Slaughter stock abattoir survey of carcasses and organ/offal condemnations in Arusha region, northern Tanzania

Esron Karimuribo

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ORIGINAL RESEARCH

Slaughter stock abattoir survey of carcasses and organ/offal condemnations in Arusha region, northern Tanzania

Benard Lesakit Mellau · Hezron Emmanuel Nonga · Esron Daniel Karimuribo

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Abstract The current study reviews a 3-year record of slaughtered animals in Arusha abattoir to determine the causes of carcasses and organ/offal condemnations. A total of 115,186 cattle, 61,551 sheep, 37,850 goats and 13,310 pigs were slaughtered. Out of the slaughtered cattle, 8.6% were pregnant. Up to 125 (0.108%), 39 (0.063%), 40 (0.106%) and 132 (0.992%) of all cattle, sheep, goats and pig carcasses, respectively, were totally condemned. Cysticercosis was the leading cause of total carcass condemnations in cattle (0.051%) and in pig (1.397%), while emaciation accounted for 0.045% and 0.074% of carcass condemnations in sheep and goats, respectively. Livers and lungs were the most condemned organs in all four animal species. The main cause of condemnations of cattle livers was fasciolosis (8.6%), while stilesiosis in sheep and goats accounted for 8.1% and 7.3%, respectively. Ascariasis (4.03%) was the only cause of liver condemnation in pigs. Pneumonia was the leading cause of lung condemnations at the rates of 3.99%, 2.43% and 2.83% in cattle, sheep and goats, respectively. Because of their zoonotic nature, occurrences of hydatidosis, cysticercosis, fasciolosis and tuberculosis may pose a public health risk. Thus, there is a need to introduce appropriate control measures of livestock diseases to minimise the rate of infection and reduce economic losses.

B. Mellau · H. Nonga (✉) · E. Karimuribo
Department of Veterinary Medicine and Public Health,
Sokoine University of Agriculture,
P.O. Box 3021, Chuo Kikuu,
Morogoro, Tanzania
e-mail: nongahezron@yahoo.co.uk

H. Nonga
e-mail: hezron@suanet.ac.tz

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Introduction

Tanzania is located in the equatorial zone of East Africa with an area of 945,000 km^2. The 2002 Population and Housing Census showed that the population of Tanzania increased from 23.1 million in 1988 to 35 million in 2002 with an average growth rate of 3% per annum (URTNC 2002). The population increase in Tanzania particularly in urban areas demands increased supply of animal protein of which the current output of livestock has not been able to provide. This is supported by the livestock population growth which shows that in 1984, there were 12.5 million cattle, 6.4 million goats, 3.1 million sheep and 0.3 million pigs, while in 2006, there were 18.5 million cattle, 13.1 million goats, 3.6 million sheep and 1.2 million pigs (Njombe and Msanga 2009). This is equivalent to about 2.7% annual growth rate which is lower than the rate of human population growth (3.0%).

Livestock sector plays an important role in the national economy and food security in Tanzania. The contribution of livestock to the national economy is 18% of total GDP, and cattle provides more than 70% of the meat consumed in Tanzania (MAFS 2002). Like in many other developing countries; livestock productions in Tanzania largely depend on traditional sector (MAFS 2002). The traditional livestock keeping faces several challenges including diseases. Vector-borne diseases, particularly trypanosomosis, and tick-borne diseases pose the major threat to livestock production in the country (Kivaria 2007; Muhairwa et al. 2006). Lung infections in particular contagious bovine pleuropneumonia (CBPP) have also been identified as

among the most important diseases of ruminants (Kusiluka and Sudi 2003). The diseases are normally associated with high morbidity and mortality rates, and their effects are usually characterised by lower outputs of animal products and by-products.

Indeed, control of livestock diseases remains a challenge because of limited veterinary services extended to livestock keepers particularly in rural areas. Concomitantly, livestock brought for slaughter into urban areas come from rural areas where disease control regimens are limited. The lack of veterinary services to these livestock-rearing areas suggests possible widespread occurrence of diseases in traditional livestock herds. This further suggests that most slaughter animals brought at abattoir may harbour chronic or subclinical infections which are rarely detected during antemortem examination.

An abattoir or slaughterhouse can be a valuable source of information on the incidence of animal diseases and conditions, some of which may be zoonotic. In this context, meat inspection data are a potential source of information and have an important role to play in epidemiology and preventive veterinary medicine (Schweizer et al. 2003); however, it is not being fully exploited. The purpose of the present study was to survey the causes of carcass and organ/offal condemnations at Arusha abattoir, northern Tanzania during a 3-year period (2005 to 2007).

