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Slaughter of pregnant Tanzania shorthorn Zebu cattle at Morogoro abattoir: Prevalence, fetal wastage, and placentome morphology

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Abstract Slaughtering pregnant cattle for meat is unethical, impends food security, and brings animal cruelty. A six-month study spinning from June and December 2020 was carried out to determine the number of Tanzania shorthorn zebu (TSHZ) slaughtered cattle, level of fetal wastage, number, size, and morphology of placentomes and their relationship with fetal age, sex, weight, and location in uteri. Results showed that 15,239 cattle were slaughtered, of which 99% (n=15,087) were TSHZ aged above three years. 61.38% (n= 9,353) of slaughtered cattle were female cattle, of which 2,599 (27.79%) were pregnant at varied gestation periods, and only 5,886 (38.63%) were males. Recovered fetuses were 1,450 (55.79%) males and 1,149 (44.21%) females, with a total of 1,081 (41.59%), 919 (35.36%), and 599 (23.05%) recovered in the first, second and third trimester, respectively. Fetal ages varied from 2.2 to 8.9 months, with body length (crown-crump) ranging from 13.7 to 83.1 cm. Fetus weight ranged from 1.1 kg to 23.2 kg. A total of 1545 (59.45%) pregnancies were localized in the right uterine horn, whereas 1054 (40.55%) were in the left uterine horn. The number of placentomes was significantly larger ($P < 0.05$) in gravid horns ranging from 71 to 115, than in non-gravid horns (5-28). Placentomes in gravid horn were greatly vascularized, large in size, convex in shape, and measured 7 cm in length and 2 cm in width. In non-gravid horns, placentomes were pale, small, and flat and measured 4 cm in length and 1 cm in width. At the microscopic level, the fetal cotyledons comprised a chorionic plate with a smooth external surface of cuboidal epithelium. From the chorionic plate's internal surface, numerous primary villi sprout inside in a pinnate fashion, producing secondary and tertiary villi. A significant fetal loss was resulting from the slaughter of pregnant animals warrants stepping up routine veterinary ante-mortem inspection of traded animals to salvage the high level of fetal wastage.

Keywords: placentome parameters, slaughter fetal wastage, Tanzania shorthorn zebu

1. Introduction

The United Republic of Tanzania (URT) has approximately 33.94 million cattle herds ranking second for the highest cattle population in Africa and accounting for 1.4% of the global cattle population (URT 2021). Of the cattle population in Tanzania, indigenous cattle, mainly the Tanzania shorthorn zebu (TSHZ), account for 98% of the national herd and contribute significantly to most people's livelihood and food security (Msalya et al 2017). The human population in Tanzania is projected to increase rapidly in the next few years; 67 million in 2025, 77.5 million in 2030, and 89.2 million in 2050 (URT 2018). This projected human population increment will present important challenges to achieving food security. Notwithstanding the steady animal protein demand accentuated by population growth, illiteracy, and poverty, farmers sell off animals without considering their fertility stage, especially breeding stock and pregnant animals, followed by inadequate meat inspection practices (Delgado 2005; Thornton 2010; Robinson and Pozzi 2011). The slaughter of a pregnant animal is unethical, and uneconomic practice decreases livestock growth capacity and lower herd replacement rates at the country level (Maurer et al 2016; Kalu et al 2019; Mutwedu et al 2019). Furthermore, the slaughter of pregnant cattle enhances the dissemination of zoonotic pathogens such as *Brucella*, *Listeria*, and zoonotic *Staphylococcus* species through contamination of the meat, environment, or abattoir personnel, thus facilitating the cycle of zoonotic infections (Ekere et al 2018; Okoli et al 2018).

To meet protein requirements for the global human population, fast-growing livestock production must have a healthy and normal placenta. The placenta is a principal feature of mammalian embryonic development, which serves as an organ of nutrient supply, waste-product elimination, insulation, and source of hormones and enzymes (Mossman 1987; Hoffmann and Schuler 2002). The bovine placenta is classified as an epitheliochorial placenta due to the occurrence of migration of fetal cells

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through the maternal-fetal junction and the fusion of these cells with the maternal epithelial cells (Wooding 1992; Carter and Mess 2017; Peter et al 2017).

