ANIMAL HUSBANDRY & VETERINARY SCIENCE | RESEARCH ARTICLE

Assessment of livestock slaughtered for food and meat inspection issues in selected abattoirs in Benue State, Nigeria

Kundu Shima[1]*, Idusiye Mosugu[1] and Ternenge Apaa[2]

*Corresponding author: Kundu Shima, Faculty of Veterinary Medicine, Department of Veterinary Public Health, University of Ibadan, Ibadan 200005, Nigeria
E-mail: kshimaelyx@gmail.com

Abstract: In recent times, many zoonotic diseases have emerged with serious negative consequences on humans. In the light of this, ante-mortem inspections were conducted, using body condition scoring to assess the health status of livestock presenting for slaughter, and to identify issues relating to meat inspection in four purposively selected government approved abattoirs in Benue State, Nigeria. The result of our assessment showed that 5.0% of the cattle and goats presented for slaughter during the investigation period were highly emaciated animals with a prevalence range of 0.0–12.1% with variance between abattoirs, whereas 37.9% were moderately emaciated and 57.2% had good body condition. Extreme emaciation was higher in cattle (6.7%) compared to the goats (3.2%). The moderately high prevalence of emaciated animals intended for human consumption coupled with unorganized and inappropriate meat inspection in the studied abattoirs has serious public health implications. To prevent consumers from contacting zoonotic diseases, education of butchers and traders is necessary for thorough and effective inspections. In addition, animal traders should be encouraged to seek veterinary assistance for their sick animals. Meat inspectors should treat all emaciated animals as suspects, as emaciation could be a cause from underlying health problems.

ABOUT THE AUTHORS

Kundu Shima holds degree in Veterinary Medicine, DVM from University of Agriculture, Makurdi, Nigeria and a master's degree in Epizootiology from University of Ibadan, Nigeria. He has special interest in epidemiology of zoonotic and infectious diseases and Global Health.

Idusiye Mosugu holds first degree in Veterinary Medicine, DVM and a master's degree in Veterinary Public Health, MVPH from the University of Ibadan, Nigeria.

Ternenge Apaa is a DVM and lecturer in the Department of Veterinary Medicine, University of Agriculture, Makurdi, Nigeria. He is currently studying for a Master of Veterinary Science degree in Infectious Diseases at the University of Nottingham, United Kingdom.

Our collective interest is in safeguarding and promoting animal and public health.

PUBLIC INTEREST STATEMENT

What we eat determines the quality of our wellbeing and long life. Meat as an essential source of energy and protein sometimes serves as a means for infections to man. In developing nations, such as Nigeria, meat processing and inspection is hardly carried out in accordance with the standard meat hygiene requirements hence indicating a risk to the wellbeing of consumers. This study provides preliminary information on the wellbeing and grade animals intended for food in selected abattoirs in Benue State, Nigeria. It showed that poor grades of animals are sometimes killed for food. The findings may be useful to government and other stakeholders involved in public health promotion in Benue State and Nigeria at large in monitoring, improving and promoting relevant meat inspection in our abattoirs, as this would safeguard consumers' health by protecting them from eating potentially harmful and poor quality meat that is unfit for food.

cogent••food & agriculture

1. Introduction

Abattoirs, if utilized effectively, play vital roles in disease surveillance, inspection of animals and meat, and could protect man from most zoonotic infections which potentially might occur following the consumption of unhygienic, unsafe and unwholesome animal flesh. The purpose of an abattoir is to produce hygienically prepared meat through humane handling of animal using hygienic techniques for slaughtering and dressing (Food and Agricultural Organization [FAO], 1992). Meat hygiene entails production of meat and meat products which are aesthetic, safe, wholesome and fit for consumption. Unhygienic issues related to food animals could emanate from slaughtering processes, inefficient standard operating procedures, marketing and improper meat handling practices (Olanike, 2002).

In most developed nations, abattoirs have aided in the detection and eradication of several diseases besides their main purpose of meat inspection (Cousins, 2001; Kaneene, Miller, & Meyer, 2006). In developing nations like Nigeria, abattoirs are not maximally utilized and even the meat passed for human consumption in many instances is not adequately monitored. Recent report however indicates that some African countries have now appeared to be using abattoir inspection services in the control of tuberculosis (African Union-Interafrican Bureau for Animal Resources [AU-IBAR], 2013).

Livestock products contribute 17 and 33% to the total kilocalorie and protein consumption, respectively, globally with demand for meat products being more likely to continue to grow rapidly to 2025 and to slow somewhat thereafter, from 1.8 to 0.9% per year (Rosegrant et al., 2009). In the same manner, total meat production in the developing world tripled between 1980 and 2002, from 45 to 134 million tons (World Bank, 2009). In many parts of Nigeria, beef, chevon and pork are widely consumed animal flesh and form part of the daily delicacies of the people.