Materials and methods

Study area and animals

This study was conducted at the Arusha municipal abattoir in Tanzania. The Arusha municipality lies between 1.6° and 4.0° latitude south and 34.5° and 37.5° longitude east. According to Tengeru meteorological station in Arusha, the municipality has unimodal and bimodal rainfall patterns, with short rains starting in September and ending in December, and the long rains starting in March and ending in May. The mean annual rainfall ranges from 800 to 1,200 mm.

The study was a retrospective abattoir survey, undertaken for a period of 3 years from January 2005 to December 2007. During this period, a total of 115,186 cattle, 61,551 sheep and 37,850 goats were slaughtered, and their records formed a source of data for the current study. It was not possible to get the exact records on breed, sex and age for each slaughtered animal due to poor recording systems at the abattoir. With regard to the setup of livestock sector in Tanzania, almost all animals sent for slaughter are adult and come from traditional sector. It was also difficult to precisely trace back the geographical origins of all the animals slaughtered due to lack of reliable animal identification method making it difficult to relate the findings to a particular locality.

Pig slaughterhouse is an annexe to the central abattoir for ruminants located about 2 km away. Slaughtered pigs usually originated from different parts of Arusha region, but the specific origin for each slaughter pig was not recorded. The majority of pigs slaughtered were Landrace and Large White crossed with local breeds. Records showed that all the slaughter pigs were adult being sourced from small scale pig farms. A total of 3,570, 4,472 and 5,268 pigs were slaughtered in 2005, 2006 and 2007, respectively.

Criteria for selection of cases and procedures

Daily condemnation records for cattle, sheep, goats and pigs in the Arusha municipal abattoir were used as the sources of data. Records of number of animals slaughtered and the organs/offal condemned were collected. Routine meat inspection is carried out by qualified meat inspectors (with diploma in Animal Health and Production) who had undertaken special training in meat inspection, meat processing and pathology of farm animals. The meat inspectors perform their work under occasional supervision by qualified veterinarians. Routinely, meat inspectors carry out antemortem examination of all animals presented for slaughter a day before or shortly prior to slaughter. This is followed by postmortem meat inspection involving visual examination, palpation, and systematic incision of carcasses and visceral organs particularly lungs, liver, kidney, heart and spleen according to procedures described by Gracey et al. (1999). Organ/offal diseases and lesions were grossly diagnosed based on pathological changes, i.e. colour, size, morphology, consistence, presence of lesions or parasites. At the end of meat inspection every day, all partial and total condemned carcasses and organs/offal were taken to the abattoir laboratory for further examination and identification of the lesions and parasites. In case of doubts, lesions that would further need investigations and as means of external validation, the abattoir submits samples to Arusha Veterinary Investigation Centre (VIC) to for diagnosis confirmation.

Quality control of the data

As a means of quality control of data, recorded cases excluded from this study were those with no proper diagnosis of organ/offal lesions and ambiguous information on species and slaughter dates. Primary data for liver fasciolosis were also collected by performing inspection of cattle slaughtered at the abattoir for 30 days in July 2008 month to validate secondary data from the retrospective study. Liver inspection was carried out by visual examination, palpation and incision of organ. *Fasciola* infection was judged based on liver enlargement with bumpy, raised, and/or depressed areas, dark blue to black discolourations, and hardness in consistence, and on incision, liver flukes sometimes were seen.

For *Fasciola* species identification, one or more samples of the worms were collected from 125 livers which had active infection. The worm samples were preserved in universal bottles which contained 70% ethanol during field work. The samples were subsequently transported to the laboratory at Sokoine University of Agriculture in Morogoro.

Laboratory sample processing and *Fasciola* species identification

For each of the 125 samples of *Fasciola* collected, a preliminary identification was done through observation of the morphology and measurements as described by Soulsby (1982). Thereafter, 60 randomly drawn *Fasciola* samples, with an average of 15 per each source of the cattle, were stained described by Soulsby (1982). The stained samples were examined under stereo microscope at ×20 magnification. For further *Fasciola* species identification, eggs, which were laid in the 70% ethanol, were recovered by sedimentation technique. A total of 50 samples had eggs which were examined using a compound microscope with a ×10 and ×40 objective lens.

Data analysis

Data were analysed using Epi Info version 6 statistical software (Coulombier et al. 2001). Using StatCalc, proportions of categorical variables were computed and further compared using chi-square test at critical probability of $P<0.05$. The strength of associations between dependent and independent variables was determined using 2×2 contingency tables. The variables compared included proportions of organ/offal lesions by years and species.