It is classified further as villous and cotyledonary (Mossman 1987), in which distinct fetal structures known as cotyledons, interlock with discrete maternal structures (caruncles) to form placentome which is the functional unit of the placenta (Schlafer et al 2000; Folusho 2012). The placental formation is linked to and pivotal for fetal development. It starts after 18 to 19 days of gestation in cattle extending from the pregnant to the non-pregnant horn (Wooding and Burton 2008). The bovine placenta is classified as polycotyledonary type, with placentomes forming from 30 days of gestation onwards, arranged in a relatively orderly manner, and varying remarkably in size and shape during pregnancy (Schlafer et al 2000).

Placentome morphology has been studied in many domestic and wild ruminant species, including domestic cattle (Laven and Peters 2001), water buffalo (Abd-Elnaeim et al 2003), sheep and goat (Mossman 1987; Hradecky et al 1988; Kashoma and Luziga 2019), deer (Sohn et al 2021) and antelope (Hradecky et al 1988; Benirschke 2005). However, the number, size, and shape of placentomes depend on species and breeds (Schlafer et al 2000; Laven and Peter 2001; Schmidt et al 2006; Lui et al 2010).

Variability in placental structures is even extraordinary in the family Bovidae, with each optimal ensuring conditions for the developing offspring and substantial divergence among species and breeds (Ritz et al 2000). There is limited information on the gross and microscopic structures of the placentome, fetal parameters, and wastage during slaughter at Morogoro Municipal abattoir. Therefore, this study aims to determine fetal wastage at the Morogoro Municipal abattoir, examine the gross and microscopic structures of placentomes, and determine the relationship between the morphology of placentome and fetal parameters such as gestational age, sex, weight, and location in uteri of TSHZ.

2. Materials and Methods

2.1. Study area

The study was conducted at Morogoro Municipal abattoir, located 200 km west of Dar es Salaam, Tanzania. The abattoir was constructed during the colonial era in 1953 to provide daily meat requirements for the inhabitants of Morogoro municipality. Geographically, Morogoro municipal lies between latitudes 5°7′ and 10°00′ south of the Equator and longitudes 35°6′ and 39°5′ east of Greenwich at an elevation of 500 to 600 meters above sea level. The municipality has a mixture of warm and cool temperatures ranging between 27 to 33.7ºC in the dry/warm season and 14.2 to 21.7 °C in the cool/wet season. The area experiences a sub-humid tropical climate with a bimodal rainfall pattern characterized by two rainfall seasons in a year, with a dry season separating the short rains (October to December) and long rains (which fall from March to May/June). There are about six months of dryness, the peak being September. The mean annual rainfall is about 870 mm, and the total annual evapotranspiration is about 1300 mm.

2.2. Animals and source of specimen

Morogoro municipal slaughterhouse, when fully operated, has a daily capacity of slaughtering 100 - 150 heads of cattle. During the active visit from June through December 2020, the slaughterhouse received animals from the Morogoro region's districts of Kilosa, Mvomero, and Gairo. Most cattle slaughtered during the study period (99%) were TSHZ. They mostly were in body condition scores of f Transportation means of animals from cattle auction to the slaughterhouse mainly using vehicles and trekking. Data on the total number of cattle slaughtered, the ratio of females to males slaughtered, and the number of fetuses with their specific ages, sex, weight, and location in uteri were recorded daily during the entire study period. After slaughtering, the uteri of the pregnant cow were collected. Depending on the estimated size of the fetus, the pregnant uterus was either removed unopened (for small-to-medium-sized fetuses), or the uterus was opened, and the fetus was freely extracted (for large fetuses).

2.3. Fetal parameters

Collected fetuses were examined to ascertain their sex, age, weight, and location in the uteri. The location of a fetus in the uterus was done through an external examination of the collected uterus.

Sexes of the fetuses were determined visually by observing the testicles in males and the V-shaped slit in females. Nevertheless, unidentifiable fetuses were counted and randomized completely as males and females due to the lack of these features. The age of the fetuses was determined by measuring the distance from occipital articulation to the base of the tail (crown-rump length) using a measuring tape (Butterfly®). The duration of the gestation and ages of the fetuses were determined using a formula described by Noakes et al (2009): $X = 2.5 (y + 21)$, where X is the developmental age (days), and Y = Crown – anus length measured in cm. The ages of fetuses collected were classified into three different gestation stages of pregnancy first, second and third trimesters. The calculated age fell between 1 and 3 months, 4 and 6 months, and 7 and 9 months, respectively.