Meat as an indispensible source of protein to man could occasionally serve as source of infections as well. The past few decades have witnessed a general decline in the burden of livestock diseases due to availability of more effective drugs, vaccines and improved diagnostic techniques and services (Perry & Sones, 2009). However, several cases of existing and emerging foodborne pathogens which are occasionally the cause of infections in human and animals abound in recent times, which include pathogenic strains of avian influenza (H5N1, H5N8, H5N3), swine influenza (H1N1), Lyme disease, brucellosis, Ebola virus disease, Middle East respiratory syndrome, among others. Many of such diseases have potentials for a change in host species from animals to man, constituting regional emerging epidemics or global pandemics of human infections.

Protecting man from most foodborne zoonoses demands strict adherence to laid down standard operational abattoir procedures. Unfortunately, in Nigerian abattoirs, critical control procedures in accordance with the "Meat Edit Regulations" and minimum meat hygienic requirements prescribed by joint Food and Agricultural Organization/World Health Organization/Codex Alimentarius Commission (FAO/WHO/CAC, 1993) are rarely observed. Ante-mortem inspection as one of such important operational procedures is grossly neglected in most cases. Ante-mortem examination takes into cognizance body condition evaluation at a glance to give a gross picture of the health status of an animal. Body condition scoring is a subjective assessment but has shown a high correlation with animal's age, sex, live weights, carcass weights and edible tissue yield (Nicholson & Butterworth, 1986).

At meat inspection, especially during ante-mortem examination, extreme emaciation is a good reason for an animal to be considered as a "suspect" and subsequent in-depth inspection (FAO, 1994) because it is an indication of a serious underlying infection. Emaciation affects the quality of meat and carcass, nutritional value and poses a threat to the health of the consumers. Emaciation as a common condition of food animals is characterized by a loss of fats and flesh following either loss of appetite or starvation, where the organs and muscular tissues appear thinner, moist and glossy (FAO, 1994). Again, in emaciation, muscle marbling may be very low resulting in reduced meat quality due to susceptibility to pale soft exudative muscle (Ikeme, 1990). Emaciation may be associated with chronic diseases and parasitic conditions such as roundworms in pigs and fascioliasis in cattle and sheep, swine erysipelas, neoplasms, tuberculosis, Johne's disease, caseous lymphadenitis, poor teeth and malnutrition (FAO, 1994).

Records kept on body condition status of animals slaughtered in Nigeria are relatively scanty. On this basis, the objectives of this study were to assess body conditions of livestock slaughtered for food and to identify issues relating to meat inspection in four purposively selected government approved abattoirs in Benue State, Nigeria. This study even though not novel as one may consider it, would add to our understanding of the problems and uncontrolled abattoir practices and would draw meat inspection agency closer to checking the problems of widespread illegal abattoir practices.

2. Material and methods

2.1. Study location
This study was conducted in Benue State, North Central region of Nigeria. It lies between Longitude 7°47′ to 10°0′E and Latitude 6°25′ to 8°8′N. The State has a population of over 4.2 million (2006 National Population Census). Agriculture is the mainstay of the State's economy with most of the people in the State being farmers. The State is acclaimed "The Food Basket of the Nation (Nigeria)" because of its diverse rich agricultural produce which include yams, rice, beans, cassava, soya beans, *Benniseed*, maize, sorghum, millet, tomatoes, among others. Over 70% of the population engaged in arable farming. Few people indulge in livestock farming such as pigs, sheep, goats and cattle—especially the Muturu cattle. Most families depend on the revenue earned from crop production for their livelihoods (Benue State Government of Nigeria, 2015; Gbaka, 2014; Okwu & Daudu, 2011). Livestock are reared mostly under seasonal confinement, tethering and semi-extensive system.

2.2. Data collection
Data were collected from April to July 2013 from 1,088 animals comprising cattle ($n = 548$) and goat ($n = 540$) presented for slaughter in four purposively selected government approved abattoirs located at Adikpo, Gboko, Katsina-Ala and Makurdi towns. While Wurukum abattoir, one of the two major abattoirs in Makurdi city where data were collected, receives an average of 50 cattle and 60 goats daily, an average of 40 cattle and 50 goats are slaughtered per day at Gboko abattoir. At Katsina-Ala abattoir, 10 cattle and 15 goats are slaughtered daily while the lowest average daily-slaughter rate is obtained at Adikpo with 5 cattle and 20 goats every eve and market day inclusively. The slaughter rate however varies with season of the year such as festive periods. All the investigated abattoirs sourced their cattle mostly from neighbouring states such as Nasarawa, Plateau, Adamawa, Taraba and other Northern parts of the country, while most of the goats are sourced within the State with an exception of Maradi goat (Sokoto red goats). In all the four studied abattoirs, meat inspection is mostly carried out by animal health professionals. Veterinarians are called upon mostly when there are major challenges. The abattoirs lacked the basic facilities of a standard twenty-first century abattoirs.

