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# A Retrospective Study on the Major Causes of Meat Condemnations in Animals Slaughtered in Juba County South Sudan.

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**Abstract:** A 5-year retrospective study was conducted in Juba County South Sudan to identify major causes of meat condemnations in slaughtered animals. A total of 14,062 indigenous and exotic cattle breeds, 4,443 sheep and 6,789 goats of both sexes and different age groups were recorded. Data were collected and analyzed using the IBM SPSS 21 compatible to Microsoft Window. Association of loss in the animals was analyzed using the Non-Parametric Chi-square test. Graphic presentations were made using Excel Window version 10. Parasitic infections showed significant difference ($P<0.05$) as major causes of meat condemnations compared to other causes. Bovine fasciolosis due to *Fasciola gigantica* in indigenous Nilotic zebu cattle showed a significant difference ($P<0.05$) for liver condemnation (79.02%) compared to exotic Ankole cattle breed. Lung condemnations were mainly due to contagious bovine pluropneumonia (69.85%). Hydatid cysts accounted for 64.52% of spleen condemnations. This study explores the major meat-borne diseases in Juba County which could be utilized for developing strategies for prospective control of such diseases in South Sudan. Further proficiency tests are needed for adequate meat inspection and hygiene in Juba County, South Sudan.

**Key words:** Retrospective study; Meat condemnations; slaughtered animals; meat-borne diseases; South Sudan

## INTRODUCTION

Meat inspection and hygiene of food animals constitute a potential source of data and information for epidemiological studies and preventive veterinary medicine (Gracey *et al.*, 1999). Meat-borne diseases create a human health hazard and cause substantial economic losses in South Sudan (Ochi *et al.*, 2015). Retrospective study on meat condemnation is imperative for veterinary public health to establish a control strategy for meat-borne diseases.

Hydatidosis causes enormous economic loss in livestock due to organs condemnation (Ahmed *et al.*, 2011) and a decrease in the quality and quantity of meat, milk and wool production (Craig *et al.*, 2007 Abebe and Yilma, 2012). Moreover, bovine fasciolosis poses substantial economic problems due to vast liver condemnations (Mousa *et al.*, 2013). Hence, such a study could ensure the delivery of good keeping quality meat for public consumption and prevent the transmission of zoonotic diseases to humans (Melaku *et al.*, 2012).

So far, a very few research works have been carried out to identify various causes of meat condemnations at the Juba slaughterhouse using retrospective study. Hence, the purpose of this study was to explore and disseminate major causes of meat condemnations which could be utilized for prospective control of meat-borne diseases in Juba County South Sudan.

## MATERIALS AND METHODS

### *Study Area*

Juba slaughter house is located in Juba town Juba County, Central Equatoria State (CES) South Sudan. It lies in the tropical climate at 0346475 and 0346484 °N and 0535105 and 0535139°E and at the altitude of 460m.

### *Study Design*

Retrospective study was made to reveal causes of meat condemnations at Juba slaughter house. Epidemiological aspects of the meat-borne diseases in indigenous and exotic cattle breeds, besides indigenous sheep and goats were considered. Animal breeds, sex and age group were recorded to reveal the consumers preference and the flexibility of livestock market.

### *Data Collection*

Primary data were obtained from authentic records and annual reports on meat condemnations at Juba slaughterhouse, Juba County from 2009 to 2014. Prevalence rate of each lesion in various condemned organs /whole carcasses was determined.

### *Data Management and Statistical Analysis*

Data were managed and statistically analyzed using the IBM SPSS 21 compatible to Microsoft Window. Graphic presentations were made using Excel window 10. The association of loss in the animal heads was analyzed using the Non-parametric Chi-square test.

## RESULTS AND DISCUSSION

### *Causes of Meat Condemnation*

Table (1) shows that 491(3.5%) liver, 136(0.97%) lungs, 93 (0.66%) spleens, 13(0.09%) hearts, 53(0.38%) kidneys and 11 (0.08%) whole carcasses of cattle were condemned due to various causes. Bovine fasciolosis 388(79.02%) revealed the main cause of liver condemnations. Contagious bovine pluropneumonia 95(69.85%) was major cause of lung condemnation. Spleen mainly condemned due to hydatid cysts 60 (64.52%). The major cause of heart condemnations was due to *Cysticercus bovis* 9 (69.23%) whereas kidneys were mainly condemned due to hydatid cysts 36(67.92%). Eleven whole carcasses were totally condemned due to suspect of generalized T.B

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7(63.64%), Jaundice 3(27.27%) and generalized C. *bovis* 1(9.09%).

