

Whole Carcass and Organ Condemnations and Their Associated Financial Loss of Cattle Slaughtered at the Tamale Abattoir

¹Abass Abdulai, ²Amadu Braimah and ³Benjamin Obukowho Emikpe

¹University for Development Studies, Nyankpala Campus, P.O. Box TL 1882, Tamale, Ghana

²Council for Scientific and Industrial Research-Crops Research Institute (CSIR -CRI),
P.O. Box 3785, Fumesua-Kumasi, Ghana

³School of Veterinary Medicine, Kwame Nkrumah University of Science and Technology,
P.O. Box 256, Kumasi, Ghana

Abstract: The study aimed to identify the risk factors, whole carcass and organ condemnations and their direct financial loss at the Tamale abattoir. Out of 12269 cattle examined during post-mortem, inspection from January to December 2023, 253 cattle were found with disease conditions that led to either organ or whole carcass condemnations, resulting in a prevalence rate of 2.1%. Female animals had the highest disease conditions. The 3-4-years cattle slaughtered had the highest disease conditions and the least recorded in the 7-8 years cattle. The Sanga breed was mostly affected. Most of the disease conditions were recorded during the rainy season. Tuberculosis (TB) was identified as the major cause of organ and carcass condemnation, The most affected organs were the lungs, liver, spleen, intestines and kidneys. In addition, 3 whole carcasses were condemned. Tamale contributed more cattle slaughtered with the disease conditions. An amount of Ghc94,247.50 (USD 6499.83) was lost due to organ and carcass condemnations. Tuberculosis and CBPP remain the most common diseases in abattoirs, posing a public health risk. To safeguard the safety of the public, strict efforts should be made to eliminate these situations.

Key words: Bovine • Disease • Economic Loss • Surveillance

INTRODUCTION

In 2018, the livestock subsector contributed 14% of Ghana's agricultural GDP [1]. It is an important component of Ghana's agricultural system and has significant import substitution potential. Because ruminant animals are a significant source of revenue and are utilized to pay dowries, they play a crucial role in the sociocultural life of rural communities [2]. Additionally, they serve as a form of banking and insurance during difficult times. Cattle are frequently slaughtered for religious purposes and festive celebrations [3]. Animal products such as meat and milk serve as a protein source for many rural dwellers [4]. Hides and skins from cattle are frequently processed for Ghana's domestic and export markets [5].

However, the large ruminant sub-sector's full potential is not fulfilled because of many obstacles. Poor genetic resources in the local stock, structural

limitations, predation, inadequate feed supplementation and the failure to identify parasites and diseases early enough to restore their health are reasons for their low production [6].

The abattoirs may serve as a valuable institution for tracking animal health and a source of information for epidemiological studies [7]. To safeguard both humans and animals from zoonotic and animal diseases, abattoirs are crucial for surveillance [8]. Abattoirs aid in the early detection of diseases affecting poultry and cattle that have an impact on the economy and public health.

It is the policy of the Veterinary Service Department (VSD) in Ghana that every livestock that is slaughtered in authorized abattoirs must undergo ante-mortem and post-mortem examinations before the meat is deemed fit for eating. This is done to prevent the spread of zoonotic illnesses from cattle and other livestock to people, like bovine tuberculosis [9]. Parasites, bacteria and other

substances can produce significant pathological alterations in organs and carcasses, leading to condemnation during post-mortem examination [10]. The decision to act on an organ, carcass, or portion of it is based on the evidence gathered by visual observation, palpation and incision [11].

Several studies have been conducted in abattoirs in Ghana to identify the major causes of the condemnation of organs and carcasses and the resulting financial losses [12,13]. All of these studies, however, did not take into account the predisposing factors related to diseases in cattle. Therefore, this study aimed to identify the major causes of organ and carcass condemnation in cattle slaughtered at the Tamale abattoir. The study also aimed to assess the associated predisposing factors and direct financial losses.

MATERIALS AND METHODS

Study Location: The Tamale Abattoir is situated in the Tamale Metropolis suburb of Shishegu. At an elevation of 183.3 meters above sea level, the city is situated between latitudes 9°15' and 9°30'N and between longitudes 0°45' and 10°W. Guinea savannah dominates the region, with two distinct seasons: a brief dry season from November to March and an unpredictable rainy season from April to October that brings 1000mm of precipitation [14].