2.3. Ante-mortem examination and body condition scoring
Ante-mortem inspection of all animals presented for slaughter during the study periods was conducted. A modified system of body condition scoring based on Nicholson and Butterworth (1986) was used. The same person carried out all the ante-mortem inspections, in order to homogenize the classification criteria. The animals assessed were categorized broadly into three major groups namely:

- Good/very good (Score 1): animals with no prominent bone appearing through the skin and showing evidence of fat deposit.
- Moderately emaciated (Score 2): thin animals with prominent ribs and hipbones.
- Highly emaciated (Score 3): animals with very thin flesh covering, sharply protruding ribs and hipbones with great depression of the para-lumbar fossa.

2.4. Statistical analysis

All data were statistically analysed using STATA version 12 software (StataCorp LP, Texas, USA). Descriptive statistics and analysis of variance, using the Bonferroni multiple comparison test, was performed on the data. A statistically significant difference between the studied variables and body condition scores was considered to exist if the calculated *p*-value is less than 0.05 at 95% confidence level.

3. Results

The studied animals comprised 50.4% of cattle (*n* = 548/1,088; Table 1) and 49.6% of goats (*n* = 540/1,088; Table 2). Of the cattle, 46.2% (*n* = 253/548) had good body condition, 47.1% (*n* = 258/548) were moderately emaciated, whilst 6.7% (*n* = 37/548) were highly emaciated with very poor body condition. Furthermore, 100% of the highly emaciated cattle were recorded at Gboko abattoir. We found significant differences in body condition scores among the abattoirs (*p* = 0.001) and sex (*p* = 0.001). The result of Bonferroni multiple comparison test further pointed out Adikpo, Gboko and Katsina-Ala abattoirs, respectively, slaughtered significantly (*p* < 0.05) lower numbers of good-looking cattle than Makurdi, while Adikpo and Katsina-Ala abattoirs slaughtered significantly (*p* < 0.05) lower numbers of moderately emaciated cattle compared with the others. Furthermore, female cattle had significantly (*p* < 0.05) lower mean good body condition score compared with their male counterpart. There was no significant (*p* > 0.05) differences in the mean poor body condition scores of the cattle as regards abattoir, breed, sex and age groups (Table 1).

Table 2 depicts the body condition status of the goats investigated. A total of 68.3% (*n* = 369/540) of the goats were in good body condition, 28.5% (*n* = 154/540) were moderately emaciated, whilst 3.2% (*n* = 17/540) were highly emaciated with very poor body condition. Most of the highly

Table 1. Distribution of body condition scores of cattle presented at slaughter

Variable	Category	Animals examined	Body condition score			F	p-Value
		n (%)	Score 1	Score 2	Score 3		
			n (%)	n (%)	n (%)		
Abattoir	Makurdi	207 (37.8)	100 (48.3)[b]	107 (51.7)[c]	0 (0.0)[a]	56.11	0.001
	Gboko	177 (32.3)	35 (19.8)[a]	105 (59.3)[b]	37(20.9)[a]		
	Katsina-Ala	105 (19.1)	79 (75.2)[a]	26 (24.8)[a]	0 (0.0)[a]		
	Adikpo	59 (10.8)	39 (66.1)[a]	20 (33.9)[a]	0 (0.0)[a]		
Breed	Bunaji	510 (93.1)	229 (44.9)	248 (48.6)	33 (6.5)	1.61	0.201
	Rahaji	13 (2.4)	9 (69.2)	3 (23.1)	1 (7.7)		
	Gudali	23 (4.2)	13 (56.5)	7 (30.4)	3 (13.0)		
	Mixed	2 (0.3)	2 (100.0)	0 (0.0)	0 (0.0)		
Sex	Male	193 (35.2)	141 (73.1)	52 (26.9)	0 (0.0)	107.57	0.001
	Female	355 (64.8)	112 (31.5)	206 (58.0)	37 (10.4)		
Age	Adult	492 (89.8)	223 (45.3)	232 (47.2)	37 (7.5)	3.35	0.068
	Young	56 (10.2)	30 (53.6)	26 (46.4)	0 (0.0)		
	Total	548 (100.0)	253 (46.2)	258 (47.1)	37 (6.7)		

Notes: Score 1 = good; Score 2 = moderately emaciated; Score 3 = highly emaciated.
Values in the same column with different letters are significantly different (*p* < 0.05).