In sheep, a total of 172(3.9%) liver, 99(2.23%) lungs, 5(0.11%) spleens, 12(0.27%) hearts, 14 (0.32%) kidneys and 11 (0.25%) whole carcasses were condemned due to various diseases/lesions. Similarly, livers were condemned mainly due to Fasciolosis 86 (50%). Lungs were mainly condemned due to calcified cysts 61 (61.62%). Hydatid cysts 2 (40%) were the causes of spleen condemnation. The major causes of heart condemnation included Jaundice 5 (41.67%), Causes of kidney condemnation included calcified cysts. Whole carcass condemnation was due to Jaundice 9(81.82%) and generalized T.B 2(18.2%) table (2).

In goats, a total of 212(3.1%) liver, 130(1.92%) lungs, 4 (0.06%) spleen, 2(0.03%) hearts, 8(0.12%) kidneys and 3 (0.04%) whole carcasses were condemned due to various causes (table 3). Fasciolosis 89 (41.98%) was the main cause of liver condemnation followed by granulomatous lesions 86(40.57%), Hydatid cyst 24 (11.32%), fatty liver 7(3.3%), Jaundice 5(2.36%) and hepatomegaly 1(0.47%). The major causes of lung were CCPP 95(73.08%), granulomatous lesions 26 (20%) and Hydatid cyst 9(6.92%). Splenomegaly 4(100%) was the most cause of spleen condemnation. Pericarditis 1(50%) and infarction 1(50%) were the major causes of heart condemnation. Jaundice 6 (75%) and pyelonephritis 2(25%) were the major causes of kidney condemnation. Moreover, Jaundice 2(66.67%) and Snake bite 1(33.33%) were the causes of whole carcass condemnation.

***Prevalence Rate (%) for major causes of meat condemnations.***

Relative prevalence rate for each organ was calculated and expressed as percentage as follows:

PR= Number of infected organ x 100

Number of organs examined in sheep and goats, cattle revealed a prevalence of 0.32%, 0.21%.0.02% in the liver, lung, spleen and kidney which led to total condemnation of seven carcasses while generalized cysticercosis accounted for 0.01%. CCPP in goats had a prevalence of 1.4%.

***The association of loss in the animal***

The loss in the animal heads was statistically associated (P<0.05) with parasitic diseases (table 4).

**Table 1:** Quantitative analysis on percentage of the animal breed, sex and age group of the animal species inspected at Juba main slaughter house (2009 - 2014).

| Animal species | Animal breed (%) | | | Sex (%) | | Age (%) | | Total |
|---|---|---|---|---|---|---|---|---|
| | Indigenous | Exotic | Cross-bred | Male | Female | Young | Adult | |
| Cattle | 39 | 56 | 5 | 92 | 8 | 33 | 67 | 14,062 |
| Sheep | 100 | 0 | 0 | 90 | 10 | 25 | 75 | 4, 443 |
| Goats | 100 | 0 | 0 | 76 | 24 | 21 | 79 | 6,789 |

**Table 2:** Causes of condemned meat (organs) and the whole carcass (es) of cattle inspected at Juba main slaughter house (2009 - 2014).

| No. of cattle Slaughtered | No of organ /whole carcass Condemned | Causes and type of condemnation | | | | Prevalence Rate (%) |
|---|---|---|---|---|---|---|
| | | Causes | Total | Partial | No (%) condemned | |
| 14,062 | 491 Liver | Fasciolosis | 33 | 355 | 388 (79.02) | 2.76 |
| | | T.B | 7 | 38 | 45 (9.16) | 0.32 |
| | | Hydatid cysts | 0 | 38 | 40 (8.15) | 0.28 |
| | | Cirrhosis | 9 | 1 | 10 (2.04) | 0.07 |
| | | Fatty liver | 5 | 0 | 5 (1.02) | 0.04 |
| | | Jaundice | 0 | 3 | 3 (0.61) | 0.02 |
| | 136 Lung | CBPP | 4 | 91 | 95(69.85) | 0.66 |
| | | T.B | 7 | 22 | 29 (21.32) | 0.21 |
| | | Hydatid cyst | 0 | 7 | 7 (5.15) | 0.05 |
| | | Pulmonary oedema | 3 | 0 | 3 (2.21) | 0.02 |
| | | Jaundice | 2 | 0 | 2 (1.47) | 0.01 |
| | 93 Spleen | Hydatid cyst | 0 | 60 | 60(64.52) | 0.43 |
| | | T.B | 7 | 11 | 18(19.35) | 0.13 |
| | | Splenomegaly | 11 | 0 | 11(11.83) | 0.08 |
| | | Jaundice | 2 | 0 | 2(2.15) | 0.01 |
| | | Abscess | 2 | 0 | 2(2.15) | 0.01 |
| | 13 Heart | *C. bovis* | 1 | 11 | 12(92.33) | 0.08 |
| | | Calcified cyst | 0 | 1 | 1 (7.69.) | 0.01 |
| | | Hydatid cyst | 0 | 35 | 36 (67.92) | 0.26 |
| | 53 Kidney | Pyelonephritis | 5 | 0 | 5 (9.43) | 0.04 |
| | | Calcified cyst | 1 | 3 | 4 (7.55) | 0.03 |
| | | Jaundice | 2 | 1 | 3 (5.66) | 0.02 |
| | | T.B | 3 | 0 | 3 (5.66) | 0.02 |
| | | Pulpy kidney | 2 | 0 | 2 (3.77) | 0.01 |
| | 9 Tongue | *C.bovis* | 1 | 8 | 9(100) | 0.06 |
| | | Generalized T.B | 7 | 0 | 7 (63.64) | 0.05 |
| | 11 Whole carcass | Jaundice | 3 | 0 | 3 (27.27) | 0.02 |
| | | Generalized *C. bovis* | 1 | 0 | 1 (9.09) | 0.01 |

