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Major causes and abnormalities of organ condemnation and financial loss in cattle slaughtered at Dessie municipal abattior North Eastern Ethiopia

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A cross sectional active and retrospective abattoir survey was undertaken from November 2013 to April 2014, on cattle slaughtered at Dessie municipal abattoir with the aim of identifying the major causes of organ condemnation, risk factors for organ condemnation and estimating the financial loss attributed to the condemned organs in cattle slaughtered at Dessie municipal abattoir, North-East part of Ethiopia. Of the total 768 examined animals, abnormalities were detected in 82 (10.68%) during ante mortem inspection and 430 (55.99%) were animals from which organ condemned during postmortem inspection. From the total cattle slaughtered, 311 (40.49%) livers, 142 (18.49%) lungs, 39 (5.08%) kidneys, 34 (4.43%) hearts and 6 (0.78%) tongues were condemned due to various causes. Hydatidosis (22.13%), fasciolosis (20.18%) and cirrhosis (8.85%), hepatitis (4.43%), pneumonia (3.25%), abscess (2.6%), pericarditis (2.08%), edema (1.82%), hydronephrosis (1.43%), nephritis (1.04%) were the major identified causes from the lesions responsible for the rejection of organs. Statistically significant difference in organ condemnation rate was found between age (p = 0.000), body condition score (p = 0.000) and origin (p = 0.013) of animals. However, there was no statistically significant difference between the two breeds although there was higher condemnation rate of organ in cross breed cattle. In the study, fasciolosis and hydatidosis were the major causes of organs condemnation. The direct financial loss from organ condemnation due to various reasons was estimated to be 122,617.70 Ethiopian Birr (6,288.08 USD) per annum. Hence, commencement and implementation of prevention and control measures are must so as to secure from the financial loss they cause.

Key words: Dessie, Ethiopia, Financial loss, major causes, organ condemnation.

INTRODUCTION

Ethiopia has large livestock population in Africa with an estimate of 44,318,877 cattle, 23,619,720 sheep, 23,325,113 goats, 6,000,000 equines, 2,300,000 camels and 43,000,000 poultry (CSA, 2008). Hence, an increase in cattle production could contribute to the attainment of food self-sufficiency in the country particularly in response to protein requirement for the growing human population as well as to enhance the export earnings (FAO, 2007). Abattoirs played an important role in examined for unusual signs, lesions or specific diseases

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surveillance of various diseases of human and animal health importance. Surveillance at the abattoir allows for all animals passing in to human food chain to be (Chhabra and Singla, 2009 and Alton et al., 2010). Monitoring and other conditions at slaughter has been recognized as one way of assessing the disease status of herd, however this source of information is not fully exploited worldwide (Mellau et al., 2010). Abattoir data is an excellent option for detecting diseases of both economic and public health importance (Abunna et al., 2010). Abattoir data can be a source of valuable information on the incidence and epidemiology of animal diseases conditions, to estimate the financial losses incurred through condemnation of affected organs (Raji et al., 2010). An important function of meat inspection is to assist in monitoring diseases in the national herd and flock by providing feedback information to the veterinary service to control or eradicate diseases (Gracey et al., 1999). The main causes of organ condemnation during postmortem inspection are diseases originated by parasites, bacteria and viruses. Flukes in liver and hydatid cyst in lung, liver and kidney, are mainly involved (Mezegebu, 2003). In Ethiopia, many studies have been undertaken to identify the major disease conditions encountered during ante mortem and postmortem inspection and to determine the economic importance of organ and carcass condemnation. Fasciolosis, hydatid cyst, Cysticercus bovis, pneumonia, emphysema, hydronephrosis, cirrhosis, hepatitis, calcification and abscessation were the major causes of organs condemnation in cattle slaughtered at Adigirat municipal abattoir (Alembrhan and Haylegebriel 2013; Singla and Juyal 2014). Genet et al., (2012) from Gonder ELFORA abattoir reported the financial loss due to edible organ and carcass condemnation to be 21,565,849 Ethiopian birr per annum. Fasciolosis and hydatidosis were the major causes for condemnation that led to huge economic losses. By another author, an annual direct financial loss of 154,850.22 Ethiopian birr was estimated in Gondar ELFORA abattoir due to condemnation of edible organs (Yifat et al., 2011). Amene et al., (2012) reported that an estimated average amount of 172,664.09 ETB was lost annually due to organ condemnation of cattle at Jimma Municipal abattoir. Of all the losses, liver condemnation has accounted for the higher proportion (92.7%). Similar economic loss analysis by Fasil, (2009) showed annual economic loss of 150,048.98 ETB at Gondar Municipal abattoir. Another report in cattle slaughtered at Mekele municipal abattoir revealed an estimated annual economic loss of 222,884.58 ETB. Most of the studies conducted in Dessie municipal abattoir have focused only on specific diseases such as fasciolosis and hydatidosis. As a result of this, there is no complete information about causes of organ condemnation at Dessie municipal abattoir. In line with this, it would be essential to have comprehensive information on occurrence of various diseases and causes of organ condemnation and their financial loss to establish appropriate strategy for prevention and controls. Therefore, the objectives of this study were to identify the major causes of organ condemnation, to identify risk factors for organ condemnation and to estimate the direct financial loss attributed to the condemned organs in cattle slaughtered at Dessie municipal abattoir.