✹ cogent ⋯ food & agriculture

Table 2. Distribution of body condition scores of goats presented at slaughter

Variable	Category	Animals examined	Body condition score			F	p-Value
		n (%)	Score 1	Score 2	Score 3		
			n (%)	n (%)	n (%)		
Abattoir	Makurdi	201 (37.2)	68 (33.8)[b]	117 (58.2)[c]	16 (8.0)[a]	98.32	0.001
	Gboko	130 (24.1)	93 (71.5)[a]	37 (28.5)[b]	0 (0.0)[a]		
	Katsina-Ala	104 (19.3)	103 (99.0)[a]	0 (0.0)[a]	1 (1.0)[a]		
	Adikpo	105 (19.4)	105 (100.0)[a]	0 (0.0)[a]	0 (0.0)[a]		
Breed	Maradi	187 (34.6)	58 (31.0)	113 (60.4)	16 (8.6)	269.28	0.001
	WAD	353 (65.4)	311 (88.1)	41 (11.6)	1 (0.3)		
Sex	Male	98 (18.1)	57 (58.2)	38 (38.8)	3 (3.1)	4.22	0.041
	Female	442 (81.9)	312 (70.6)	116 (26.2)	14 (3.2)		
Age	Young	73 (13.5)	53 (72.6)	17 (23.3)	3 (4.1)	0.32	0.573
	Adult	467 (86.5)	316 (67.7)	137 (29.3)	14 (3.0)		
	Total	540 (100.0)	369 (68.3)	154 (28.5)	17 (3.2)		

Notes: WAD = West African dwarf; Score 1 = Good; Score 2 = moderately emaciated; Score 3 = highly emaciated.
Values in the same column with different letters are significantly different ($p < 0.05$).

emaciated goats were observed at Makurdi abattoir (16 out of 17). The Maradi goats were found to be highly emaciated compared with the West African dwarf goats (16 out of 17). Body condition scores of the goats were significantly different between abattoir ($p = 0.001$), breed ($p = 0.001$) and sex ($p = 0.041$) groups. The result of Bonferroni multiple comparison test also indicates significant ($p < 0.05$) differences in the mean body scores of both the good-looking and moderately emaciated goats recorded among the abattoirs. Adikpo, Gboko and Katsina-Ala, respectively, received significantly ($p < 0.05$) higher numbers of goats with good body condition scores than Makurdi abattoir. Likewise, Adikpo and Katsina-Ala abattoirs each slaughtered significantly lower ($p < 0.05$) numbers of moderately emaciated goats compared to Gboko and Makurdi, respectively. The West African dwarf (WAD) had significantly ($p < 0.05$) higher mean good body condition score than the Maradi breed, while female goats had significantly ($p < 0.05$) higher mean good body condition score compared with the males. As it pertains to highly emaciated goats, differences in the mean body scores were not significant ($p > 0.05$) neither between abattoir, breed, sex, nor age groups.

Table 3 shows an overall body condition scores of cattle and goats inspected at slaughter during the studied period. A total of 1,088 animals that were presented for slaughter, 57.2% ($n = 662/1,088$)

Table 3. Summary of body condition scores of cattle and goats presented at slaughter

Variables		Animals examined	Body condition scores			F	p-Value
		n (%)	Score 1	Score 2	Score 3		
			n (%)	n (%)	n (%)		
Species	Cattle	548 (50.4)	253 (46.2)	258 (47.1)	37 (6.7)	54.27	0.001
	Goats	540 (49.6)	369 (68.3)	154 (28.5)	17 (3.1)		
Abattoir	Makurdi	408 (37.5)	168 (41.2)[c]	224 (54.9)[c]	16 (3.9)[a]	82.11	0.001
	Gboko	307 (28.2)	128 (41.7)[b]	142 (46.2)[b]	37(12.1)[a]		
	Katsina-Ala	209 (19.2)	182 (87.8)[a]	26 (12.4)[a]	1 (0.5)[a]		
	Adikpo	164 (15.1)	144 (87.8)[a]	20 (12.2)[a]	0 (0.0)[a]		
	Total	1,088 (100.0)	622 (57.2)	412 (37.9)	54 (5.0)		

Notes: Score 1 = good; Score 2 = moderately emaciated; Score 3 = highly emaciated.
Values in the same column with different letters are significantly different ($p < 0.05$).