Study Animal: Only cattle that were slaughtered and passed through post-mortem inspection at the Tamale abattoir served as study animals. During the study, 12269 cattle were slaughtered (January to December 2023).

Study Design and Sampling Technique: A cross-sectional survey was carried out in 2023, from January to December. All cattle slaughtered were considered. However, data were taken purposefully on cattle with a condition or disease lesion that led to the whole carcass or organ condemnation.

Direct Financial Loss Assessment: A survey of 20 meat stores in the Tamale Metropolis determined the average market price for carcasses and organs (GH¢/Kg). Organs and carcasses that were rejected were classified as losses.

The direct financial loss (DAL) due to condemned carcasses and organs was calculated using the formula from Ogurinde and Ogurinde [15]:

$$DAL = \Sigma (AC \times AP \times CR)$$

DAL = Direct annual financial loss.

AC = Annual slaughter rate at the abattoir.

AP = Average price of a condemned carcass/organ at market.

CR = Condemnation rate at the abattoir.

Data Collection: Primary data was collected every day from 7:00 am to 1:00 pm. The cattle's age, sex, breed, season and source were all gathered. The cattle's age was estimated using their dentition as described by Grant [16]. The gender was determined by examining the perineal area to identify the sex organ. The physical traits of the cattle were used to determine their breed. Information on the source of cattle with disease incidents was achieved through interviews with cattle dealers and butchers. The mean costs for the organs and carcasses were acquired from beef vendors to ascertain the direct financial loss.

Post-mortem Examination: The postmortem examination was performed as described by Herenda *et al.* [17]. A thorough inspection of the head's lymph nodes, including the parotid and submaxillary retropharyngeal lymph nodes, through incision. The lungs were examined visually, palpated and incised. An incision was made in the lungs, liver, spleen, kidneys, trachea, bronchi and bronchial and mediastinal lymph nodes to check for abnormalities. Palpation of the stomach and mesenteric lymph nodes was done in addition to visual examination of the intestinal tract and mesentery.

Data Analysis: Data were entered, coded and scored using IBM SPSS (version 20) for descriptive analysis. The Chi-square (χ^2) test was used to compare disease incidence rates among different sexes, ages, breeds and seasons as risk factors. Statistically significant differences were indicated by a P-value of less than 0.05.

RESULTS

Prevalence of Diseases at the Abattoir: The number of cattle slaughtered from January to December 2023 was 12,269. However, cattle with disease conditions were 253. The prevalence of diseases is estimated to be 2.1%.

Risk Factors of the Disease Conditions: From Table 1, female animals had the highest disease conditions ($P=0.104$), with the age of the cattle slaughtered ranging from birth to over 9 years. The 3-4 years group of cattle

Table 1: Risk factors associated with the disease conditions

Variable	Frequency	Percentage
Sex		
Female	168	66
Male	85	34
Age (years)		
0-2	52	21
3 to 4	73	29
5 to 6	42	16
7 to 8	39	15
Over 9	47	19
Breeds		
Gudali	52	21
Muturu	10	4
Ndama	49	19
Sanga	84	33
WASH	31	12
White Fulani	27	11
Season		
Dry	95	3
Wet	158	62
Location		
Tamale Metro	81	32
Gushiegu	51	20
Tolon	31	12
Buipe	24	10
Savelugu	23	9
Kariga	11	4
Kpalbe	1	2
Kumbugu	3	1
Sagnarigu	6	2
Sang	8	3
Walewale	11	4
Yendi	3	1
Total	253	100

slaughtered had the highest disease conditions, followed by 0-2 years and the least recorded in the 7-8 years group ($p=0.818$). The Sanga breed of cattle was mostly affected and the least recorded was in the muturu breed. Most of the disease conditions were recorded in the rainy season ($P=0.3733$) and the Tamale metropolis was where most of the cattle with disease conditions were sourced from ($P=0.4416$).

Disease Conditions That Cause Organ and Carcass Condemnation: Tuberculosis was identified as the major cause of organ and carcass condemnation, followed by CBPP, enteritis and lumpy skin disease. The most affected organs were the lungs, liver, spleen, intestines and kidneys. Additionally, three whole carcasses were affected as presented in Table 2.