Results

A total of 115,186 cattle, 61,551 sheep, 37,850 goats and 13,310 pigs were slaughtered within the study period. In 2005, 2006 and 2007, a total of 3,202 (10.3%), 3,728 (9.3%) and 2,944 (6.7%) pregnant cattle, respectively, were slaughtered summing to 9,874 (8.6%) animals for the whole study period. During this period, 155 (0.136%) cattle brought for slaughter were condemned due to emaciation during the antemortem examination. Similarly, 125 (0.108%), 39 (0.063%), 40 (0.106%) and 132 (0.992%) of all cattle, sheep, goats and pig carcasses, respectively, were totally condemned (Table 1). The leading causes of whole carcass condemnation were *Cystericercus bovis* in cattle 59 (0.051%), emaciation in sheep 28 (0.045%) and goats 28 (0.074%) and *Cystericercus cellulosae* in pigs 186 (1.397%). Causes and percentages of organ/offal condemnations are shown in Tables 2 and 3. The percentages of different organ/offal conditions recorded in 2005, 2006 and 2007 were not statistically different ($P>0.05$) among cattle, sheep and goats (Tables 2 and 3).

The percentages of different organ/offal lesions recorded in cattle, sheep and goats were statistically not different ($P>0.05$; Tables 2 and 3). The main causes of condemnations of cattle organs/offal were fasciolosis (8.6%), while stilesiosis in sheep and goats accounted for 8.1% and 7.3%, respectively (Tables 2 and 3). Livers and lungs were the most condemned organs. Furthermore, 18,829 (16.3%), 10,515 (17.1%) and 7,011 (18.5%) cattle, sheep and goat livers, respectively, were condemned. The overall detection rate of ascariasis in pig liver was 536 (4.03%). This means that a total of 188 (5.3%), 105 (2.3%) and 243 (4.6%) pig livers in 2005, 2006 and 2007, respectively, were condemned due to ascariasis. Similarly, 15,245 (13.2%), 4,668 (7.8%) and 3,192 (8.4%) cattle, sheep and goat lungs, respectively, were condemned.

Table 1 Causes of total carcass condemnations in Arusha abattoir from 2005 to 2007

Species	Condition	Number (%) of carcasses condemned			
		2005	2006	2007	Total
Bovine	*Cysticercus bovis* infection	19 (0.06)	24 (0.06)	16 (0.04)	59 (0.051)
	Emaciation	15 (0.05)	15 (0.04)	8 (0.02)	38 (0.033)
	Jaundice	7 (0.02)	5 (0.01)	2 (0.01)	14 (0.012)
	Bovine tuberculosis	2 (0.01)	5 (0.01)	1 (0.002)	8 (0.006)
	Abscesses	1 (0.003)	1 (0.002)	4 (0.01)	6 (0.005)
Ovine	Emaciation	13 (0.09)	15 (0.07)	0 (0.0)	28 (0.045)
	Abscesses	1 (0.01)	5 (0.02)	1 (0.0)	7 (0.011)
	Jaundice	2 (0.01)	2 (0.01)	0 (0.0)	4 (0.006)
Caprine	Emaciation	11 (0.12)	6 (0.04)	11 (0.07)	28 (0.074)
	Abscesses	5 (0.06)	7 (0.05)	10 (0.07)	22 (0.058)
	Jaundice	9 (0.09)	4 (0.03)	1 (0.01)	14 (0.036)
Porcine	*C. cellulosae* infection	46 (1.29)	67 (1.54)	73 (1.39)	186 (1.397)

Table 2 Causes of cattle organ/offal condemnations in Arusha abattoir from 2005 to 2007