had good body scores, 37.9% (n = 412/1,088) were moderately emaciated, while 5.0% (n = 54/1,088) were highly emaciated with very poor body condition. Of the emaciated animals, cattle had 6.7% (n = 37/548) against 3.2% (n = 17/540) recorded in the goats. The distribution of highly emaciated animals of public health concern was highest at Gboko abattoir (12.1%; n = 37/307) followed by Makurdi with 3.9% (n = 16/408) and lowest in the others. Both the abattoir and species groups differed significantly (p = 0.001) in the mean body condition scores of the animals slaughtered. According to the result of Bonferroni multiple comparison test, significant (p < 0.05) differences in the mean body condition scores were found associated with the good-looking and moderately emaciated animals across the abattoirs. The mean difference were significantly (p < 0.05) higher in the good-looking animals slaughtered at Adikpo and Katsina-Ala, respectively, compared with Gboko, and higer in those presented at Katsina-Ala than Makurdi, but lower in animals presented at Adikpo compared to Makurdi abattoir. Again, the mean body condition scores of the moderately emaciated animals were significantly (p < 0.05) lower in livestock presented at Adikpo and Katsina-Ala, respectively, than those at Gboko and Makurdi abattoirs, respectively. In addition, the mean good body condition score was significantly (p < 0.05) lower in cattle compared with the goats. No statistically significant (p > 0.05) differences were observed in the mean body condition scores of the extremely emaciated animals registered in the four abattoirs.

4. Discussion

This study has clearly shown that emaciated cattle and goats of public health concern are slaughtered in the abattoirs under the investigation. The 6.7% emaciation recorded in cattle herein is rather higher than 2.88% reported by an earlier study (Raji, Salami, & Ameh, 2010), while 3.2% emaciation in goats described is also higher than 1.27% reported by Ojo (1994) at Zaria abattoirs, Nigeria. Several factors including diseases, harsh weather conditions and poor nutrition could influence emaciation in farm animals. Unorganized abattoir settings, slaughter process rapidity, coupled with other factors, limited this study from obtaining useful disease data associated with the various body condition scores of the animals. However, a quick scan on some of the diseases noted at slaughter during the investigation period were tuberculosis, pneumonias, *Peste des Petits Ruminants*, liver and lung abscesses, hydatidosis, cysticercosis and fascioliasis. These diseases among others have also been reported at slaughter in several documented abattoir surveys in Nigeria (Alawa, Etukudo-Joseph, & Alawa, 2011; Bala, Garba, & Yazah, 2011; Ejeh, Raji, et al., 2014; Idahor, 2013; Ojo, 1994; Okoli, Okoli, Okorondu, & Opara, 2006) with one of the studies even associating emaciation and leanness in cattle with tuberculosis (Ejeh, Adesokan, et al., 2014).

Body condition scores revealed that emaciation was statistically not significantly (p > 0.05) more prevalent in Bunaji (6.5%), females (10.4%) and adults (37.5%) among the breed, sex and age categories of the cattle, respectively. The absence of statistically significant differences is an indication that breed, sex and age related underlying health problems could have little or no influence on the emaciations observed in the cattle. Nonetheless, the differences could be associated with population distribution, stress factors, nutritional factors and differences in management or production systems. Previous studies indicate breed, age and sex succeptibility in certain diseases like tuberculosis and Johne's disease which are characterized by emaciation but are not neccessarily associated with poor body condition (Ameni et al., 2007; Awah-Ndukum et al., 2012; National Animal Disease Information Service [NADIS], 2015). Underfed animals are expected to have a decreased immunity that is manifested by poor body condition (Faye & Bengoumi, 2006). Among the goats, Maradi had the highest emaciation rate (8.6%) compared to the WAD breed. This agrees with the previous study's prevalence of 13.4% emaciation in Maradi goats higher than 3.3% in the WAD goats (Idahor, 2013). However, the abscence of statistically significant (p > 0.05) difference could indicates that, under normal conditions, both breeds have similar likelihood of becoming emaciated. Most of the Maradi goats slaughtered at Makurdi abattoir were bought from other northern states of Nigeria where there is feed scarcity, harsh weather conditions and prevailing disease conditions like helminthosis. The WAD breed, on the other hand, is the predominant goat breed in Benue State, where there is readily available feed/pasture, and are reared mostly under seasonal confinement during rainy seasons and are released mostly in dry seasons, post-harvest to feed on crop residues.