Table 2: Disease conditions and the organs affected

Variable	Frequency	Percentage
Diseases/Conditions		
Bovine Tuberculosis (BTB)	107	42.3
Contagious Bovine Pleuropneumonia (CBPP)	73	28.9
Enteritis	18	7.1
Lumpy Skin Disease (LSD)	13	5.1
Hepatic cirrhosis	10	4.0
Pneumonia	7	2.8
Cysticercosis	1	0.4
Decomposition	1	0.4
Emphysema	2	0.8
Foot and Mouth Disease (FMD)	3	1.2
Fasciolosis	2	0.8
Footrot	1	0.4
Fracture	4	1.6
Nephritis	1	0.4
Poisoning	1	0.4
Snakebite infection	3	1.2
Splenitis	5	2.0
Tryponomiasis	1	0.4
Organs and carcasses affected		
Lungs	181	45.5
Spleen	85	21.4
Kidneys	6	1.5
Liver	89	22.4
Intestine	6	1.5
Gluteal muscles	3	1.0
Skin/hide	13	3.3
Forelimbs	4	1.0
Retropharyngeal lymph nodes	4	1.0
Rumen	1	0.3
Udder	2	0.5
Tongue	1	0.3
Whole carcass	3	1.0
Total	398	100

Sources of Cattle Slaughtered with Disease Conditions:

From Table 3, Tamale contributed more cattle slaughtered with disease or conditions, followed by Gushiegu, Tolon and least recorded in Kpalbe. Suspected TB was recorded in all the locations except in Kpalbe and Sagnarigu. Kpalbe, Kumbungu, Sagnarigu and Yendi were locations where suspected cases of CBPP disease were not reported. Suspected LSD was recorded in six different locations, whilst suspected FMD was only found in two locations ($p<2.2e-16$).

Association among Parameters: The chi-square test revealed a significant relationship ($p=0.05$) between sex and age, location (District) and diagnosis, location (District) and breed, location (District) and organs affected. However, there was no significant relationship

Table 3: Suspected Diseases or conditions associated with the sources of cattle slaughtered.

Diagnosis Diseases	Sources (Location)												Total
	Buipe	Gush	Tamale	Kariga	Kpalbe	Kumb	Sag	Sang	Sav	Tolon	Wal	Yendi	
TB	14	20	34	6	-	2	-	1	9	15	4	2	107
CBPP	9	14	23	4	-	-	-	1	7	10	5	-	73
Enteritis	-	3	6	-	-	-	2	2	2	3	-	-	18
LSD	-	6	3	1	-	-	1	-	1	-	-	1	13
Cirrhosis	1	2	3	-	-	-	-	1	3	-	-	-	10
Pneumonia	-	-	3	-	-	-	3	-	-	1	-	-	7
Splenitis	-	1	1	-	-	-	-	1	-	1	1	-	5
Fracture	-	2	-	-	-	-	-	-	-	-	-	-	4
FMD	-	1	-	-	1	1	-	-	-	-	-	-	3
Snake bite	-	-	-	-	-	-	1	1	-	-	1	-	3
Emphysema	-	1	1	-	-	-	-	-	-	-	-	-	2
Faciolosis	-	1	1	-	-	-	-	-	-	-	-	-	2
Cysticercosis	-	-	-	-	-	-	1	-	-	-	-	-	1
Decomposition	-	-	1	-	-	-	-	-	-	-	-	-	1
Nephritis	-	-	1	-	-	-	-	-	-	-	-	-	1
Foot rot	-	-	1	-	-	-	-	-	-	-	-	-	1
Trypanosomosis	-	1	-	-	-	-	-	-	-	-	-	-	1
Poisoning	-	-	1	-	-	-	-	-	-	-	-	-	1

Gushe = Gushegu, Kumb = Kumbungu, Wal = Walewale, Sag = Sagnarigu, Sav = Savelugu

Table 4: Direct financial losses as a result of organ and carcass condemnations

Organ/carcass	Number condemned	Unit price (Ghc)	Financial loss (Ghc)
Lungs	181	200	36,200
Spleen	85	37.5	3,187.5
Kidneys	6	30	180
Liver	89	250	22,250
Intestine	6	150	900
Gluteal Muscles	3	250	750
Skin/hide	13	350	4,450
Forelimbs	4	520	2,080
Retropharyngeal lymph nodes	4	10	40
Rumen	1	60	60
Udder	2	60	120
Tongue	1	30	30
Whole carcass	3	8000	24,000
Total	398		Ghc94, 247.50 (6, 499.83 USD)

Ghc (Ghanaian cedi), USD (United States Dollar), USD 1= GHC 14.50

among sex and diagnosis, sex and breed, sex and location, sex and organ affected, season and diagnosis, season and age, season and location, season and organ affected, location and age, breed and diagnosis, breed and age, breed and organ affected, age and diagnosis, age and organ affected.