MATERIALS AND METHODS

Study area

The study was conducted from November 2013 to April 2014 at Dessie Municipal abattoir. The animals were brought from different areas (Tewuledere, Dessie Zuria, Kutaber and Tenta). Tehuledere is located at the eastern edge of the Ethiopian highlands in the Debub Wollo Zone and the altitude of Tehuledere ranges from 500 meters above sea level along the boundary with the Debub Wollo Zone to 2700 meters along its southwest border. Dessie is the capital of South Wollo Zone situated at the North-east part of Ethiopia at a distance of about 400 km away from Addis Ababa the capital of Ethiopia. Dessie is located at 11 08' North latitude and 39 38' East longitudes and has an elevation of about 2600 meters above sea level. The area gets 936 to 1070 mm Hg rainfall annually. The mean monthly minimum and maximum temperatures are 12.37°C and 26.27°C, respectively (DFEDB, 2007).

Study population and sample size determination

Study population

The study population constitutes of local and cross breed cattle originating from different localities and districts around the town; Tewuledere (midland), Tenta (midland), Dessie Zuria (Highland) and Kutaber (Highland). The majority of animals slaughtered were local breeds and age wise adult animals took the greater proportion.

Sampling and sample size determination

Systematic random sampling technique was used to select the animals to be included in the sample. The required sample size was calculated based on the expected prevalence of 50%, absolute desired precision of 5% and at confidence level of 95% according to the formula provided by Thrusfield, (2005). However, to increase the precision, the sample size was doubled consequently. The total sample size taken for the study was 768 cattle.

$$N = \frac{1.96^2 \times P_{exp}(1 - P_{exp})}{d^2}$$

Where N = Number of sample size, P_{exp} = expected prevalence, d^2 = Absolute precision, CI = Confidence interval (95%)

Therefore the sample size will be;

$$N = \frac{(1.96)^2 \times 0.5\ (1 - 0.5)}{0.05^2} = 384 \times 2 = 768$$

In active abattoir survey, each week four days visit was done for

ante mortem and postmortem examination of slaughter animals.

Study design

The study conducted was basically cross sectional type based on active abattoir survey. Three year retrospective data from the abattoir was also used to estimate the financial loss due to organ condemnation.

Active abattoir survey

Ante mortem examination

During ante mortem examinations, identity tag numbers were given to the selected animals and relevant information including origin (Tehuledera and Tenta as midland while Dessie Zuria and Kutaber Highland), physical condition and health status were recorded. Body condition score of the sample animals were measured and standard grades given as described by Nicholson and Butterworth, (1986). The judgment have also been passed based on the procedure given by FAO, (2007).

Postmortem examination

Postmortem examination was conducted by visualization, inspection, palpation and systematic incision of each visceral organ particularly the liver, lung, heart and kidney for the presence of cysts, various adult parasites and other abnormalities (Gracy, 1999). The pathological lesions were differentiated and judged based on meat inspection guidelines (FAO, 2007).