2.4. Morphometric measurements of placentome

The distribution, shape, and number of the placentomes in both left and right horns were examined. The size (length and width) of selected placentomes (selected according to the location within the horns) were measured using a Vernier caliper. Placentomes were then severed from the endometrium by cutting through the upper part of the caruncular stalk, and ten randomly selected placentomes per animal were processed for histological examination. The protocol for histological preparations was according to the methods of Wooding (2006). Briefly, whole placentomes were cut free and placed in Petri dishes containing 10% neutral-buffered formalin. The positioning of the placentome was such that the fetal side was uppermost. The placentomes were sliced across the center to produce 3-4 mm thick samples, the full depth of the placentome. These were fixed by immersion in 10% neutral-buffered formalin. The samples were dehydrated in increasing ethanol concentrations, cleared in xylene, and embedded in paraffin wax. For light microscopy, sections of 4-5µm thickness were cut and stained with haematoxylin and eosin (H&E). Photomicrographs were captured using a Moticam 1000 camera (Motic China Group Ltd.) attached to an Olympus binocular microscope at a magnification of × 40.

2.5. Statistical analyses

The data collected were stored in Microsoft Excel and analyzed using version 7.1 of the Epi-Info software package (Centers for Disease Control and Prevention, Atlanta, GA, USA). Descriptive statistics were generated, such as the proportion of all slaughters, the frequency of pregnant slaughtered cows, and the extent of fetal wastage. Regression analyses were used to evaluate the relationship between the estimated age and fetal parameters, the relationship between the estimated fetal age and placentome size, and the relationship between the estimated fetal age and the number of placentome. The percentage of fetal wastage was calculated as the total number of fetuses recovered divided by the total number of cows slaughtered.

3. Results

3.1. Total number of cattle slaughtered

A total of 15,239 cattle were slaughtered between June through December 2020, representing a monthly kill average of 2,540 and a daily kill average of 85. A total of 15,087 (99%) of the cattle presented to the abattoir for slaughter were TSHZ and above three years of age, while improved breeds were only 152 (1%).

3.2. Number of female and pregnant cattle slaughtered

All slaughtered female cattle were 9,353 (61.38%), and 5,886 (38.63%) were males. 27.79% (2,599) of all female animals slaughtered were pregnant at varied gestation periods. This observation indicates that at least one out of every three female animals brought to the abattoir for slaughter was pregnant (Table 1).

Table 1 Monthly cattle slaughter and fetal wastage at Morogoro Municipal abattoir between June to December 2020.

Month	Total cattle Slaughtered	Male cattle slaughtered (n)	Male cattle slaughtered (%)	Female cattle slaughtered (n)	Female cattle slaughtered (%)	Fetuses recovered (n)	Fetal wastage (%)
June	2549	994	39.00	1555	61.00	409	26.30
July	2516	965	38.35	1551	61.64	435	28.05
September	2445	934	38.20	1511	61.80	452	29.91
October	2464	952	38.64	1512	61.36	434	28.70
November	2506	947	37.79	1559	62.21	421	27.52
December	2759	1094	39.65	1665	60.35	448	26.91
Total	15,239	5,886	38.63	9,353	61.38	2,599	27.79

3.3. Fetal wastage

The total number and percentage of fetal wastage (percentage fetal wastage defined as the total number of fetuses recovered divided by the total number of female cattle slaughtered) revealed 1,081 (41.59%) fetuses were recovered in the first trimester, 919 (35.36%) in the second and 599 (23.05%) in the third. Male fetuses were 1,450 (55.79%), while females were 1,149 (44.21%). No twins or multiple fetuses were retrieved (Table 2; Figures 1 and 2).

3.4. Fetal age, weight, and location in uteri

Fetal ages varied from 2.7 to 8.9 months, with body length (crown-crump) ranging from 13.71 cm to 82.8 cm. Fetus weight varied from 1.0 kg to 23.2 kg, with an average weight of 12.2 kg (Table 3). A total of 1545 (59.45%) pregnancies were localized in the right uterine horn, whereas 1054 (40.55%) were in the left uterine horn.

Table 2 Age distribution of fetuses recovered from the slaughter of pregnant cows.