The prevalence rate of highly emaciated animals slaughtered was not significantly ($p > 0.05$) associated with abattoir in the present study. The highest emaciated goats were recorded at Makurdi abattoir. This could be attributed with a more intense attention during the inspections in this slaughterhouse compared with the others, probably related with the general and completely wrong perception that goats have fewer zoonotic diseases than cattle and this could cause a relax at the inspection in the other three abattoirs. Makurdi abattoir receives predominantly the Maradi goat compared to the WAD breed. The Maradi goats are naturally known for emaciation. They are indigenous to northern Nigeria where there is feed scarcity, harsh weather conditions and prevailing disease conditions like helminthosis. This could be responsible for emaciations in this goat breed hence, the higher percentage of emaciated goats registered at Makurdi abattoir. At Adikpo, Katsina-Ala and Makurdi abattoirs, respectively, no highly emaciated cattle was recorded. The location of Makurdi abattoir in the State Capital city where meat is regularly inspected could have influenced the butchers to purchase apparently healthy and good-looking cattle, while at Adikpo and Katsina-Ala, the relatively low human population in the towns coupled with the people's higher preference for pork and bushmeat to beef and chevon could have compelled the butchers to purchase apparently healthy looking animals in order to attract patronage. Gboko abattoir on the other hand received the highest prevalence of highly emaciated animals (12.1%) of public health concern. This prevalence was however, not significantly ($p > 0.05$) different as compared with the other three abattoirs. The location of this particular abattoir very close to a busy route where many cattle traders frequently ply has encouraged the high rate of highly emaciated cattle registered at this abattoir. Cattle traders who enroute through Gboko town as they transport their livestock from north-east to southern parts of Nigeria often sell off to butchers at this abattoir at very cheaper rates, unhealthy animals or suspects which they believe might not make it to their intended destinations. This is further compounded by the existence of non-functional interstates veterinary control posts in Benue, similar to a report by Okoli et al.(2006). Interstate veterinary control posts in Nigeria in most cases serve as revenue generation—Trade animals fee outposts rather than the intended disease surveillance (Anonymous, 2010). Furthermore, the overall 3.9% highly emaciated animals recorded at Makurdi abattoir, which is located in the State Capital city could be influenced by leniency in abattoir meat inspections, which mandated the traders/butchers in acquiring poor grade animals for food.

Other factors that could influenced increase in slaughter rate of obviously or extremely emaciated animals of public health concern for food are inefficient ante-mortem examination, laxity and compromised inspection. For instance, the hostile attitude of the butchers and animals traders—which is still common in our abattoirs, could result in lenient nature of meat inspection (Ojo, 1994). When more emphasis is placed on revenue accruable from animals slaughtered than the intended purpose of meat inspection. The economic and financial status of butchers could also determines the quality of animals they buy. Butchers with low capital base would tend to purchase much lower grade animals at cheaper price. Besides, poor or lack of knowledge on zoonoses (Awosile, Oseni, & Omoshaba, 2013; Swai, Schoonman, & Daborn, 2010) in addition to a dire demand for animal protein could encourage butchers to indulge in the act of purchasing and slaughtering obviously sick animals. Similarly, lack of strict abattoir operational policies by the appropriate authorities could encourage this act. For instance, operational activities in the abattoirs visited commenced very early, about 5:00 am when meat inspectors who have children of pre-school and/or school age to cater for before going out for meat inspections may not be available by such hour.

5. Conclusion and recommendations

This study clearly shows that cattle and goats of public health concern are slaughtered in the abattoirs investigated, and that emaciation occurs more commonly in cattle than in goats. All the abattoirs investigated have similar likelihood of slaughtering highly emaciated animals for food. This is supported by the overall observations which portrays poor animal husbandry and management, lack of stringent meat inspection policies and poor knowledge on zoonoses, as it is expressed in the attitudes of the livestock traders/butchers through the purchase of obviously sick or lower grade animals for human consumption. It can be deduced herein that, carcasses of "suspected" emaciated animals also are possibly passed freely for consumption across the studied abattoirs with inade-

cogent•food & agriculture

quate in-depth inspection to ascertain the underlying causes. This portends a significant zoonotic threat to the consumers. It is no doubt these inadequacies are responsible in part for the high incidences of tuberculosis, brucellosis, cysticercosis, fascioliasis and teniasis reported in humans across Nigeria. In order to promote safe food culture, butchers and livestock traders should be encouraged to seek veterinary assistance for their sick animals. They should also be enlightened on health implications associated with acquisition and slaughter of obviously sick animals for food. Meat inspectors should always treat emaciated animals as "suspects" and subsequently, thoroughly inspect their carcasses. The government on her part should enforce stringent meat inspection policies, employ competent and retrain existing inspectors and ensure their continuing education or training is ensued. Ultimately, farmer education on improved livestock management, aimed at healthy livestock production should be embraced as the best approach to reducing emaciations in farm animals and the risk of zoonoses transmission.