Assessment of direct financial loss

The total direct financial loss due to organ condemnation was computed or determined by using the condemnation rate of each edible organ that has been determined by this study, the average annual slaughter capacity of the abattoir from three year retrospective data and average current local market price of major organs. Average current local market price of each organ and carcass was collected by questionnaire from the butcheries in Dessie town for ease of computing the loss. Consequently the total financial loss was calculated by the following formula set by Ogunrinade and Ogunrinade (1980).

EL = ἐsrk X Coy X Roz

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

Data management and analysis

Collected data was entered into Microsoft excel and summarized by descriptive statistical methods like percentage and proportion. Then data was also analyzed by using version 20 of SPSS software. The results of this study were considered statistically significant when P value is less than 0.05.

RESULTS

Abattoir survey

Ante mortem examination

During ante mortem inspection, abnormalities were detected in 82 (10.68%). The major abnormal conditions encountered during ante mortem examination are summarized in the Table 1.

Postmortem examination

In the postmortem inspection, from 430 (55.99%) cattle, different organs were condemned (Table 2). Analysis of potential risk factors with animals from which organ condemned revealed that there is statistically significant difference (P = 0.000), (P = 0.000) and (P = 0.013), between age, body condition score respectively in organ condemnation rate. However, there was no statistically significant difference between breed (P = 0.060). From the total 768 cattle slaughtered, 311 (40.49%) livers were condemned because of various abnormalities or causes of condemnation. Out of these condemned livers, fasciolosis was responsible for 141 (18.36%) liver condemnation followed by cirrhosis 68 (8.85%), hepatitis 34 (4.43%), hydatidosis 31 (4.04%) and the rest rejection rate was due to Fasciolosis + Hydatidosis 14 (1.82%), abscess 10 (1.3%), calcification 7 (0.9%) and *cysticercus bovis* 6 (0.78%). In condemnation rate of liver, there was statistically significant difference (p = 0.019) and (p = 0.017) between the two age groups and among body condition score categories (Table 3). Out of the total cattle slaughtered, 142 (18.49%) lungs were totally condemned because of various abnormalities or causes of condemnation. Out of these condemned lungs, hydatidosis was the cause for 111 (14.45%) of the condemnation followed by Pneumonia 25 (3.25%) and abscess 6(0.78%). There was statistically significant difference (p = 0.017 and p = 0.008) in condemnation rate of lung between age and body condition score categories respectively (Table 4). From the total 768 cattle at slaughtered, 39 (5.08%) kidneys were totally condemned because of various abnormalities or cause of condemnation. Out of these condemned kidneys hydronephrosis was identified as cause for 11(1.43%) followed by hydatidosis 10 (1.3%), Nephritis 8 (1.04%), Calculi 5 (0.65) and cyst 5 (0.65%). There was statically significant difference (p = 0.037) between the body score condition categories in frequencies of causes of kidney condemnation (Table 5a). 34 (4.43%) of hearts were condemned due to various abnormalities. Out of the condemned hearts, Pericarditis was responsible for 16

Table 1. Abnormalities encountered during ante mortem examination.

Abnormalities	No. of animals with abnormalities/etiologies	Prevalence (%)
Ectoparasites	22	2.86
Lacrimation	10	1.3
Lameness	9	1.17
Nasal discharge	7	0.91
Salivation	7	0.91
Branding	6	0.78
Blindness	5	0.65
Fracture	5	0.65
Depression	4	0.52
Localized swelling	4	0.52
Emaciation	3	0.39
Total	82	10.68

Table 2. Over all organ condemnation rate by breed, age, body condition score and origin.

Variables		No. of animals Slaughtered	Animals from which organ condemned	Prevalence (%)	X^2	P - VALUE
Breed	Cross	35	25	71.4	3.55	0.060
	Local	733	405	55.3		
	Total	768	430	55.99	-	-
Age	Adult	477	301	63.1	27.94	0. 000
	Young Adult	291	129	44.3		
	Total	768	430	55.99	-	-
BCS	Good	306	113	36.9	82.13	0.000
	Medium	395	261	66.1		
	Poor	67	56	83.6		
	Total	768	430	55.99	-	-
Origin	Highland	505	299	59.2	6.2	0.013
	Midland	263	131	49.8		
	Total	768	430	55.99	-	-

(2.08%) condemnation followed by Edema 14 (1.82%) and hydatid cyst (0.52%). There was statically significant difference (p = 0.000) between the body score condition categories with frequencies of heart condemnation rate (Table 5b).