	Age of fetuses in months			
	1 – 3	4 - 6	7 - 9	Total
June	168 (41.08%)	153 (37.41%)	88 (21.52%)	409
July	195 (44.83%)	142 (32.64%)	98 (22.53%)	435
September	174 (38.50%)	162 (35.84%)	116 (25.66%)	452
October	186 (42.86%)	154 (35.48%)	94 (21.66%)	434
November	172 (40.86%)	141 (33.49%)	108 (25.65%)	421
December	186 (41.52%)	167 (37.28%)	95 (21.21%)	448
Total	1,081 (41.59%)	919 (35.36%)	599 (23.05%)	2,599

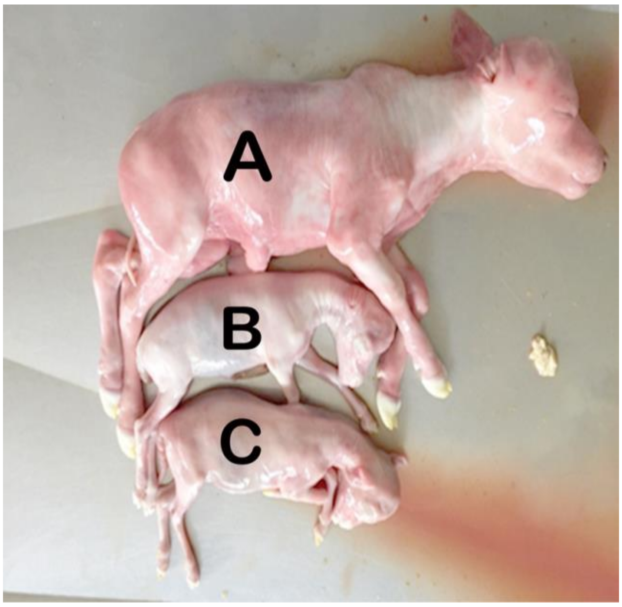

Figure 1 Photograph of Tanzania shorthorn zebu fetuses wasted at different gestation periods. Fetus size wasted during the third trimester [A] and second trimester [B & C].

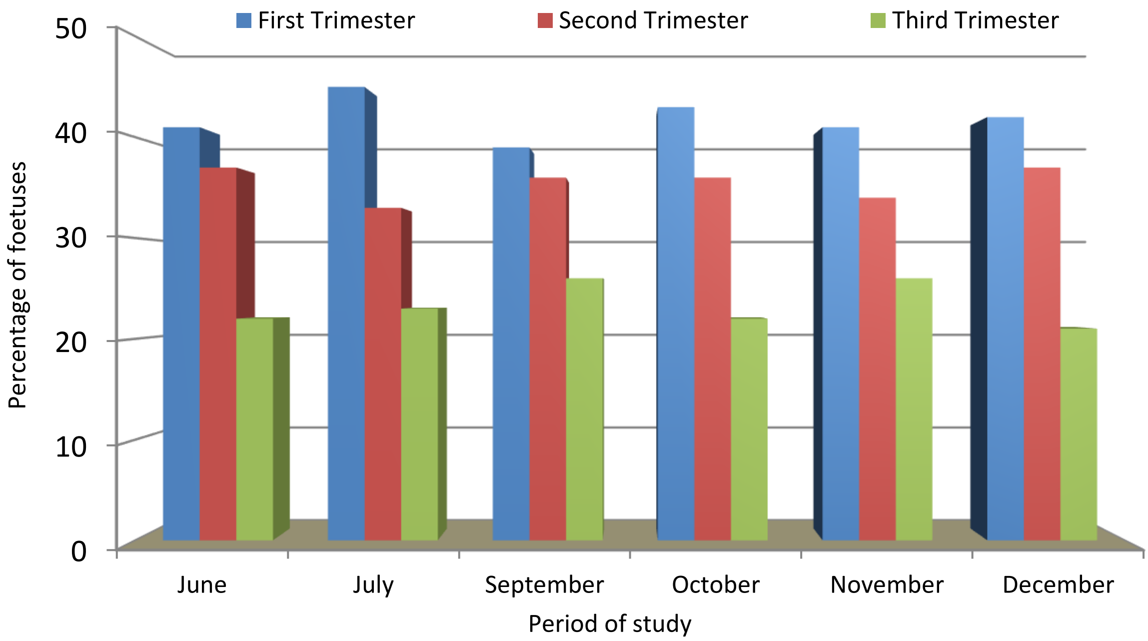

Figure 2 Percentage (%) of fetuses wasted by trimester and month for the period of study.