Author details
Kundu Shima[1]
E-mail: kshimaelyx@gmail.com
Idusiye Mosugu[1]
E-mail: janet_idusie@yahoo.com
Ternenge Apaa[2]
E-mail: docapath@yahoo.com
[1] Faculty of Veterinary Medicine, Department of Veterinary Public Health, University of Ibadan, Ibadan 200005, Nigeria.
[2] Department of Veterinary Medicine, College of Veterinary Medicine, University of Agriculture, Makurdi 970001, Nigeria.

Citation information
Cite this article as: Assessment of livestock slaughtered for food and meat inspection issues in selected abattoirs in Benue State, Nigeria, Kundu Shima, Idusiye Mosugu & Ternenge Apaa, *Cogent Food & Agriculture* (2015), 1: 1106386.

References
African Union-Interafrican Bureau for Animal Resources. (2013, September). *Pan African animal resources yearbook, 2013* (60 p.). African Union Commission (AUC). ISSN: 1811-007X. Retrieved from http://www.au-ibar.org/pan-african-animal-resources-yearbook

Alawa, C. B. I., Etukudo-Joseph, I., & Alawa, J. N. (2011). A 6-year survey of pathological conditions of slaughtered animals at Zango abattoir in Zaria, Kaduna State, Nigeria. *Tropical Animal Health and Production, 43*, 127–131. http://dx.doi.org/10.1007/s11250-010-9664-5

Ameni, G., Aseffa, A., Engers, H., Young, D., Gordon, S., Hewinson, G., & Vordermeier, M. (2007). High prevalence and increased severity of pathology of bovine tuberculosis in holsteins compared to zebu breeds under field cattle husbandry in central Ethiopia. *Clinical and Vaccine Immunology, 14*, 1356–1361. http://dx.doi.org/10.1128/CVI.00205-07

Anonymous. (2010, September 26). Veterinary control posts not for revenue collection. *Vanguard Newspaper*. Retrieved from http://www.vanguardng.com/veterinary-control-posts-not-for-revenue-collection.html

Awah-Ndukum, J., Kudi, A. C., Bradley, G., Ane-Anyangwe, I., Titanji, V. P. K., Fon-Tebug, S., & Tchoumboue, J. (2012). Prevalence of bovine tuberculosis in cattle in the highlands of Cameroon based on the detection of lesions in slaughtered cattle and tuberculin skin tests of live cattle. *Veterinarni Medicina, 57*, 59–76.

Awosile, B., Oseni, O., & Omoshaba, E. (2013). Hazards exposures of workers of animal related occupations in Abeokuta Southwestern, Nigeria. *Journal of Veterinary Advances, 3*, 9–19.

Bala, A. N., Garba, A. E., & Yazah, A. J. (2011). Bacterial and parasitic zoonoses encountered at slaughter in Maiduguri abattoir, Northeastern Nigeria. *Veterinary World, 4*, 437–443. http://dx.doi.org/10.5455/vetworld.

Benue State Government of Nigeria. (2015). *Benue State*. Retrieved from http://www.benuestate.gov.ng/

Cousins, D. V. (2001). *Mycobacterium bovis* infection and control in domestic livestock. *Revue Scientifique et Technique, 20*, 71–85.

Ejeh, E. F., Adesokan, H. K., Raji, M. A., Bello, M., Musa, J. A., Kudi, A. C., & Cadmus, S. I. B. (2014). Current status of bovine tuberculosis in Otukpo, Nigeria. *Journal of Animal Production Advances, 4*, 501–507. doi:10.5455/japa.20140821112921

Ejeh, E. F., Raji, M. A., Bello, M., Lawan, F. A., Francis, M. I., Kudi, A. C., & Cadmus, S. I. B. (2014). Prevalence and direct economic losses from bovine tuberculosis in Makurdi, Nigeria. *Veterinary Medicine International, 2014*, 1–6. doi:10.1155/2014/904861

Faye, B., & Bengoumi, M. (2006). Assessment of body condition and body composition in camel by barymetric measurements. *Journal of Camel Practice and Research, 13*, 67–72.

Food and Agricultural Organization. (1992). Construction and operation of medium-sized abattoirs in developing countries. In *97th Animal Production and Health Paper* (pp. 1–104). Rome: Author.

Food and Agricultural Organization. (1994). *Manual on meat inspection for developing countries* (Animal Production and Health Paper 119). Retrieved from http://www.fao.org/docrep/003/t0756e/T0756E00.htm#TOC

Food and Agricultural Organization/World Health Organization/Codex Alimentarius Commission. (1993, March 29–April 2). *Report of the 7th Session of the Codex Committee on Meat Hygiene (ALINORM 93/16A)*. Rome: FAO/WHO.