From table (1) quantitative analysis on percentage of the animal breed, sex and age group of the animal species inspected at Juba main slaughter house (2009 - 2014) showed that exotic Ankole cattle breed were more slaughtered (56%) compared to indigenous breed (39%). This could be explained partly by our norms and culture in keeping cattle for social prestige and other engagements. Moreover, Ankole cattle are market-oriented sizeable and lucrative breed. Adults, particularly old animals and males are usually brought to livestock markets for slaughter purposes which could be ascribed to productive status and reproductive performances.

**Table 3:** Causes of condemned meat (organs) and the whole carcass (es) of sheep inspected at Juba main slaughter house (2009 - 2014).

| No. of sheep Slaughtered | No of organ/ whole carcass condemned | Causes and type of condemnation | | | No. (%) Condemned | Prevalence Rate (%) |
|---|---|---|---|---|---|---|
| | | Causes | Total | Partial | | |
| 4, 443 | 172 Liver | Fasciolosis | 0 | 86 | 86 (50.0) | 1.94 |
| | | Hydatid cyst | 0 | 26 | 26 (15.12) | 0.59 |
| | | T.B | 2 | 17 | 19 (11.05) | 0.43 |
| | | Jaundice | 4 | 13 | 17 (9.88) | 0.38 |
| | | Cirrhosis | 11 | 2 | 13 (7.56) | 0.29 |
| | | Fatty liver | 6 | 5 | 11 (6.40) | 0.25 |
| | 99 Lung | Calcified cysts | 1 | 60 | 61(61.62) | 1.37 |
| | | T.B | 1 | 30 | 31(31.31) | 0.70 |
| | | Hydatid cysts | 0 | 7 | 7 (7.07) | 0.16 |
| | 5 Spleen | Abscess | 0 | 3 | 3 (60.0) | 0.07 |
| | | Hydatid cyst | 0 | 2 | 2 (40.0) | 0.05 |
| | 12 Heart | Jaundice | 0 | 5 | 5 (41.67) | 0.11 |
| | | Calcified cysts | 0 | 4 | 4 (33.33) | 0.10 |
| | | Hydatid cyst | 0 | 2 | 2 (16.67) | 0.05 |
| | | Pericarditis | 0 | 1 | 1 (8.33) | 0.02 |
| | 14 Kidney | Calcified cysts | 0 | 6 | 6 (42.86) | 0.14 |
| | | Jaundice | 3 | 0 | 4 (28.57) | 0.10 |
| | | Pyelonephritis | 3 | 0 | 3 (21.43) | 0.07 |
| | | T.B | 1 | 0 | 1 (7.14) | 0.02 |
| | 11 Whole carcass | Jaundice | 9 | 0 | 9 (81.82) | 0.20 |
| | | Generalized T.B | 2 | 0 | 2 (18.18 ) | 0.05 |

**Table (4):** Causes of condemned meat (organs) and the whole carcass (es) of goats inspected at Juba main slaughterhouse (2009 - 2014).

| No. of goats Slaughtered | No of organ /whole carcass condemned | Causes and type of condemnation | | | | Prevalence Rate (%) |
|---|---|---|---|---|---|---|
| | | Causes | Total | Partial | No. (%) Condemned | |
| 6,789 | 212 Liver | Fasciolosis | 1 | 88 | 89 (41.98) | 1.31 |
| | | T.B | 12 | 74 | 86 (40.57) | 1.27 |
| | | Hydatid cysts | 0 | 24 | 24 (11.32) | 0.35 |
| | | Fatty liver | 2 | 5 | 7 (3.30) | 0.10 |
| | | Jaundice | 3 | 2 | 5 (2.36) | 0.07 |
| | | Hepatomegaly | 1 | 0 | 1(0.47) | 0.01 |
| | 130 Lung | CCPP | 43 | 52 | 95 (73.08) | 1.40 |
| | | T.B | 2 | 24 | 26 (20.00) | 0.38 |
| | | Hydatid cysts | 0 | 9 | 9 (6.92) | 0.13 |
| | 4 Spleen | Splenomegaly | 4 | 0 | 4 (100) | 0.06 |
| | 2 Heart | Pericarditis | 0 | 1 | 1 (50) | 0.01 |
| | | Infarction | 0 | 1 | 1 (50) | 0.01 |
| | 8 Kidney | Jaundice | 0 | 6 | 6 (75) | 0.08 |
| | | Pyelonephritis | 2 | 0 | 2(25) | 0.02 |
| | 3 Whole carcasses | Jaundice | 2 | 0 | 2(66.7) | 0.02 |
| | | Snake bite | 1 | 0 | 1(33.33) | 0.01 |