3.5. Gross morphology and morphometric parameters of placentomes

Placentomes were observed in both gravid and non-gravid uteri. In gravid uteri, placentomes were found to be arranged into four rows that run lengthwise along both uterine horns. Two rows were found parallel to the border of insertion of the mesometrium (ventral), and the other two were parallel to the antimesometrial border (dorsal). Placentomes varied greatly both in shape and colour. Placentomes in the gravid horn were greatly vascularized or deep red, while those in non-gravid uteri were small and paler in colour. Furthermore, placentomes in younger fetuses were pale in colour but more vascularized and deep red in older fetuses. Placentome shapes varied from ellipsoidal to round or spherical and oval (Figures 3A and B). However, large placentomes were ovoid and measured approximately 7 cm in length and 2 cm in width, dome-shaped in cross-section, displaying a broad flat base, convex at the periphery, and were covered by the convex chorionic membrane (Figure 3A). Typical placentomes showed a convex appearance and were narrow at the base (caruncular stalk), demonstrating convex, pedunculated placentomes. At all gestation ages, the number and size of placentomes were significantly larger ($P < 0.05$) in the gravid horns than in non-gravid horns. The average number of placentomes in the gravid uteri ranged from 71 to 115, while non-gravid uteri ranged from 5 to 28 (Table 4). Placentomes collected from the center of the pregnant uterine horn were consistently larger in size than those collected from the tip of each horn. There was a significant increase ($P < 0.05$) in both the diameter and length of placentomes with increased gestational age (Table 5). However, there was no correlation between the mean placentome size (diameter and length) in the pregnant horn and the total number of placentomes ($P > 0.05$).

Table 3 Characteristics of fetuses wasted at Morogoro Municipal abattoir.

Parameters	Modality	June	July	September	October	November	December
Sex	Males	226 (55.3)	229 (52.6)	250 (55.3)	249 (57.4)	242 (57.5)	254 (46.7)
	Female	183 (44.7)	206 (47.6)	202 (44.7)	185 (44.6)	179 (42.5)	194 (43.3)
Age	Minimum	2.7	3.2	2.2	2.7	2.3	2.6
	Mean	5.6	4.8	5.3	5.8	5.5	5.6
	maximum	8.5	8.0	8.3	8.9	8.6	8.7
Length (cm)	Minimum	14.1	15.2	13.7	14.3	14.2	13.9
	Mean	48.5	48.3	47.7	48.7	48.3	48.1
	maximum	82.8	82.2	81.6	83.1	82.3	82.2
Weight (kg)	Minimum	1.1	1.4	1.2	1.3	1.2	1.0
	Mean	12.2	11.8	11.5	11.8	12.1	12.1
	maximum	23.2	22.3	21.7	22.2	22.9	23.1

Values in the bracket represent fetal wastage proportion (%).

3.6. Histological findings of placentomes

The placentomes contained two major parts; fetal cotyledons and maternal caruncles. The fetal cotyledone comprised the chorionic plate with a smooth external surface of simple epithelium comprising low cuboidal cells intermixed with mononucleated and binucleated cells (Figures 4A and B). Below the chorionic plate dwell a connective tissue, pale staining consisting of a few delicate collagenous fibrins and sections of large blood vessels, namely arteries, veins, and capillaries. From the internal surface of the chorionic plate, numerous primary villi sprout inside in a pinnate fashion producing secondary and tertiary villi which interdigitate with the crypts of the maternal endometrium. The maternal caruncles predominantly comprise the surface epithelium of the endometrium containing simple columnar epithelium. The maternal crypts consisted of blood vessels, connective tissues intermingled with cuboidal cells throughout, and epithelial cell lining.

