Tropical Veterinarian
International Journal Devoted to All Aspects of Health and Diseases of Animals in the Tropics

Tropical Vet. 43 (1), Pages 01 – 11, 2025

Fetal characteristics of slaughtered pregnant cows at different stages of gestation at the Ibadan Central Abattoir

Omobowale Oparinde[1], Ekundayo Samuel[*2], Amos Oladipupo[1], Oluwatoyin Ajala[1]

[1]Department of Theriogenology, Faculty of Veterinary Medicine, University of Ibadan
[2]Department of Veterinary Physiology and Biochemistry, Faculty of Veterinary Medicine, University of Ibadan

[*]Corresponding author: sekundayo90@yahoo.com; 08038905747

Abstract

The surge in human population has increased the need for more cattle and their products as a source of food and other human needs. Unfortunately, fetal wastage due to the slaughter of pregnant cattle is a bane to achieving this. The present study aims to provide information on fetal characteristics of slaughtered pregnant cows at different stages of gestation. Two hundred and ten (210) fetuses from seven breeds of slaughtered pregnant cows at different stages of gestation were collected from Ibadan Central Abattoir between June and August 2019. Fetal morphometry was done using the tape rule and Vernier calliper, while the gestational age of the fetuses was determined using the formula X = 2.5 (CRL + 21) days where X is the gestational age, CRL is the crown-rump length in centimetres. Twenty-seven (27) samples of amniotic fluid were collected from slaughtered pregnant cows for progesterone assay and biochemical tests using standard procedures. Fetal wastage and economic assessments were carried out. Fetal crown-rump length and eye-socket length show the highest (R^2 crown-rump length = 0.999) and least (R^2 eye-socket length= 0.851) relationship with age of gestation. The association between age and fetal morphometry in all the breeds was significant, where, the R^2 value among all breeds was found to be 1.00, except for the Sokoto Gudali breed (R^2 = 0.996). Red Bororo shows the strongest positive relationship between the age of gestation and the biparietal diameter (R^2 = 0.979). Progesterone levels were high in the first and third trimesters. The potassium level increased non-significantly with the age of gestation. Contrarily, the total protein, albumin, sodium, and glucose levels decreased, though non-significantly with age of gestation. There was a huge fetal wastage and high economic loss, valued at ₦13,650,000 monthly. Fetal characteristics remain a reliable biometric parameter in the determination of gestation age in cattle, and fetal wastage due to pregnant cattle slaughter has negative reproductive and economic implications.

Keywords: Cow, Fetus, Gestational age, Amniotic fluid, Abattoir

Introduction

Livestock are a source of food and their products are used as animal feed, clothing, shelter, weapons, utensils and industrial items (Church 1993). Nigeria's livestock (cattle, sheep and goat) populations have been estimated with annual growth rates that are too low to satisfy the requirements of the increasing human population (FAO 2014). Research findings revealed that the Nigerian cattle industry generates USD 6.8 billion of a potential USD 20 billion annually (Bénard *et al.,* 2010). Meat and

meat products provide a means for reducing malnutrition and increasing household food and food security (Babatunde *et al.,* 2017). Ninety-nine per cent of global cattle are utilized for meat and other products such as hides and skins which are processed into leather before being used (Liu 2009; AFRIS 2010). However, the increasing human population is an indication that more cattle for meat production will be needed. Unfortunately, the slaughter of pregnant cattle leading to fetal wastage is a bane to achieving this much-needed increase (Ngbedea *et al*., 2012). Fetal wastage accounts for 20-25% fall in livestock production in sub-Saharan Africa (Chaudhari and Paul-Bokko, 2000; Ngbedea *et al*., 2012), in addition to huge economic losses have been reported (Alhaji 2011; Ngbedea *et al.,* 2012; Dunka *et al.,* 2017). The composition of the fetal amniotic fluid and maternal serum was reported previously (Khadjah *et al.,* 2017; Essawi *et al.,* 2020)

Despite the various reports on the magnitude of fetal wastage (Cadmus and Adesokan, 2009; Idahor *et al.,* 2009; Ibironke, 2010; Alhaji 2011), the challenges still linger. There is a need to have up-to-date information on the fetuses evacuated during the slaughter of pregnant cattle in the Abattoirs. This will allow for easy assessment of the reproductive and economic implications. Therefore, this study aims to provide information on fetuses at different stages of development and generate data for the basic composition of amniotic fluid at different stages of gestation.