Direct Financial Loss as a Result of Organ and Carcass Condemnation: An amount of Ghc 94247.50 was lost due to organ and carcass condemnation. Lung condemnation contributed to the highest loss, followed by the liver, while the tongue contributed the least loss. Whole carcass condemnation resulted in a direct financial loss of Ghc24,000. This is presented in Table 4.

DISCUSSION

Prevalence of Diseases and Risk Factors: The study sought to identify risk factors of the causes of organ condemnation and their direct financial losses at the Tamale abattoir. Out of the 12,269 cattle slaughtered, 253 cattle had various pathological lesions resulting in their organ or whole carcass condemnations, with a prevalence rate of 2.1%. This finding is higher than the findings of Swai and Schoonman [18] and similar to the findings of Mohammed *et al.* [12]. The difference could be due to the differences in location and sample size.

Females (66%) cattle slaughtered were identified with the highest organ and carcass condemnation than the male cattle. This may be due to female animals'

experiencing high physiological stress and therefore easily succumbing to infections [19]. Cattle within the 3-4 years group (29%) were found to have more infections. This age group with a high incidence of disease may be due to stress caused by early weaning or a lack of maternal antibodies [20].

The study reveals that the Sanga breed of cattle (33%) is more susceptible to infections compared to other breeds. The susceptibility can be attributed to several environmental factors, including inadequate nutrition, poor management practices and transportation stress. It was also observed that a high incidence of diseases and other conditions mostly occurred during the rainy or wet season. The highest number of ill-health cases in the wet season may imply that there is an association between disease occurrence and climatic factors [12, 29]. This agrees with the findings of Gale *et al.* [21]. The majority of disease cases were reported in the Tamale metropolis (32%). This could be attributed to the highly popular cattle market in Tamale. Most cattle dealers and butchers source their cattle from there due to the perceived lower prices compared to other locations. This study disagrees with the findings of Mohammed *et al.* [12].

The presence of tuberculosis in practically every area indicates that the disease is widespread. This suggests that TB and CBPP remain a problem in many districts of the Northern region, possibly because both TB and CBPP are difficult for farmers and veterinarians to detect early in cattle at the subclinical stage [9, 12, 27]. Furthermore, producers resort to selling their calves to butchers when they recognize that the animals are wasting away at the clinical stage after ineffective therapeutic management.

The significant relationship revealed by the chi-square test between location and diagnosis indicates that disease infection, animal breed and organs affected by disease depend on the location where the animals are reared. The relationship observed between sex and age indicates that the age of animals slaughtered can be used to determine the sex of the animal. This relates to the fact that only mature females are sometimes slaughtered, while males can be slaughtered at any age.

Causes of Organ and Carcass Condemnation: The occurrence of disease conditions can result in the rejection of carcasses and organs, as demonstrated in this study. In this current study, suspected TB is the major cause of organ condemnations, followed by CBPP,

enteritis, lumpy skin disease and hepatic cirrhosis. This study agrees with the study by Mohammed *et al.* [12] and Jarikre *et al.* [22], where carcasses and organs were condemned as a result of TB and CBPP at the same location. This is also in agreement with Atawalna *et al.* [13] who linked organ condemnations to fasciolosis, abscesses, jaundice, tuberculosis, nonspecific pneumonia, CBPP, hydro nephritis and traumatic reticulo-pericarditis at the Bolgatanga abattoir in Ghana. This may be a result of poor management practice, the inability of veterinarians to diagnose the disease early and the lack of vaccines to prevent most of these diseases.

In Ethiopia, factors such as fascioliasis, cirrhosis, necrosis, abscesses, hydatidosis, CBPP, tapeworm infections, hydronephrosis and hemorrhages were responsible for organ condemnation in three abattoirs [28]. In addition, Mesele *et al.* [24] identified hydatid cysts, fasciolosis, cirrhosis, hepatitis, abscess and calcification as the major causes of organ condemnation in cattle slaughtered at Gonda, Northwest Ethiopia. Nevertheless, our present study did not find nonspecific pneumonia, hydatidosis, necrosis, or hemorrhages to be causes of organ condemnation. This variation might be due to differing geographical locations and the environmental conditions that promote the spread of various diseases.