Organ/offal	Condition	Number (%) of organs condemned			
		2005 (n=31,080)	2006 (n=40,069)	2007 (n=44,037)	Total (n=115,186)
Lungs	Pneumonia	1,576 (5.07)	1,252 (3.12)	1,766 (4.01)	4,594 (4.00)
	Hydatidosis	727 (2.34)	1,642 (4.10)	1,015 (2.30)	3,384 (2.94)
	Emphysema	630 (2.03)	630 (1.57)	734 (1.67)	1,994 (1.73)
	Abscesses	519 (1.67)	502 (1.25)	228 (0.52)	1,249 (1.08)
	Anthracosis	329 (1.06)	340 (0.85)	443 (1.00)	1,112 (0.97)
	Pleurisy	369 (1.19)	295 (0.74)	319 (0.72)	983 (0.85)
	Calcified cysts	518 (1.67)	493 (1.23)	367 (0.83)	1,378 (1.20)
	Melanosis	180 (0.58)	104 (0.26)	158 (0.36)	442 (0.38)
	Bovine tuberculosis	42 (0.14)	43 (0.11)	24 (0.05)	109 (0.09)
Liver	Fasciolosis	3,315 (10.67)	3,579 (8.93)	3,009 (6.83)	9,903 (8.60)
	Hydatidosis	773 (2.49)	1,721 (4.30)	1,211 (2.75)	3,705 (4.22)
	Calcified cysts	702 (2.26)	819 (2.04)	637 (1.45)	2,158 (1.87)
	Abscess	462 (1.49)	491 (1.23)	366 (0.83)	1,319 (1.15)
	Others (telangiectasis, hepatitis, fatty degeneration, melanosis, liver cirrhosis)	1,460 (4.70)	971 (2.42)	772 (1.75)	3,203 (2.79)
Kidney	Hydronephrosis	502 (1.62)	778 (1.94)	857 (1.95)	2,137 (1.86)
	Nephritis	461 (1.48)	454 (1.13)	327 (0.74)	1,242 (1.08)
	Infarct	320 (1.03)	165 (0.41)	438 (1.00)	923 (0.80)
	Cysts	573 (1.84)	500 (1.25)	596 (1.35)	1,669 (1.45)
	Fatty change	301 (0.97)	268 (0.67)	265 (0.60)	834 (0.72)
	Melanosis	99 (0.32)	172 (0.43)	143 (0.32)	414 (0.36)
Heart	Pericarditis	388 (1.25)	446 (1.11)	375 (0.85)	1,209 (1.04)
	Cysticercus cysts	70 (0.23)	50 (0.12)	30 (0.07)	150 (0.13)
	Calcified cysts	539 (1.73)	346 (0.86)	130 (0.29)	1,015 (0.88)
	Haemorrhages	293 (0.94)	334 (0.83)	164 (0.37)	791 (0.69)
	Hydatidosis	87 (0.28)	69 (0.17)	18 (0.04)	174 (0.15)
	Melanosis	50 (0.16)	21 (0.05)	37 (0.08)	108 (0.09)
Spleen	Hydatidosis	401 (1.29)	290 (0.72)	63 (0.14)	754 (0.65)
	Splenomegaly	259 (0.83)	159 (0.40)	124 (0.28)	542 (0.47)
	Haematoma	109 (0.35)	134 (0.33)	109 (0.25)	352 (0.30)
	Abscess	257 (0.83)	282 (0.70)	183 (0.42)	722 (0.63)
Intestine	Enteritis	315 (1.01)	531 (1.32)	389 (0.88)	1,235 (1.07)
	Pimply guts	539 (1.73)	445 (1.11)	297 (0.67)	1,281 (1.11)
Head	Abscess	60 (0.19)	74 (0.18)	85 (0.19)	219 (0.19)
	Cysticercus cysts	47 (0.15)	21 (0.05)	10 (0.02)	78 (0.07)
Muscle	Cysticercus cysts	59 (0.19)	42 (0.10)	30 (0.07)	131 (0.11)
	Bruises	973 (3.13)	1,553 (3.87)	470 (1.07)	2,996 (2.60)
Aorta	*Onchocerca*	314 (1.01)	297 (0.74)	63 (0.14)	674 (0.59)

In the primary data, 469 (10.8%) livers were condemned, and out of these, 150 (31.9%) were due to fasciolosis (Table 4). Up to 83.3% of the livers condemned due to fasciolosis had active infection with live flukes. Laboratory species identification of liver flukes sampled revealed that all the 60 worm samples examined were *Fasciola gigantica*.

Discussion

The findings of this study show that there were several disease conditions recorded in cattle, sheep, goats and pigs slaughtered in Arusha. The number of carcasses and organs condemned due to various reasons has serious economic losses to the farmers and is a drawback to livestock industry

Table 3 Causes of sheep and goats organ/offal condemnations in Arusha abattoir from 2005 to 2007

Organ/offal	Condition	2005		2006		2007		Total	
		Sheep (n=14,501)	Goat (n=9,088)	Sheep (n=20,266)	Goat (n=14,020)	Sheep (n=26,784)	Goat (n=14,742)	Sheep (n=61,551)	Goat (n=37,850)
Lungs	Pneumonia	416 (2.87)	327 (3.60)	508 (2.51)	396 (2.82)	571 (2.13)	349 (2.37)	1,495 (2.42)	1,072 (2.83)
	Hydatidosis	271 (1.87)	149 (1.64)	291 (1.44)	179 (1.28)	353 (1.35)	221 (1.50)	915 (1.59)	549 (1.45)
	Emphysema	259 (1.79)	159 (1.75)	317 (1.56)	199 (1.42)	279 (1.04)	213 (1.44)	855 (1.39)	571 (1.51)
	Abscesses	305 (2.10)	239 (2.63)	245 (1.21)	186 (1.33)	131 (0.49)	87 (0.59)	681 (1.11)	512 (1.35)
	Calcified cysts	230 (1.59)	134 (1.47)	179 (0.88)	93 (0.66)	413 (1.54)	260 (1.76)	822 (1.34)	487 (1.29)
Liver	Stilesiosis	1,603 (11.05)	953 (10.48)	1,708 (8.43)	906 (6.46)	1,691 (6.31)	922 (6.25)	5,002 (8.13)	2,781 (7.34)
	Hydatidosis	543 (3.74)	398 (4.38)	720 (3.55)	541 (3.86)	883 (3.30)	599 (4.06)	2,146 (3.48)	1,538 (4.06)
	Fasciolosis	435 (3.00)	255 (2.81)	693 (3.42)	510 (3.64)	784 (2.93)	420 (2.85)	1,912 (3.11)	1,185 (3.13)
	Calcified cysts	244 (1.68)	222 (2.44)	213 (1.05)	304 (2.17)	201 (0.75)	695 (4.71)	916 (1.49)	695 (1.84)
	Abscesses	156 (1.08)	184 (2.02)	307 (1.51)	262 (1.87)	139 (0.52)	135 (0.92)	960 (1.56)	581 (1.54)
	Cysticercus tenuicollis	63 (0.43)	35 (0.38)	35 (0.17)	44 (0.31)	51 (0.19)	39 (0.26)	247 (0.40)	103 (0.27)
Spleen	Hydatidosis	28 (0.19)	54 (0.59)	36 (0.18)	66 (0.47)	42 (0.16)	60 (0.40)	106 (0.17)	180 (0.48)
	Abscesses	33 (0.22)	11 (0.12)	40 (0.20)	39 (0.28)	23 (0.09)	26 (0.17)	96 (0.16)	76 (0.20)