4. Discussion

The total number of pregnant cows slaughtered at Morogoro abattoir was 2,164, representing 17.01% of all cattle from September 2019 to January 2020. Similar findings of 16.9 - 20.6% have been reported in Ghana (Atawalna et al 2013). On the other hand, a low percentage of pregnant cows slaughtered 15.6% has been reported in Bukoba Municipal abattoir (Msafiri et al 2014), 4.1 – 14.4% in Nigeria (Nwakpu et al 2007; Addass et al 2010; Salami et al 2010; Oduguwa et al 2013; Ardo et al 2013) and 6.8% reported in Ghana (Jarikre et al 2014). However, the percentage of pregnant cows slaughtered in this study is lower than the 30.7% reported in Arusha (Mellau et al 2011), 23.7% reported during 2010-2011 in Morogoro Municipal abattoir (Nonga 2015), 29.1% – 40.5% at Tanga Municipal abattoir (Swai et al 2015), 46.0% at Dodoma Municipal abattoir (Tembo and Nonga 2015), 31% in Uganda (Nantongo et al 2013) and 35.7% in Zambia (Zulu et al 2013). The dissimilarity in the number of pregnant submitted for slaughter in different places may be attributed by meet requirements which solely depends on the human population and eating habits of people in the city or town where the abattoirs are situated. Other factors contributing to the slaughter of pregnant cows that lead to fetal wastage include the need for money by farmers to meet household requirements, shortage of animal feed during the prolonged drought, less knowledge to some farmers on the importance of pregnancy diagnosis, scarcity of livestock extension services, and lack of execution of regulation against the slaughter of pregnant animals (Nonga 2015). Although the slaughter of pregnant animals is contrary to the Tanzania Animal disease Act of 2003, which prohibits slaughtering pregnant animals except for emergencies to relieve animal suffering, indiscriminate sales and ultimate slaughter of pregnant cows could be a result of culling unwanted, old or injured animals from the herds (Njoga et al 2021). However, if animals for sale are professionally examined for pregnancy before they are taken to the livestock market (according to Tanzania Animal Diseases Act 2003) and future re-examined at the slaughterhouse during the ante-mortem inspection, the losses associated with the slaughter of pregnant animals would have significantly minimized.

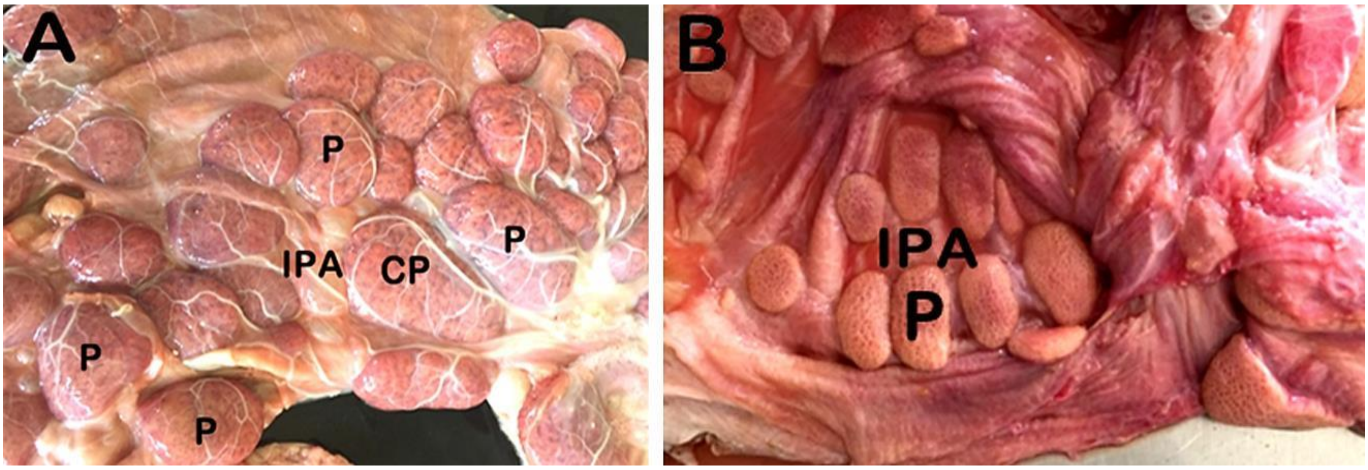

Figure 3 Placentomes in the uterine horns of TSHZ: in pregnant (A) and non-pregnant (B) horns. The placentomes are significantly well developed, many convex and larger (A) compared to poorly developed, fewer, flat, and smaller placentomes in non-pregnant horns (B). The chorionic plate (CP) forms the convex face of the placentome (P) directed toward the fetus, and between the placentomes is the interplacentomal area (IPA).

The percentages of fetuses wasted for the three trimesters during this study were 24.83%, 50.83%, and 24.37 % for the first, second, and third trimesters, respectively. These results are comparable with the findings reported in Tanga, Tanzania (Swai et al 2015), Cameroon (Hakoueu et al 2018), and Nigeria (Ardo et al 2013). The lower percentage in the first trimester could be because pregnancy at this stage may not be detected since farmers mostly depend on visual inspection for pregnancy detection. Furthermore, since the present was limited to visual inspection of the uterus, we were unable to detect early pregnancy (defined as the age between fertilization and day 45), which requires flushing the uterus using normal saline for embryo collection and subsequent laboratory examination. Moreover, most cows presented for slaughter do not have any record detailing their age, last breeding, and calving dates. This could have contributed to the low fetal recovery rate in the first trimester of this study. The high percentage (50.83%) during the second trimester is most likely because pregnant cows phenotypically have a better body condition score than non-pregnant cows, which may be the reason for theft preferences and slaughter of these animals. There is a drop in the third trimester, possibly because, at this stage, the pregnancy is too big closer to calving, and most farmers who want to increase their herds will not sell their animals before calving. Generally, fetal wastage occurs in both developed (Nielsen et al 2019; Zitterer and Paulsen 2021) and developing countries (Atawalna et al 2013; Nonga 2015; Meaza et al 2017; Mutwedu et al 2019) and is quite frightening and thus efforts should be geared towards establishing stringent routine ante-mortem examination including pregnancy diagnosis in cattle sent for slaughter.