Materials and Methods

Animal source and collection

The study was carried out at the Ibadan Central Abattoir, Amosun, Oyo State. Data on the total number of cattle slaughtered including pregnant cows and fetuses were collected daily

Fetal morphometry

The fetuses were collected immediately after slaughter and transported to the point where measurements were taken. Parameters such as crown-rump length (CRL), weight, bi-parietal diameter(cm), fore- and hind-limb lengths (cm), eye-socket length (cm), and tail length (cm) were determined (Kouamo *et al.,* 2018).

Determination of Fetal Age

The age of the fetus was determined according to Noakes *et al.* (2009) as shown below:

$X = 2.5 (Y + 21)$; X = age of fetus in days, and Y = CRL in cm.

Amniotic fluid biochemistry

The levels of total protein, albumin, globulin, and glucose were determined in the amniotic fluid using a standard diagnostic kit (DIALAB®, Austria). The glucose liquid colour kit (Human - Gesellschaft fur Biochemica und Diagnostica mbH, Germany). TECO® diagnostics test kits were used to determine both sodium and potassium levels. For progesterone determination, 10ml of amniotic fluid was collected from each of the randomly selected 27 slaughtered pregnant cows into plain sample bottles. The samples were then transported with the use of an iced-pack cooler and stored at 4ºC. The progesterone level was determined

as described by the manufacturer (CALBIOTECH) using a progesterone-enzyme conjugate solution kit.

Calculation on the economic implication of fetal wastage

Taking the average market price of cattle (₦/tropical livestock unit) to be ₦240,000

as reported by Sosina (2020) and the calculation on the economic losses was determined.

Statistical analysis

The data were expressed as mean ± standard error mean (SEM) and analysis was done using student t- test and analysis of variance (ANOVA) with SPSS software package version 20.

Results

Two hundred and ten samples were collected from seven breeds of cows; White Fulani (41%), Sokoto Gudali (28.1%), Adamawa Gudali (10.5%), Red Bororo (10%), Red Fulani (7.6%), Kuri (2.4%), and N'dama (0.5%), at the Ibadan Central Abattoir. The samples were collected from an equal number of male and female fetuses.

Fetal morphometry

Seven fetal morphometric parameters were measured as shown (Table 1). The fetuses were grouped by periods of 30 days to show the mean age in these periods. According to the findings of this study, an average fetus in Ibadan Central Abattoir within 241-270 days has a crown-rump length of 78.79±2.47cm, body weight of 16.90±2.05kg, biparietal diameter of 41.59±1.99cm, hind limb length of 60.33±2.22cm, fore limb length of 50.03±2.67cm, tail length of 36.47±4.19cm, and eye-socket length of 2.16±0.44 (Table 1).

Secondary data from the Abattoir shows that 71.43% of all fetuses evacuated during slaughter were in the second trimester (Figure 1). Tables 2 - 7 show the variation that exists across breeds with the gestational ages of the fetuses. It was observed that fetal gestational ages (91-120, 121-150, 151-180, and 181-210 days) were seen in more than one breed, and compared with observable fetal morphometries (Table 2). There was an increased value in the fetal morphometries of the Sokoto Gudali breed with other breeds for gestational ages 91-120 days (Table 2). Similarly, the Kuri, White Fulani, and Adamawa Gudali have increased mean values of the fetal morphometries for gestational ages 121-150, 151-180, and 181-210 days, respectively (Tables 3 - 5). There was no particular pattern for the fetal morphometries in gestational ages 211-240 and 241-270 days for all the breeds (Tables 6 - 7).

Gestational age correlations with fetal morphometries

In Tables 8 - 9, there was a strong positive and significant correlation between fetal gestational age and crown-rump length (r=1.000), biparietal diameter (r=0.984), hind limb length(r=0.985), fore limb length (r=0.985), tail length (r=0.964), eye-socket length (r=0.923), and body weight (r=0.943). Despite this positive and significant correlation, the variation that exists among the various breeds was not significant (Tables 8 - 9).