Gbaka, E. (2014). Managing conflict between farmers and pastoralists in Benue State, Nigeria. *Peace Trends, 2*, 1–3. Centre for Sustainable Development and Education in Africa. ISSN 2360-9230. Retrieved from http://www.csdea-africa.org/wp-content/managing-conflict-between-farmers-and-pastoralists-in-benue-state-nigeria-ephraim-gbaka-2/

Idahor, K. O. (2013). Sheep and goats slaughtered at Keffi abattoir: health status, carcass yield and foetal deaths. *Journal of Animal Science Advances, 3*, 276–283. doi:10.5455/jasa.20130619102201

cogent food & agriculture

Ikeme, A. I. (1990). *Meat science and technology: A comprehensive approach*. Onitsha: Africana First Publishers.

Kaneene, J. B., Miller, R., & Meyer, R. M. (2006). Abattoir surveillance: The US experience. *Veterinary Microbiology, 112*, 273–282. http://dx.doi.org/10.1016/j.vetmic.2005.11.018

National Animal Disease Information Service. (2015). *Johne's disease (para tuberculosis)*. NADIS. Retrieved from http://www.nadis.org.uk/Johne's_disease

Nicholson, M. J., & Butterworth, M. H. (1986). *A guide to condition scoring of Zebu cattle* (pp. 1–29). Addis Ababa: International Livestock Centre for Africa.

Ojo, S. A. (1994, Dececmber 5–9). A survey of pathological conditions in slaughtered goats at Zaria slaughterhouses. In S. H. B. Lebbie & E. Kagwini (Eds.), *Proceedings of the 3rd Biennial Conference of the African Small Ruminats Research Network* (pp. 139–141). Kampala: UICC; Nairobi: International Livestock Research Institute (ILRI) (1996, July). Retrieved from http://www.fao.org/wairdocs/ilri/x5473b/x5473b.htm

Okoli, C. G., Okoli, I. C., Okorondu, U. V., & Opara, M. N. (2006). Environmental and public health issues of animal food products delivery system in Imo State, Nigeria. *Online Journal of Health Allied Sciences, 5*, 1–11. Retrieved from http://www.ojhas.org/issue18/2006-2-2.htm

Okwu, O. J., & Daudu, S. (2011). Extension communication channels' usage and preference by farmers in Benue State, Nigeria. *Journal of Agricultural Extension and Rural Development, 3*, 88–94. Retrieved from http://academicjournals.org/JAERD

Olanike, A. K. (2002). Unhygienic operation of a city abattoir in south west Nigeria: Environmental implication. *African Journal of Environment Assessment and Management, 4*, 23–28. Retrieved from http://www.ajeam-ragee.org/

Perry, B., & Sones, K. (2009). *Global livestock disease dynamics over the last quarter century: Drivers, impacts and implications* (Background Paper for the SOFA 2009). Rome: FAO.

Raji, M. A., Salami, S. O., & Ameh, J. A. (2010). Pathological conditions and lesions observed in slaughtered cattle in Zaria abattoir. *Journal of Clinical Pathology and Forensic Medicine, 1*, 9–12.

Rosegrant, M. W., Fernandez, M., Sinha, A., Alder, J., Ahammad, H., de Fraiture, C., … Zhu, T. (2009). Looking into the future for agriculture and AKST (Agricultural Knowledge Science and Technology). In B. D. McIntyre, H. R. Herren, J. Wakhungu, & R. T. Watson (Eds.), *Agriculture at a crossroads* (pp. 307–376). Washington, DC: Island Press.

Swai, E. S., Schoonman, L., & Daborn, C. J. (2010). Knowledge and attitude towards zoonoses among animal health workers and livestock keepers in Arusha and Tanga, Tanzania. *Tanzania Journal of Health Research, 12*, 282–288.

World Bank. (2009). *Minding the stock: Bringing public policy to bear on livestock sector development* (Report No. 44010–GLB). Washington, DC: Royal Society. Retrieved from http://rstb.royalsocietypublishing.org/content/365/1554/2853.full#xref-ref-69-1

Cogent Food & Agriculture (ISSN: 2331-1932) is published by Cogent OA, part of Taylor & Francis Group.

Publishing with Cogent OA ensures:

- Immediate, universal access to your article on publication
- High visibility and discoverability via the Cogent OA website as well as Taylor & Francis Online
- Download and citation statistics for your article
- Rapid online publication
- Input from, and dialog with, expert editors and editorial boards
- Retention of full copyright of your article
- Guaranteed legacy preservation of your article
- Discounts and waivers for authors in developing regions

Submit your manuscript to a Cogent OA journal at www.CogentOA.com