Placental development is a key requirement for fetal growth during gestation. This study has provided insight into assessing the growth of Tanzania shorthorn zebu fetus and some accompanying structures throughout pregnancy. This result shows that the placentomes of the Tanzania shorthorn zebu are convex-shaped, pedunculated, and arranged into four rows that run lengthwise along both uterine horns. The shape and arrangement of placentomes observed in Tanzanian shorthorn zebu are consistent with the findings of Okafor et al (2013) observed in Fulani zebu and Laven and Peters (2001) for *Bos taurus* placentomes but differ markedly from the convex and non-pedunculated-of-buffaloes (Abd-Elnaeim et al 2003) and the concave shape of the West African Dwarf goat (Igwebuike and Ezeasor 2013) and Tanzanian goats and sheep (Kashoma and Luziga 2019).

The size of placentomes varied in the different regions of the uterus and different pregnancy stages. This finding is comparable with observation reported in Fulani Zebu (Okafor et al 2013), Yaks (Liu et al 2010), Indian goats (Kumar et al 2015), and West African Dwarf goats (Igwebuike and Ezeasor 2013). The size of placentomes increased with the stage of pregnancy. It varied with the location in the uterus, being the largest in the placentomes nearest the conceptus and declining with distance from the fetus. The increased size of the placentome enhances the rate of physiological exchange between the foetal and maternal systems (Reynolds and Ferrell 1987). The size and number of placentomes were significantly higher in the gravid horn as compared to the non-gravid horn, similar observations previously reported in cattle (Schlafer et al 2000; Laven and Peters 2001), Buffaloes (Abd-Elnaeim et al 2003), Yak (Lui et al 2010) and small ruminants (Gupta 1984; Kashoma and Luziga 2019). The placentomes were generally arranged in four rows in both gravid and non-gravid horns; similar observations have been reported in cattle (Okafor et al 2013). However, Hafez (1954) observed 2 to 6 rows of placentomes in the bovine uterine body and two rows at the extremities of the horn.

Table 4 Number of placentomes in each horn concerning estimated gestational period (range and mean).

Gestation period	Pregnant horn		Non-pregnant horn	
	Mean	Range	Mean	Range
First trimester (n-14)	86.71	71 - 114	16.3	5 – 22
Second trimester (n=18)	89.22	70 – 115	22.6	6 – 25
Third trimester (n=14)	92.71	71 - 109	26.1	9 – 28
Total (n=46)	89.55	71 - 115	21.67	5 - 28

Table 5 Placentome size in pregnant uterine horns.

Gestation period	Placentome diameter (mm)		Placentome length (mm)	
	Mean ± SD	Range	Mean ± SD	Range
First trimester (n-14)	21.2 ± 5.8	11.2 – 27.5	31.0±5.2	19.1 – 38.4
Second trimester (n=18)	33.3 ± 3.9	22.4 – 46.3	53.4 ± 3.0	37.9 – 61.5
Third trimester (n=14)	44.9 ± 4.5	31.8 – 57.9	71.1 ± 3.3	66.5 –78.4