Biochemistry of the Amniotic Fluid

Twenty-seven samples were collected from fetuses in the three trimesters (2, 16, and 9 in the first, second, and third trimesters of pregnancy, respectively). There was no significant difference ($p>0.05$) in the fetuses' amniotic fluid progesterone, total protein, albumin, globulin, glucose, sodium, and potassium levels in all three trimesters (Table 11).

Observable morphological features based on gestational age

Physical observation revealed that the number of morphological features in the fetuses increased from two to fourteen as the fetal age increased (Table 10). The fetus with the least gestational age was in the third month, and at this stage, claw bud and scrotum were the only observable features. An estimated 10.5% of fetuses evacuated in the abattoir were in the 7th month of gestation with additional morphological features (Table 10). At the 8th and 9th months of gestation, equal morphological features were noticed on the fetuses.

Fetal wastage

In figure 1, 210 fetal samples (0.48%, 71.43%, 2.09% at 1st, 2nd, and 3rd trimester, respectively) were collected from the Abattoir in two months and used in this study. This translates to an average fetal wastage of 105 fetuses per month and 1260 fetuses per year. An average slaughtered cattle cost 240,000 Naira in the abattoir. This amounts to an economic wastage of 25,200,000 million Naira monthly and annual financial losses of 302,400,000 million Naira.

Table 1: Fetal morphometric parameter with gestational ages

Fetal parameter	Fetus age (days)						
	(61-90)	(91-120)	(121-150)	(151-180)	(181-210)	(211-240)	(241-270)
Sample size	1	33	71	46	22	19	18
BW	0.00	0.62±0.31	1.42±0.46	3.08±0.84	6.93±1.67	11.48±2.23	16.90±2.05
CRL	11.50	23.12±2.77	33.46±3.47	44.08±3.59	56.91±3.30	66.95±90	78.79±2.47
BPD	6.50	15.78±2.03	21.43±1.82	26.75±2.26	32.98±2.21	37.67±2.12	41.59±1.99
HLL	5.00	13.12±2.26	20.52±3.55	29.03±3.57	41.91±5.24	53.53±4.38	60.33±2.22
FLL	3.00	10.98±2.03	16.65±2.43	23.73±2.94	34.50±4.64	42.97±4.17	50.03±2.67
TL	3.00	8.71±1.26	12.08±2.07	16.57±2.14	23.64±2.75	30.97±3.36	36.47±4.19
ESL	0.00	0.02±0.05	0.23±0.19	0.62±0.40	1.53±0.42	1.88±0.31	2.16±0.44

BW = Body weight (kg), CRL = Crown-rump length (cm), BPD = Biparietal diameter (cm), HLL = Hind limb length (cm), FLL = Fore limb length (cm), TL = Tail length (cm), ESL = Eye-socket length (cm)

Table 2: Fetal morphometry with age of gestation (91-120 days)

Fetal parameter	91-120days				
	Adamawa Gudali	Red Bororo	White Fulani	Sokoto Gudali	N'dama
Total Sample	5	3	19	5	1
BW	0.46±0.20	0.50±0.36	0.66±0.35	0.76±0.11	0.20
CRL	22.86±0.69	20.50±2.60	23.05±2.47	26.40±1.34	17.00
BPD	14.50±2.00	14.67±1.53	15.84±1.58	18.38±0.80	11.50
HLL	12.80±1.25	11.00±2.65	13.13±2.12	15.50±0.87	9.00
FLL	11.20±1.64	9.67±2.31	10.71±1.97	13.14±0.55	8.00
TL	8.86±0.77	8.17±1.44	8.55±1.12	10.14±0.22	5.50
ESL	0.02±0.04	0.00	0.03±.0.07	0.00	0.00

Table 3: Fetal morphometry with age of gestation (121-150 days)

Fetal parameter	121-150days					
	Adamawa Gudali	Kuri	Red Bororo	Red Fulani	White Fulani	Sokoto Gudali
Total Sample	8	4	3	3	28	25
BW	1.23±0.51	1.68±0.25	1.53±0.91	1.27±0.21	1.46±0.38	1.41±0.52
CRL	31.69±3.35	36.00±1.83	31.50±5.63	34.67±0.58	34.32±3.34	32.74±3.47
BPD	20.31±1.83	23.12±2.25	21.17±3.31	22.00±1.00	21.71±1.69	21.18±1.66
HLL	18.94±3.04	22.13±3.47	20.33±5.86	20.50±1.32	21.79±3.89	19.38±2.83
FLL	15.44±2.58	18.75±3.40	17.33±4.93	16.33±0.58	17.10±2.24	16.14±2.08
TL	11.81±1.28	13.75±1.71	12.33±2.08	11.50±1.50	12.17±2.75	11.84±1.43
ESL	0.14±0.11	0.40±0.82	0.23±0.32	0.37±0.12	0.28±0.22	0.18±0.15