in the country. Some of the zoonotic diseases like cysticercosis, hydatidosis, fasciolosis and tuberculosis may pose health risks to the meat consumer. This justifies for routine disease surveillance in clinically normal animals to better determine the prevalence, possible economic impacts and public health consequences.

Our findings revealed that 8.6% of all cattle slaughtered over the period under review were pregnant. Large numbers of offspring could have been saved if routine antemortem pregnancy diagnosis was practised. The proportion of foetal wastage observed in Arusha abattoir accounts for a considerable loss of animal protein and future national herd if similar occurrences from all other abattoirs in the country are considered. The rate of foetal (8.6%) wastage recorded in this study falls within range of the wastage recorded in other countries (Cadmus and Adesokan 2009; Cadmus and Adesokan 2010).

Fasciolosis was the leading cause of organ condemnations in cattle, sheep and goats, suggesting the parasite economic importance in domestic ruminants. Previous studies by Kambarage et al. (1995) reported higher prevalence of fasciolosis in cattle in other parts of Tanzania (Kambarage et al. 1995; Swai and Ulicky 2009) as well as in other countries (Mungube et al. 2006; Berhe et al. 2009). Apart from its veterinary and economic importance throughout the world, fasciolosis has recently been shown to be a re-emerging and widespread zoonosis affecting a number of human populations (Mas-Coma and Bargues 1997; Esteban et al. 2003). Furthermore, as a zoonotic disease, the World Health Organization estimated that 2.4 million people were infected with *Fasciola* in 1995 and that a further 180 million were at risk of infection (Anonymus 1995).

Similarly, *Stilesia* infection contributed significantly to sheep (8.1%) and goat (7.3%) liver condemnations which were lower than the prevalence reported in Kenya and Ethiopia (Mungube et al. 2006; Sissay et al. 2008). Although *Stilesia* infection is not usually perceived to be important in live animals, the parasite contributes significantly to condemnations of otherwise edible meat in sheep and goats as it has been shown in the current study.

Most of the lung condemnation in ruminants during this study was caused by pneumonia. Pneumonia is a complex condition, involving interaction among host, pathogens and environmental factors (Brodgen et al. 1998). A number of factors may explain the high prevalence of pneumonic lungs recorded in this study. These include stress factors such as exposure to dust from the environment or exhaustion during long treks of pastoral livestock in search of pasture and water, and when animals are taken to livestock markets or abattoirs, and parasitism (Kusiluka and Kambarage 1996; Blood et al. 2007). Poor housing and overcrowding, which are common in the study area, subject the animals to various stresses like cold, wind, rain and

Table 4 Prevalence of bovine liver fasciolosis based on cattle market as recorded in July 2008

Cattle market	Number of cattle slaughtered	Number of livers condemned (%)	Number of livers condemned due to *Fasciola* infection (proportion of livers condemned) (%)	Fasciolosis prevalence (%)
Meserani	1,707	193 (11.31)	61 (31.61)	3.57
Ngaramtoni	1,232	153 (12.42)	36 (23.53)	2.92
Themi	750	83 (11.06)	39 (46.99)	5.2
Oldonyosambu	642	40 (6.23)	14 (35.00)	2.18
Total	4,329	469 (10.83)	150 (31.98)	3.46

dust, and consequently, opportunistic bacteria like *Pasteurella* spp. and *Arcanobacterium pyogenes* are likely to attack the lungs.