**Table 5:** Association between the parasites and the loss in the animals (cattle, sheep and goats) from 2009-2014, using the Non-Parametric Chi-Square Test.

| DF | Chi- Square | Asymptotic Significance | Exact Significance |
|---|---|---|---|
| 28 | 60.545 | 0 | 0.001 |

P> 0.05 = Non- significant P<0.05 =Significant P<0.001=High significant difference, DF=Degree of freedom

## DISCUSSIONS

This study revealed that limited meat hygiene facilities have been employed at Juba Slaughter house suggesting widespread prevalence of meat-borne diseases among traditional cattle herdsmen. Moreover, most cattle brought for slaughter had abnormalities that might explain chronic or subclinical infections which could be rarely detected during ante-mortem examination (Kambarage *et al.*, 1995). As such an implication of meat hygiene and public health risk could be addressed during ante mortem and postmortem examinations.

Fasciolosis is the main cause of parasitic infection in cattle, sheep and goats as indicated by relatively high prevalence rate. This could be explained by the presence of swampy areas in which potential vector snails inhabit

(Kambarage *et al.*, 1995 Mungube *et al.*, 2006). Bovine fasciolosis is highly prevalent among indigenous Nilotic cattle compared to exotic Ankole cattle breed which is supported by Mousa *et al.,* (2013). It appears that the low prevalence of fasciolosis among the exotic Ankole cattle could be reflected by de-worming operations carried out for exported livestock in the neighbouring Uganda. However, literature review indicated that the prevalence of fasciolosis in Uganda was 10% (Ozung *et al.*, 2011). Studies conducted in different abattoirs in Ethiopia had revealed that parasitic infection of livers, lungs, pericarditis and pyelonephritis were the major causes of organs condemnation (Yimam *et al.*, 2003).

The high prevalence of hydatid cysts in the liver of cattle, sheep and goats was reported by Kebede *et al.,* (2009) in Ethiopia, Elmahdi *et al.,* (2004) in Sudan and Ochi *et al.,* (2015) in South Sudan. This may be attributed to the presence of astray dogs and unhygienic disposal of condemned organs. Livers have been found to be the major condemned organs 25(6.23%) cattle, 10(2.9%) sheep and 35(4.85%) goats. This might be due to the importance of the liver pathophysiology.

Apart from the pleurcy due to CCPP, the granulomatous lesions in lungs were most probably due to T.B infection. Simply because there was no facility for probing the gross lesions in Juba Slaughter house. Biffa *et al.,* (2010) revealed insufficient inspection protocols utilized at the abattoirs in Ethiopia to detect the majority of TB lesions at the gross level. This is apparently observed by the low prevalence (0.5%) among male cattle compared to 17.93% due to cysticercosis in Tigray region (Assefa *et al.*,2015). Jaundice indicated by yellow colouration of the carcasses might be due to Anaplasmosis. Similarly, the presence of pulmonary oedema may suggest East Coast fever (ECF). Out of the total of 14,062 cattle, 4,443 sheep and 6,789 goats slaughtered at main Juba slaughter house, livers demonstrated to be the most condemned organs with the condemnation rate of 3.49% in cattle, 3.87% in sheep and 3.12% in goats due to Fasciolosis, Hydatidosis, T.B, *Cysticercus bovis*, Jaundice, fatty liver and liver cirrhosis. This is supported by similar reports from Ethiopia (Shegaw *et al.*, 2009 Nurit *et al.*, 2012). Losses from liver condemnation were generally reported to associate with infection of public health importance (Jibat, 2006).

## CONCLUSION

Retrospective study revealed that parasitic infections were mainly responsible for meat (organs) and carcasses condemnation. Total organs ascribed to liver, lung, heart, spleen and whole carcass condemnations posing great economic loss in the country. Determining the causes of meat condemnation is imperative for developing control strategies. Retrospective study serves as a tool for monitoring and evaluation of meat inspection to reduce economic losses incurred at Juba slaughterhouse. Further proficiency tests are needed for adequate meat inspection and hygiene in Juba County, South Sudan.

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