Table 4: Fetal morphometry with age of gestation (151-180 days)

Fetal parameter	151- 180days				
	Adamawa Gudali	Red Bororo	Red Fulani	White Fulani	Sokoto Gudali
Total Sample	5	2	2	5	4
BW	3.10±0.69	2.90±0.72	2.44±0.59	3.31±1.01	3.14±0.72
CRL	44.00±4.12	40.67±0.29	42.07±2.56	45.53±3.99	44.07±3.05
BPD	27.30±2.33	25.00±1.50	25.29±1.63	27.21±2.63	27.11±1.85
HLL	28.40±3.78	27.33±0.58	26.86±2.50	31.15±3.84	28.14±2.93
FLL	23.10±3.21	21.67±1.15	22.07±1.69	25.32±3.20	23.29±2.53
TL	16.10±1.67	15.83±2.47	15.29±0.95	17.09±2.38	16.89±2.26
ESL	0.60±0.29	0.41±0.10	0.31±0.09	0.85±0.48	0.55±0.33

Table 5: Fetal morphometry with age of gestation (181-210 days)

Fetal parameter	181- 210days					
	Adamawa Gudali	Kuri	Red Bororo	Red Fulani	White Fulani	Sokoto Gudali
Total Sample	2	1	2	2	7	8
BW	8.05±1.63	4.50	7.10±2.55	7.15±0.49	7.14±1.40	6.66±2.00
CRL	60.00±1.41	54.50	57.25±4.60	57.00±2.83	57.57±2.94	55.75±3.92
BPD	35.00±1.41	31.00	33.75±3.18	32.50±0.71	33.14±2.19	32.50±2.55
HLL	45.00±7.07	34.00	42.50±7.78	40.00±1.41	43.29±5.02	41.25±5.42
FLL	37.50±4.95	28.00	34.50±6.36	32.00±1.41	35.50±4.37	34.31±5.23
TL	25.50±3.54	21.00	24.50±3.54	23.50±0.71	24.21±2.04	22.81±3.48
ESL	1.80±0.14	0.80	1.60±0.42	1.75±0.21	1.59±0.42	1.42±0.47

Table 6: Fetal morphometry with age of gestation in different breeds

Fetal parameter	211-240days			
	Red Bororo	Red Fulani	White Fulani	Sokoto Gudali
Total Sample	5	2	9	3
BW	12.06±2.62	9.40±2.97	11.96±2.16	10.50±0.52
CRL	68.00±2.92	65.00±1.41	67.44±3.28	65.00±1.00
BPD	36.72±2.45	36.00±3.54	38.79±1.65	37.00±0.00
HLL	53.80±2.77	50.50±6.36	54.78±5.29	51.33±1.15
FLL	42.80±2.68	38.50±7.78	44.28±4.54	42.33±1.15
TL	31.00±2.35	27.50±2.12	32.50±3.80	28.67±0.58
ESL	1.76±0.38	1.9±0.28	1.87±0.31	2.13±0.06