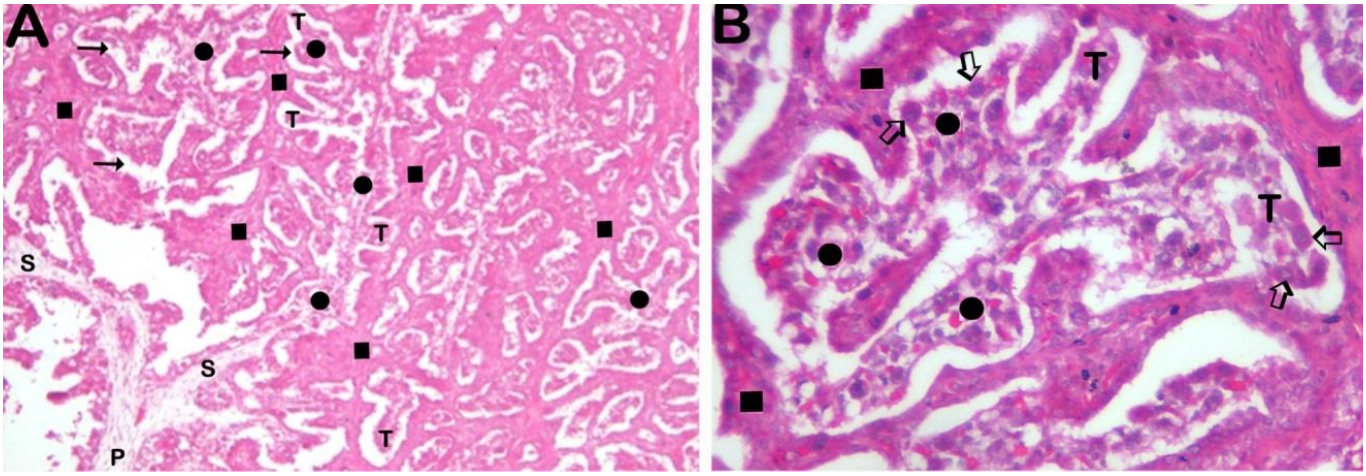

Figure 4 Histological section of placentome from TZSH zebu. A and B show primary chorionic villi (P) arising from the chorionic plate, the secondary chorionic villi (S) that sprout to produce tertiary chorionic villi (T), which interdigitate with the crypt of maternal endometrium. Note the feto-maternal junction (arrows), fetal tissue (rounds), maternal tissue (Squares), and fetal epithelium (Open arrows). Magnification: A, X100; B, X200.

The placentome counts in the present study showed great variability from 71 to 151 and 5 to 28 in the pregnant and non-pregnant horns, respectively. This finding is within the normal range of placentome number (50 - 175) in bovid genera (Mossman 1987). However, cotyledonary numbers differed greatly between present observations and reports by Okafor et al (2013) in Fulan zebu (51 to 128), Rakha and Igboeli (1971) in Angoni cattle (63 -113), Abd-Elnaeim et al (2003) in water buffaloes (90-130) and Schmidt et al (2006) in African Buffaloes (89-178). The reason for this discrepancy in cotyledonary numbers is possibly breeding differences. Therefore, Tanzania shorthorn zebu has a polycotyledonary placenta with placentomes varying remarkably in size and shape during pregnancy.

The placentomes form the link between the mother and fetus during pregnancy and are closely related to the survival and development of the fetus. In this study, the histological features of tissues constituting fully term placentomes revealed caruncular connective tissue septae compartmentalize placentomes into main crypts containing villous trees of various shapes. Similar features have been reported in bovid genera (Hradecky et al 1988), in African buffaloes (Schmidt et al 2006), and in water buffaloes (Abd-Elnaeim et al 2003). Although studies on foetal and maternal vasculature in bovids have been reported, information regarding the Tanzania shorthorn zebu breed is so far lacking. Therefore, the present study revealed evidence for similar architectures in placentomes of Tanzania shorthorn zebu to other bovids (Leiser et al 1997; Pfarrer et al 2001; Abd-Elnaeim et al 2003; Schmidt et al 2006).

5. Conclusions

This study has shown that the incidence of foetal wastage is high, and the abattoirs should work hard to minimize foetal wastage as much as possible by strict pregnancy diagnosis. Subsequently, as veterinarians are competently trained in pregnancy, they should be engaged and kept in the day-to-day running of slaughterhouses and together with strict implementation of the provisions of the Tanzania Animal Disease Act of 2003, which may reduce the number of pregnant animals to be slaughtered. The Tanzania shorthorn zebu placenta is synepitheliochorial with convex placentomes. The placentome number ranges from 71 to 151 in gravid uteri, with size increasing with gestation age in response to greater nutrient/metabolic requirements of the foetus, as the pregnancy progresses.

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Ethical Considerations

The Executive Director of Morogoro Municipality granted permission to carry out this study. Verbal consent was obtained from each of the traded stock owners after explaining the purpose and importance of the study before data collection.

Conflict of Interest

There was no conflict of interest.

Funding

Funds were not received from any agency.

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