Assessment of direct financial loss

The annual direct financial loss due to condemnation of edible organs at Dessie municipal abattoir was estimated to be 122,617.70 Ethiopian birr (6,288.08 USD) (Table 6).

DISCUSSION

The main causes of organ condemnation during postmortem inspection were fasciolosis in the liver and hydatid cyst in the lung (Teka, 1997). In this study 40.49% of livers were condemned because of various abnormalities found during postmortem examination. Among the major causes of liver rejection, 20.18% prevalence of fasciolosis observed in this study is lower when compared with the prevalence of 24.3, 29.6 and 41% reported by Gebretsadik et al., (2009) and Mulat et al., (2012) and Getachew et al., (2006), respectively. The result of the present study is higher than 14.1% from Tanzania by Swai and Ulicky, (2009) and 16.64% by Genet et al., (2012) in Gondor. The difference in the rejection rate of liver due to fasciolosis among this study and the above reports can be mainly attributed to the variation in the climatic and ecological conditions such as altitude, rainfall and temperature as well as the livestock management system among the study areas

Table 3. Disease conditions/causes of condemnation encountered in liver.

Causes of condemnation	Animals as per their age			Animals as per their body condition			
	Adult (477)	Young adult (291)	Total (768)	Good (306)	Medium (395)	Poor (67)	Total (768)
Abscess	5 (1.05)	5 (1.72)	10 (1.3)	4 (1.31)	6 (1.52)	-	10 (1.3)
Calcification	4 (0.84)	3 (1.03)	7 (0.9)	2 (0.65)	5 (1.27)	-	7 (0.9)
Cirrhosis	49 (10.27)	19 (6.53)	68 (8.85)	28 (9.15)	36 (9.11)	4 (5.97)	68 (8.85)
Cysticercosis	3 (0.63)	3 (1.03)	6 (0.78)	2 (0.65)	1 (0.25)	3 (4.48)	6 (0.78)
Fasciolosis	102 (21.38)	39 (13.4)	141 (18.36)	29 (9.48)	80 (20.25)	32 (47.76)	141 (18.36)
Fasciolosis + hydatid cyst	9 (1.89)	5 (1.72)	14 (1.82)	3 (0.98)	10 (2.53)	11 (16.38)	14 (1.82)
Hepatitis	25 (5.24)	9 (3.09)	34 (4.43)	6 (1.96)	23 (5.82)	5 (7.46)	34 (4.43)
Hydatid cyst	21 (4.4)	10 (3.44)	31 (4.04)	4 (1.31)	24 (6.08)	3 (4.48)	31 (4.04)
Total	218(45.7)	93 (31.96)	311 (40.49)	78 (25.5)	185 (46.84)	48 (71.64)	311 (40.49)

X^2 = 18.27; P - value = 0.019, X^2 = 106.31; P - value = 0.017.

Table 4. Disease conditions/causes of condemnation identified in lung.

Causes of condemnation	Animals as per their age			Animals as per their body condition			
	Adult (477)	Young adult (291)	Total (768)	Good (306)	Medium (395)	Poor (67)	Total (768)
Abscess	4 (0.84)	2 (0.69)	6(0.78)	4 (1.31)	2 (0.51)	-	6 (0.78)
Hydatidosis	83 (17.4)	28 (9.62)	111 (14.45)	33 (10.78)	65 (16.46)	13 (19.4)	111 (14.45)
Pneumonia	18 (3.77)	7 (2.4)	25 (3.25)	4 (1.31)	15 (3.8)	6 (8.96)	25 (3.25)
Total	105 (22.01)	37 (12.71)	142 (18.49)	41 (13.4)	82 (20.76)	19 (28.36)	142 (18.49)

X^2 = 12.078; P - value = 0.017, X^2 = 20.71; P - value = 0.008.