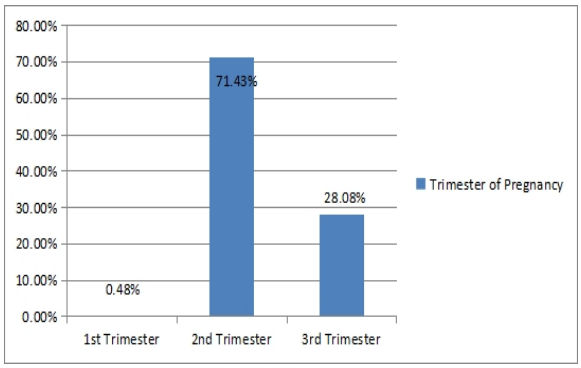

Figure 1: Percentage of fetuses evacuated in each trimester

Table 7: Fetal morphometry with age of gestation in different breeds

Fetal parameter	241- 270 days				
	Adamawa Gudali	Red Bororo	Red Fulani	White Fulani	Sokoto Gudali
Total Sample	5	2	2	5	4
BW	19.60±2.69	15.22±1.43	16.50±0.57	16.77±0.89	18.45±2.45
CRL	82.50±6.36	78.20±1.92	77.50±0.71	79.06±1.29	78.00±1.41
BPD	44.00±1.41	40.90±0.74	40.30±0.99	40.50±2.18	43.25±1.71
HLL	63.00±4.24	58.60±1.14	60.00±0.00	60.40±2.27	61.25±1.50
FLL	53.50±0.71	47.60±2.07	49.50±3.53	49.9±1.75	57.75±2.06
TL	37.50±0.71	33.30±3.83	37.75±1.77	38.20±5.81	37.13±3.12
ESL	2.15±0.21	2.00±0.37	1.70±0.57	2.18±0.54	2.55±0.21

Table 8: Association between gestational age and fetal morphometry

Breed	Regression model		Correlation	
	R^2	P value	R	P value
Gestational age and crown-rump length				
Adamawa Gudali	1.000	0.000	1.000	0.000
Kuri	1.000	0.003	1.000	0.000
Red Bororo	1.000	0.000	1.000	0.000
Red Fulani	1.000	0.000	1.000	0.000
Sokoto Gudali	0.996	0.000	0.998	0.000
White Fulani	1.000	0.000	1.000	0.000
Gestational age and biparietal diameter				
Adamawa Gudali	0.974	0.000	0.987	0.000
Kuri	0.896	0.015	0.947	0.015
Red Bororo	0.979	0.000	0.990	0.000
Red Fulani	0.973	0.000	0.987	0.000
Sokoto Gudali	0.974	0.000	0.987	0.000
White Fulani	0.965	0.000	0.982	0.000
Gestational age and hind limb length				
Adamawa Gudali	0.977	0.000	0.989	0.000
Kuri	0.875	0.019	0.936	0.019
Red Bororo	0.988	0.000	0.994	0.000
Red Fulani	0.982	0.000	0.991	0.000
Sokoto Gudali	0.965	0.000	0.982	0.000
White Fulani	0.969	0.000	0.984	0.000
Gestational age and forelimb length				
Adamawa Gudali	0.973	0.000	0.987	0.000
Kuri	0.813	0.036	0.902	0.036
Red Bororo	0.979	0.000	0.989	0.000
Red Fulani	0.965	0.000	0.982	0.000
Sokoto Gudali	0.967	0.000	0.983	0.000
White Fulani	0.971	0.000	0.986	0.000

Table 9: Association between gestational age and fetal morphometry

Breed	Regression model		Correlation	
	R^2	P value	R	P value
Gestational age and tail length				
Adamawa Gudali	0.963	0.000	0.981	0.000
Kuri	0.937	0.007	0.968	0.007
Red Bororo	0.939	0.000	0.969	0.000
Red Fulani	0.972	0.000	0.986	0.000
Sokoto Gudali	0.947	0.000	0.973	0.000
White Fulani	0.908	0.000	0.953	0.000
Gestational age and eye-socket Length				
Adamawa Gudali	0.874	0.000	0.935	0.000
Kuri	0.951	0.005	0.975	0.005
Red Bororo	0.889	0.000	0.943	0.000
Red Fulani	0.754	0.000	0.868	0.000
Sokoto Gudali	0.885	0.000	0.941	0.000
White Fulani	0.853	0.000	0.924	0.000
Gestational age and body weight				
Adamawa Gudali	0.896	0.000	0.947	0.000
Kuri	0.996	0.000	0.998	0.000
Red Bororo	0.933	0.000	0.966	0.000
Red Fulani	0.944	0.000	0.971	0.000
Sokoto Gudali	0.883	0.000	0.940	0.000
White Fulani	0.881	0.000	0.938	0.000

Discussion

There is a need to have correct information on the fetuses evacuated during the slaughter of pregnant cattle in the Abattoirs to allow for easy assessment of the reproductive and economic implications. The increased fetal body weight from the sixth to ninth months of gestation in this study was about three-fold greater than the

foetal body weight from the third to sixth months of gestation. This finding corroborates earlier reports (Ferell 1991; Orourke *et al*., 1991; Mao *et al*., 2008).