Tuberculosis was recorded only in cattle at the rate of 0.1% and may have a great impact to public health. This is lower than the 3.3% previously reported in Morogoro, Tanzania (Kambarage et al. 1995). Elsewhere, our findings tally with other studies conducted in Cameroon and Ethiopia (Asseged et al. 2004; Awah-Ndukum et al. 2007), but different from findings in Nigeria (Cadmus et al. 2008; Cadmus and Adesokan 2009). The low prevalence recorded in this study reflects the bovine tuberculosis prevalence in live animals which was reported to be 1.3% (Shirima 1999). Despite lower prevalence recorded in the current study, the significance of this finding cannot be underestimated considering the zoonotic implication of this disease and the animal husbandry system being practised by the farmers. It is therefore recommended that there is the need to intensify the screening of dairy and beef animals for this disease with the aim of reducing human risk.

Hydatidosis was another leading disease which was recorded at the abattoir. It affected most of the visceral organs ranging from lungs, liver, heart and spleen in all slaughter ruminants. Similar low level of infection rates of hydatidosis in slaughter ruminants was reported by Njoroge et al. (2002) and Ansari-Lari (2005). In contrast, a high prevalence of hydatidosis was reported in slaughter ruminants in Sudan (Elmahdi et al. 2004), Morroco (Azlaf and Dakkak 2006) and Ethiopia (Kebede et al. 2008). The differences in prevalence of hydatidosis may arise due to differences in environmental conditions that are conducive to the perpetuation of the parasite, abundance of infected definitive host, livestock husbandry, stocking rate, nature of the pasture and grazing patterns of animals. Due to presence of large stray dog population in Tanzania and improper disposal of abattoir-condemned organs, there is a high risk of hydatidosis to human population particularly in pastoral communities (Ernest et al. 2009).

Cysticercosis in pigs caused carcass condemnation rate of 1.4%. This rate is lower than 5.9% reported in Dar es Salaam slaughter slabs (Mkupasi et al. 2010). Abattoir survey carried out in 1995 in northern Tanzania showed a prevalence ranging from 4.5% to 37.7% (Boa et al. 1995). Moreover, a lingual cysticercosis survey conducted in the southern part of Tanzania reported a prevalence ranging from 5.5% to 16.9% (Phiri et al. 2003). In Uganda, a survey by Kisakye and Masaba (2002) reported a prevalence of 9.4% in pigs slaughtered in Kampala City, while Phiri et al. (2002) reported a prevalence of 20.6% in Zambia. Generally, the present study, like other studies elsewhere, shows that porcine and bovine cysticercosis are endemic diseases in Tanzania and may have impacts on pig and cattle industry, and pose a serious health risks to the pork consumers. Therefore, to reduce the transmission of taeniasis/cysticercosis, adequate meat inspection, public education to avoid consumption of raw/undercooked meat, use of latrines and improved standards of human hygiene are recommended.

Another pig disease, which is of economic importance recorded in this study, was ascariasis. Up to 4.03% of slaughtered pig had their liver condemned due to liver ascariasis. Studies by Ngowi et al. (2004) and Mkupasi et al. (2010) reported higher prevalence rates of liver ascariasis than the current study in other regions in Tanzania. Such difference in prevalence may again be contributed by limitations of abattoir records, pig management systems and diagnosis methods used. Nevertheless, the observed prevalence is of economic and public health importance as now there is a report of cross-infection of *Ascaris suum* from pigs to human (Nejsum et al. 2005).

Generally, some of the limitations encountered in this study included the use of only gross pathology in the diagnosis of the diseases; thus, only those diseases with gross pathological lesions that are pathognomonic were likely to be diagnosed. The records may also have been underestimated because of general poor record keeping. In spite of the limitations mentioned, the public health implications of the quantity of infected carcasses and organs/offal condemned at Arusha abattoir on the consumers and the role that postmortem inspection plays in safeguarding the health of the public cannot be overemphasised. The future of the livestock industry is affected as this part of the country loses up to 8.6% of her trade cattle population to indiscriminate

slaughtering of pregnant animals. A need to screen for pregnancy in slaughter cattle during antemortem inspection is necessary to minimise the menace of foetal wastage in the abattoir.

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References

Anonymus 1995. Control of Foodborne Trematode Infections. WHO Technical Series No. 849. WHO, Geneva, pp 157.

Ansari-Lari, M., 2005. A retrospective survey of hydatidosis in livestock in Shiraz, Iran, based on abattoir data during 1999–2004. Veterinary Parasitology, 133, 119–123.

Asseged, B., Woldesenbet, Z., Yimer, E. and Lemma, E., 2004. Evaluation of abattoir inspection for diagnosis of *Mycobacterium bovis* infection in cattle at Addis Ababa abattoir. Tropical Animal Health and Production, 36(6), 537-546.