Manyazewal et al. (2014). In relation to the BCS of the animals, liver condemnation rate due to fasciolosis was 64.14% in the poor BCS, 22.78% in medium BCS, and 10.46% in good BCS animals. Mulat et al., (2012) reported 52%, in medium body condition animals and 41.7% in good body condition animals. Another similar findings were reported from Gondar abattoir 28.4 and 20.4% and from Debre zeit abattoir 30 and 24% (Yemisrach and Mekonnen, 2012), in medium and good body condition animals, respectively. The results reveal that the weight of animals increase as the parasitic infection decrease which could be due to acquired immunity in the host. Body condition become good as fasciola infection decreases since fasciola worms suck blood and tissue fluid and damage the parenchyma of liver due to the migrating immature worms (Marquardt et al., 2000). Finding of 8.85% of liver condemnation due to cirrhosis is comparable with report of Raji et al. (2010) 10.4% at Zaria abattoir. However, this finding is higher than that of 1.1% reported by Yifat et al., (2011) in Gondar and liver condemnation due to cirrhosis in the present study was lower than 16.05% reported by Nurit et al., (2012) in Kombolcha. In this finding hepatitis was responsible for 4.43% of liver condemnation from the total slaughtered cattle which is higher than the report of 0.6% in Kombolcha by Jemal (2009) and lower than 14.83% in Kombolcha by Nurit et al., (2012). In the present study, the rejection rate of liver due to hydatidosis is 4.04%,

Table 5a. Disease conditions/causes of condemnation identified in kidney and heart by body condition.

Kidney				
Reason of condemnation	Animals as per their body condition			Total (768)
	Good (306)	Medium (395)	Poor (67)	
Cyst	-	4 (1.01)	1 (1.49)	5 (0.65)
Hydronephrosis	2 (0.65)	9 (2.28)	-	11 (1.43)
Hydatidosis	6 (1.96)	3 (0.76)	1 (1.49)	10 (1.3)
Nephritis	-	8 (2.03)	-	8 (1.04)
Calculi	1 (0.33)	4 (1.01)	-	5 (0.65)
Total	9 (2.94)	28 (7.09)	1 (1.49)	39 (5.08)

X^2 = 19.3; P - value = 0.037.

Table 5b. Disease conditions/causes of condemnation identified in kidney and heart by body condition.

Heart				
Reason of condemnation	Animals as per their body condition			Total (768)
	Good (306)	Medium (395)	Poor (67)	
Hydropercardium	1 (0.33)	7 (1.77)	6 (8.96)	14 (1.82)
Hydatidosis	1 (0.33)	2 (0.51)	1 (1.49)	4 (0.52)
Pericarditis	2 (0.65)	9 (2.28)	5 (7.46)	16 (2.08)
Total	4 (1.31)	18 (4.56)	12 (17.91)	34 (4.43)

X^2 = 38.81; P - value = 0.00.

Table 6. Estimated direct annual financial loss.

Organ condemned	Average rejection rate of organs (%)	Average annual slaughtered animals from retrospective data	Average price of organs at local market (ETB)	Annual loss estimation (ETB)
Liver	40.49	4116	55	91,661.26
Lung	18.49	4116	20	15,220.97
Kidney	5.08	4116	35	7,318.25
Heart	4.43	4116	40	7,293.55
Tongue	0.78	4116	35	1,123.67
Total estimated loss	122,617.70			

which is similar to 4.2% in Tanzania by Mellau et al., (2011) and comparable with 3.7% in Gondar by Yifat et al., (2011). The analysis of the result on the bases of age indicated the total liver rejection rate was higher in older animals and a significant difference was observed between the two age groups. This may be due to most of liver diseases are chronic and the older animals are mostly affected by many diseases Mesele et al., (2013). 8.49% lungs were condemned due to various causes. Of those causes, hydatidosis and pneumonia were the most important reason for rejection of lung. The current study result in condemnation of lung by hydatidosis (14.45%) is comparable with the result 19.37% of Shegaw et al., (2009) in Mekelle. This variation in prevalence of hydatidosis could be due to differences in animal husbandry system, back yard slaughtering of animals, lack of proper disposal of infected carcass and the presence of stray dogs and their relations with animals Mesele et al., (2013). In the present study, the overall prevalence of hydatidosis 22.13% is higher than 13.61% by melaku et al., (2012) in Dessie municipal abattoir, 15.2% as reported by Kebede et al., (2009b) in Birre-Sheleko and Dangila abattoirs, 16% in Wolaita Sodo abattoir by Kebede et al. (2009a, c), 32.1% by Gebretsadik Berhe, (2009) in mekelle. These variations in prevalence of the diseases in different areas might be due to variation in the ecological factors that determine the occurrence of the diseases. Different prevalence results may be reported from the same area due to variations in the number of animals examined, the

