapped in the fine blood capillaries and the only small number of onchospheres reach the remaining organs. Bovine fascioliasis has been reported to be 56.6%, 47.0%, 46.58% and 14.4% at abattoirs in Sodo, Ziway, Jimma and Dire Dawa of Ethiopia respectively (Tolossa and Tigre, 2007, Daniel, 1995, Adem, 1994, Abdul, 1992). The 35.22% prevalence of fascioliasis found in this study is lower than at abattoirs at Sodo, Ziway and Jimma but higher than at Dire Dawa. This variation is probably due to the ecological and climatic difference and the management systems in practice. Condemnation due to cysticercosis at a rate of 7.33% (liver 64, lung 1, heart 8, tongue 1, kidney 1) is in agreement of 8.33% bovine cysticercosis reported in parts of Tigray region of Ethiopia (Kumar and Berhe, 2009)

Using all the necessary information in the formula set by Ogurinate *et al.* (1980), the annual direct economic loss due to condemnation of edible organs at Mekelle abattoir was estimated to be 233,501.94 Ethiopian birr (approximately 11,67,509.70 INR). Among the various causes of organ condemnation, hydatidosis, fascioliasis and cysticercosis were responsible for major share of this loss and measures to control them are strongly recommended. Many workers in Ethiopia have indicated even a higher economic loss due to condemnation of carcass and edible organs (Ngategize *et al.*, 1993, Ferrede, 1995, Jobre *et al.*, 1996, Jembrie, 2002, Aseffa, 2005) that support the results of the present study.

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