Direct Financial Loss: The direct financial loss is estimated to be Ghc94,247.50 (6,499.83 USD) as a result of organs and carcass condemnations at the Tamale abattoir. The financial loss in the present study is higher than the findings of Disassa *et al.* [28] in the Dire Dawa Municipal abattoir in Eastern Ethiopia, where 6.375 USD were loss and Atawalna *et al.* [13] in the Bolgatanga municipal abattoir, where GH?31,645.00 (8790.27 USD) was lost due to carcass and organ condemnations. However, this finding is lower than the finding of Berbersa *et al.* [25], who reported that the yearly direct economic loss resulting from the condemnation of organs in cattle slaughtered at the Hawassa municipal abattoir was estimated to be 15,843.89 USD. The disparity in the financial losses projected across different abattoirs could be attributed to differences in disease prevalence and the average annual cattle slaughtered.

Tuberculosis and CBPP remain the most common diseases in abattoirs, posing a public health risk. The direct financial loss as a result of carcasses and organ condemnations was estimated to be Ghc94247.50 (6499.83 USD).

ACKNOWLEDGMENT

Appreciation to the staff members of the Tamale abattoir for allowing us to take data. We also thank the cattle dealers and butchers at the abattoir for providing us with information about the source of cattle and the cost of condemned organs and carcasses.

REFERENCES

1. Kansanga, M., P.D. Andersen, Kpienbaareh, S. Mason-Renton, K. Atuoye, Y. Sano and I. Luginaah, 2019. Traditional agriculture in transition: examining the impacts of agricultural modernization on smallholder farming in Ghana under the new Green Revolution. *International Journal of Sustainable Development and World Ecology*, 26(1): 11-24.
2. Bettencourt, E.M.V., M. Tilman, P.D.D.S. Henriques, V. Narciso and M.L.D.S. Carvalho, 2013. The economic and socio-cultural role of livestock in the well-being of rural communities of Timor-Leste.
3. Anteneh, B.T., 2006. Studies on cattle milk and meat production in Fogera woreda: Production systems, constraints and opportunities for development (Doctoral dissertation, Debub University).
4. McAfee, A.J., E.M. McSorley, G.J. Cuskelly, B.W. Moss, J.M. Wallace, M.P. Bonham and A.M. Fearon, 2010. Red meat consumption: an overview of the risks and benefits. *Meat Science*.
5. Boahin, J.O.B., K. Asubonteng and V. Gyebi-Agyapong, 2016. Ghanaian Indigenous Tanned Leather; An Architectural Decorative Material for Interior Ceiling. *International Journal of Innovative Research and Advanced Studies (IJIRAS)*, 3(7).
6. Hadgu, A., A. Lemma, T. Yilma and H. Fesseha, 2021. Major causes of calf and lamb mortality and morbidity and associated risk factors in the mixed crop-livestock production system in Jamma District, South Wollo, Ethiopia. *Veterinary Medicine International*.
7. Van Klink, E.G., P.G. Prestmo and A. Grist, 2015. Animal health and disease monitoring in the abattoir. *Livestock*, 20(6): 330-335.
8. García-Díez, J., S. Saraiva, D. Moura, L. Grispoldi, B.T. Cenci-Goga and C. Saraiva, 2023. The importance of the slaughterhouse in surveilling animal and public health: a systematic review. *Veterinary Sciences*, 10(2): 167.
9. Ciui, S., A. Morar, E. Tîrziu, V. Herman, A. Ban-Cucerzan, S.A. Popa and K. Imre, 2023. Causes of Post-Mortem Carcass and Organ Condemnations and Economic Loss Assessment in a Cattle Slaughterhouse. *Animals*, 13(21): 3339.
10. Ciui, S., A. Morar, E. Tîrziu, V. Herman, A. Ban-Cucerzan, S.A. Popa and K. Imre, 2023. Causes of Post-Mortem Carcass and Organ Condemnations and Economic Loss Assessment in a Cattle Slaughterhouse. *Animals*, 13(21): 3339.
11. Alemu, B., G. Ayele, U. Magnusson, U. König, H. Desta, B. Wieland and M. Lemma, 2018. Field postmortem examination training module.
12. Mohammed, A., A. Abdulai, P.T. Birteeb and S.M.A. Husssein, 2018. Major causes of organ and carcass condemnations of cattle and their associated financial loss at the Tamale abattoir, Ghana. *UDS International Journal of Development*, 5(1): 53-67.
13. Atawalna, J., M. Gbordzi, B.O. Emikpe and T. Anyorigeyah, 2016. Whole carcass and organ condemnation and their associated financial losses in ruminants slaughtered at the Bolgatanga municipal abattoir of Ghana.
14. Chagomoka, T., A. Drescher, R. Glaser, B. Marschner, J. Schlesinger and G. Nyandoro, 2015. Vegetable production, consumption and its contribution to diets
15. Ogurinade, A. and A. Ogunrinade, 1980. Economic importance of bovine fascioliasis in Nigeria. *Trop Anim Health Prod*, 12: 155-60.
16. Grant, A., 2016. Variation in dental attrition in mammals and its relevance to age estimation. *Research problems in zooarchaeology*, pp: 103-106.
17. Herenda, D.C. and P.G. Chambers, 1994. *Manual on meat inspection for developing countries* (No. 119). Food and Agriculture Org.
18. Swai, E.S. and L. Schoonman, 2012. A survey of zoonotic diseases in trade cattle slaughtered at Tanga city abattoir: a cause of public health concern. *Asian Pacific Journal of Tropical Biomedicine*, 2(1): 55-60.
19. Emikpe, B.O., T.A. Jarikre, S.O. Akpavie, T. Opoku-Agyemang, D. Asare and R.D. Folitse, 2019. Histological and immunohistochemical assessments of pneumonia in sheep slaughtered at Ibadan, Nigeria and Kumasi, Ghana. *Journal of Immunoassay and Immunochemistry*, 40(3): 300-313.
20. Mohamed, R.A. and E.B. Abdelsalam, 2008. A review on pneumonic pasteurellosis (respiratory mannheimiosis) with emphasis on pathogenesis, virulence mechanisms and predisposing factors. *Bulg. J. Vet. Med.*, 11(3): 139-160.