Awah-Ndukum, J., Tchoumboue, J., and Niba, A.T., 2007. Current status of bovine tuberculosis and other pathological conditions at the SODEPA Douala abattoir, Dschang, Cameroon (1995–2003). Tropical Veterinarian, 25, 58–64.

Azlaf, R. and Dakkak, A., 2006. Epidemiological study of the cystic echinococcosis in Morocco. Veterinary parasitology, 137, 83–93.

Berhe, G., Berhane, K., and Tadesse, G., 2009. Prevalence and economic significance of fasciolosis in cattle in Mekelle Area of Ethiopia. Tropical Animal Health and Production, 41, 1503-1504.

Blood, D.C., Radostits, O.M., Gay, C.C., Hinchcliff, K.W. and Constable, P.D., 2007. Veterinary Medicine: A textbook of the diseases of cattle, horses, sheep, pigs and goats. 10th Edition, Saunders Ltd. 2065 pp.

Boa, M.E., Bøgh, H.O., Kassuku, A.A. and Nansen, P., 1995.The prevalence of *Taenia solium* metacestodes in pigs in northern Tanzania. Journal of Helminthology, 69, 113 - 117.

Brodgen, K.A., Lehmkuhl, H., Cutlip, D. and Randall, C., 1998. *Pasteurella haemolytica* complicated respiratory infections in sheep and goats. Veterinary Research, 29 (3–4), 233–254.

Cadmus, S.I.B., Adesokan, H.K. and Awosanya, A.E.J., 2008. Public health issues and observations made during meat inspection at Bodija Municipal Abattoir, Ibadan, Oyo state, Nigeria. Nigerian Veterinary Journal, 29(2), 43–47.

Cadmus, S.I.B. and Adesokan, H.K., 2009. Causes and implications of bovine organs/offal condemnations in some abattoirs in Western Nigeria. Tropical Animal Health and Production, 41, 1455–1463.

Cadmus, S.I.B. and Adesokan, H.K., 2010. Bovine foetal wastage in Southwestern Nigeria: a survey of some abattoirs. Tropical Animal Health and Production, 42, 617–621.

Coulombier, D., Fagan, R. Hathcock, L., and Smith, C., 2001. Epi Info 6 version 6.04. A word processing, database and statistical program for public health. Centers for Disease Control and Prevention, Delaware, USA.

Esteban, J.G., Gonzalez, C., Curtale, F., Muñoz-antoli, C., Valero, M. A., Bargues, M.D., El sayed, M., l Wakeel, A.A.W., Abdelwahab, Y., Montresor, A., Engels, D., Savioli, L. and Mas-coma, S., 2003. Hyperendemic fascioliasis associated with schistosomaisis in villages in the Nile delta of Egypt. American Journal of Tropical Medicine and Hygiene, 69, 429–437.

Elmahdi, I.E., Ali, Q.M., Magzoub, M.M., Abrahim, A.M., Saad, M. B. and Romig, T., 2004. Cystic echinoccosis of livestock and humans in central Sudan. Annals of Tropical Medical Parasitology, 98, 473–9.

Ernest, E., Nonga, H.E. Kynsieri,. N. and Cleaveland, S., 2009. A retrospective survey of human hydatidosis based on hospital records during a period from 1990–2003 in Ngorongoro, Tanzania. Zoonosis and Pubulic Health doi: 10.1111/j.1863-2378.2009.01297.x.

Gracey, J.F., Collins, D.S. and Huey, R.J. 1999. Meat Hygiene, 10th ed. W.B. Saunders Company LTD, pp. 261–287.

Kambarage, D.M., Kimera, S.I., Kazwala, R.R. and Mafwere, B.M., 1995. Disease conditions responsible for condemnation of carcasses and organs in short-horn Zebu cattle slaughtered in Tanzania. Preventive Veterinary Medicine, 22, 249-255.

Kebede, N., Mitiku, A. and Tilahun, G., 2008. Hydatidosis of slaughtered animals in Bahir Dar Abattoir, Northwestern Ethiopia. Tropical Animal Health and Production, 10.1007/s11250-008-9152-3.

Kisakye, J.J.M. and Masaba, S.C., 2002. *Cysticercus cellulosae* in pigs slaughtered in and around Kampala city. Uganda Journal of Agricultural Science, 7, 23-24.

Kivaria, F.M. 2007. The control of East Coast Fever in Africa: A constant battle for impoverished dairy farmers. The Veterinary Journal, 174, 221–222.

Kusiluka, L.J.S. and Sudi, F.F., 2003. Review of successes and failures of contagious bovine pleuropneumonia control strategies in Tanzania. Preventive Veterinary Medicine, 59, 113-123.

Kusiluka, L.J.M. and Kambarage, D.M., 1996. Diseases of Small Ruminants in Subsaharan Africa: A Hand Book on Common Diseases of Sheep and Goats in Sub-Saharan Africa, VETAID. Capital Print Ltd.