duration and months of the study period. Varying prevalence figures of hydatidosis have been reported in cattle in Africa by several scholars Gebretsadik et al., (2010). A possible reason for the difference in the prevalence of hydatidosis might be due to the contact between large numbers of stray dogs with the herd of cattle. Dogs, which are the final host for the disease transmission, are used as guards for herds and are routinely fed with uncooked offal which deemed unfit for human consumption (Getaw et al., 2010). Additionally variability could be related with age factors. Other factors like difference in culture, social activities and attitudes to dogs in different regions may contribute to variation (Arbabi and Hooshyr, 2006). In the present study, condemned lung by Pneumonia was 3.25% comparable with 2.45% Genet et al., (2012) at Gondor and lower than 8.8% reported by Raji et al., (2010) in cattle slaughtered at Zaria. A number of factors may explain in the different prevalence of pneumonic lungs, including 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 Benard et al., (2011). In this study, 5.08% kidneys of cattle were totally condemned due to different abnormalities. This finding was closer to 5.77% by Shegaw et al., (2009) in Mekelle and lower than 8.6% reported by Jembere, (2002) at Nazareth abattoir in Ethiopia. However, it was higher from the report of 4.2% by Monaghan and Hannan, (1983). There was statically significant difference ($p = 0.037$) in condemnation rate of kidneys among the body condition score groups.

In this study, 4.43% of heart was totally condemned due to different reasons. This finding was comparable with 3.71% reported by Shegaw et al., (2009) in Mekelle. In the present study, pericarditis accounts 2.08% for the condemnation of heart which is higher than 1.17% reported by Shegaw et al., (2009) in Mekelle. Heart condemnation rate have been statistically significant different ($p = 0.000$) in relation to the body condition which was higher in animals with poor body condition. From the slaughtered cattle, 0.78% of tongues were condemned. The result of this finding coincides with that of 0.9% Shegaw et al., (2009). There is no statistically significant difference between the origin, age, and body condition in rejection rate of tongues.

In the present study the annual direct financial loss due to condemnation of edible organs at Dessie Municipal abattoir was estimated to be 122,617.70 Ethiopian birr (6,288.08 USD), which is comparable with direct financial loss analysis estimated by Fasil, (2009) who reported an annual financial loss of 150,048.98 ETB at Gondar Municipal abattoir. On other hand, the present result is less than the estimation by Amene et al., (2012). He reported 172,664.09 ETB annual losses due to organ condemnation from cattle at Jimma Municipal abattoir. Another report in cattle slaughtered at Mekele municipal abattoir revealed an estimated annual economic loss of 222,884.58 ETB, which is certainly higher than the financial loss estimated by the present study. The difference in the financial loss estimated in various abattoir and/or parts of Ethiopia would be due to the variations in the prevalence of disease, mean annual number of cattle slaughtered in the different abattoirs and also the variation in the retail market price of organs Arbabi and Hooshyar, (2006).

Conclusion

In accordance with the results of this study, fasciolosis, hydatidosis, pneumonia, Abscess, pericarditis and hydronephrosis were the major causes for organ condemnation. There was higher overall organ condemnation rate in adult than in young adult, poor body condition animals than the other body condition score categories and in animals from highland than midland origin and this difference was statistically significant. The organ condemnation rate determined by this study incurred in substantial financial loss which is about 122,617.70 ETB per annum. Hence, this study is valuable for the country by providing information on disease conditions most frequently occurring in the study area and organs condemned by those lesions/disease conditions which have public health hazard and aesthetic value. Therefore, further studies should be conducted especially in assessing the indirect losses.

Conflict of Interests

The authors have not declared any conflict of interests.

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