21. Gale, P., T. Drew, L.P. Phipps, G. David and M. Wooldridge, 2009. The effect of climate change on the occurrence and prevalence of livestock diseases in Great Britain: a review. *Journal of Applied Microbiology*, 106: 1409-1423.
22. Jarikre, T.A., B.O. Emikpe, R.D. Folitse, T.K. Odoom, E. Shaibu and A. Fuseini, 2014. Some diseases associated with carcass condemnation in Tamale Abattoir, Northern Ghana. *Bullet Animal Health Production Africa*, 62: 45-51.
23. Phiri, A.M., 2006. Common conditions leading to cattle carcass and offal condemnations at 3 abattoirs in the Western Province of Zambia and their zoonotic implications to consumers. *South African Vet.*, 77(1): 28-32.
24. Mesele, G., T. Guadu, B. Bogale and M. Chanie, 2012. Pathological conditions causing organ and carcass condemnation and their financial losses in cattle slaughtered in Gondar, Northwest Ethiopia. *African Journal of Basic and Applied Sciences*, 4(6): 200-208.
25. Berbersa, S.M., T.S. Mengistu and F.T. Woldemariyam, 2016. Major causes of organ condemnation and associated financial loss in cattle slaughtered at Hawassa Municipal Abattoir, Ethiopia. *Journal of Veterinary Medicine and Animal Health*, 8(10): 150-156.
26. Asres, Z., B. Nigus, S. Abiy, L. Mesfine and T. Abebe, 2014. On-station retrospective epidemiologic study of small ruminant disease in Sirinka agricultural research center, sheep and goat breeding, evaluation and distribution site. *Academic Journal of Animal Diseases*, 3(3): 39-44.
27. Admassu, B., A. Shite and W. Molla, 2015. Contagious Bovine Pleuropneumonia in Ethiopia (Review Article). *Academic Journal of Animal Diseases*, 4(2): 87-103.
28. Disassa, H., M. Ahmednur, H. Jaleta, T. Zenebe and G. Kebede, 2015. Major cause s of organ condemnation and its financial losses in cattle slaughtered at Dire Dawa municipal abattoir, Eastern Ethiopia. *Acad J Anim Dis*, 4(3): 118-23.
29. Ashagrie, A., S. Abera and D. Zewde, 2022. Review on ecology and drivers of emerging infectious diseases. *Academic Journal of Animal Disease*, 11(2): 44-52.