Mas-Coma, S. and Bargues, M.D., 1997. Human liver flukes: a review. Research Reviews in Parasitology, 57, 145–218,

Ministry of Agriculture and Food Security, MAFS. Basic Data-Agriculture Sector 1994/95–2000/2001. Statistics Unit, MAFS, Dar es Salaam, Tanzania, August 2002, 72 pp.

Mkupasi, E.M., Ngowi, H.A. and Nonga, H.E., 2010. Slaughter Slab Survey for Extra-Intestinal Porcine Helminth Infections in Dar es salaam City, Tanzania. Tropical Animal Health and Production, DOI 10.1007/s11250-010-9708-x.

Muhairwa, A.P., Mellau, L.S.B., Kusiluka, L.J.M. Nonga, H.E., Makungu, M., Kimera, S.I., Karimuribo, E.D. and Mtambo, M. M.A., 2006. Trends of Tick-borne disease cases in cattle attended at the Sokoine University of Agriculture Veterinary Clinic, Morogoro Tanzania. Tanzania Veterinary Journal, 23, 68-78.

Mungube, E.O. Bauni, S.M., Tenhagen, B.A., Wamae, L.W., Nginyi, J.M. and Mugambi, J. M., 2006. The prevalence and economic significance of *Fasciola gigantica* and *Stilesia hepatica* in slaughtered animals in the semi-arid coastal Kenya. Tropical Animal Health and Production, 38, 475–483.

Nejsum, P., Parker, E.D. Jr., Frydenberg, J., Roepstorff, A. Boes, J., Haque, R., Astrop, I., and Sørensen, U.B.S., 2005. Ascaris is a zoonosis in Denmark. Journal of Clinical Microbiology, 43(3), 1142 - 1148.

Ngowi, H.A., Kassuku, A.A., Maeda, G.E., Boa, M.E. and Willingham, A.L., 2004. A slaughter slab survey for extra-intestinal porcine helminth infection in northern Tanzania. Tropical Animal Health and Production, 36, 335 - 340.

Njombe A.P. and Msanga, Y.N., 2009. Livestock and Dairy Industry Development in Tanzania. www.mifugo.go.tz Accessed on 06/04/2010.

Njoroge, E.M, Mbithi, P.M., Gathuma, J.M., Wachira, T.M., Magambo, J. K. and Zeyhle, E.A., 2002. Study of cystic echinococcosis in slaughter animals in three selected areas of northern Turkana, Kenya. Veterinary Parasitology, 104, 85– 91.

Phiri, I.K., Ngowi, H., Afonso, S., Matenga, E., Boa, M., Mukaratirwa, S., Githigia, S., Saimo, M., Sikasunge, C., Maingi, N., Lubega, G. W., Kassuku, A., Michael, L., Siziya, S., Krecek, R.C., Noorma-

homed, E., Vilhena, M., Dorny, P. and Willingham, A.L., 2003. The emergence of *Taenia solium* cysticercosis in Eastern and Southern Africa as a serious agricultural problem and public health risk. Acta Tropica, 87, 13 – 21.

Phiri, I.K., Dorny, P., Gabriel, S., Willingham, A.L., Speybroeck, N. and Vercruysse, J., 2002. The prevalence of porcine cysticercosis in Eastern and Southern provinces of Zambia. Veterinary Parasitology, 108, 31–39.

Schweizer, G., Plebani, G.F. and Braun, U., 2003. Prevalence of *Fasciola hepatica* and *Dicrocoelium dendriticum* in the cow: inspection in an east Switzerland abattoir. Schweiz Arch Tierheilkd, 145, 177–179.

Shirima, G.M., 1999. Epidemiology of Bovine Tuberculosis in cattle in different farming systems in the eastern zone of Tanzania. (Unpublished master dissertation, Sokoine University of Agriculture, Morogoro, Tanzania).

Sissay, M.M., Uggla, A. and Waller, P.J., 2008. Prevalence and seasonal incidence of larval and adult cestode infections of sheep and goats in eastern Ethiopia. Tropical Animal Health and Production, 40, 387–394.

Soulsby E.J.L. 1982. Helminths, Arthropods and Protozoa of domesticated animals, Seventh edition, Bailliere Tindall, London. pp119 – 127.

Swai, E.S. and Ulicky, E., 2009. An evaluation of the economic losses resulting from condemnation of cattle livers and loss of carcass weight due to Fasciolosis: a case study from Hai town abattoir, Kilimanjaro region, Tanzania. Livestock Research Rural Development Volume 21, Article #186. Retrieved on February 4, 2010, from http://www.lrrd.org/lrrd21/11/swai21186.htm

United Republic of Tanzania National Census (URTNC), 2002. http://www.tanzania.go.tz/census/report2.htm.