Table 10: Observable morphological features based on age in month

Gestation period (month)	Number of fetuses	Observable features
3rd	1	Claw bud, Scrotum present
4th	33	Claw bud, Scrotum present, Teat developing
5th	71	Claw bud, Scrotum present, Teat developing, Hair on lips, eyelids, chin, muzzle
6th	46	Claw bud, Scrotum present, Teat developing, Hair on lips, eyelids, chin, inside the ear, around the horn pit, tail tip, muzzle
7th	22	Claw bud, Scrotum present, Teat developing, Hair on lips, eyelids, chin, inside the ear, around the horn pit, tail tip, muzzle, metatarsal, metacarpal, skin
8th	19	Claw bud, Scrotum present, Teat developing, Hair on lips, eyelids, chin, inside the ear, around horn pit, tail tip, muzzle, metatarsal, metacarpal, and skin, Milk teeth
9th	18	Claw bud, Scrotum present, Teat developing, Hair on lips, eyelids, chin, inside the ear, around horn pit, tail tip, muzzle, metatarsal, metacarpal, and skin, Milk teeth

Table 11: Amniotic fluid biochemistry in the trimesters of pregnancy

Trimester of Gestation	**First**	**Second**	**Third**
Progesterone concentration (ng/ml)	0.9±0.01[a]	0.7±0.02[a]	0.8±0.05[a]
Total Protein (mg/dl)	37.50±2.50[a]	37.13±1.74[a]	35.22±3.00[a]
Albumin (mg/dl)	9.950±0.25[a]	10.62±0.62[a]	10.66±1.27[a]
Globulin (mg/dl)	27.55±2.75[a]	26.51±1.42[a]	24.57±1.88[a]
Sodium (mEq/L)	236.8±0.40[a]	238.6±1.44[a]	238.5±2.25[a]
Potassium (mEq/L)	48.50±0.50[a]	48.94±0.55[a]	49.78±1.41[a]
Glucose (mg/dl)	36.50±0.50[a]	36.69±0.41[a]	37.89±1.78[a]

First trimester (0 - 90 days), Second trimester (91 - 180 days), Third trimester (181 - 270 days). The means with the same superscript are not significantly different ($p>0.05$).

The body weight of the fetuses in our study was lower compared with the report made by Prior and Laster (1979). The report stated that growth in a developing fetus follows an exponential equation with a body weight gain of 25 g/day up to four months of gestation and a maximum body weight gain of 352 g/day by the late seventh month. The disparity might be due to the genetic makeup of the dam as well as the fetus (Bellows *et al.,* 1993), and could also result from the management. The slaughtered pregnant cows in this present study were free-ranged, where nutrition is inadequate.

The fore and hind limb lengths increased from the third to ninth months in all breeds studied in this study. This is similar to the findings of Evans and Sack (1973) who reported a linear increase in crown-rump length from three to nine months. Long bone and crown-anus length have been considered the most predictable parameters for a given gestational age (Richardson *et al.,* 1991; Chavatte-Palmer *et al.,* 2006; Kohan Ghardr *et al.,* 2008). Several studies have shown that the age and weight of the fetus have a high correlation with other fetal parameters, thus making it possible to measure the most accessible parameter and to predict age from ultrasonography (Singh *et al.,* 2004; Van Hanh *et al.,* 2013; Djallel *et al.,* 2017). In this study, the correlation and regression between the estimated age of gestation and other parameters were shown to be very strong. There exists a very strong positive relationship between crown-rump length and age of gestation ($r = 1.00$; $R^2 = 0.999$) for the combined breed which is slightly higher than previous reports (Kahn

1989; Van Hanh *et al.,* 2013; Camilla *et al.,* 2018).

In this study, the Kuri breed has the least positive relationship between the age of gestation and the biparietal diameter contrary to what was reported by Camilla *et al.* (2018). Reports in a wide range of species have shown a significant correlation between the biparietal diameter and age of gestation (Ferreira *et al.,* 2012; Ardkani *et al.,* 2022). Furthermore, this study reported no differences between the number of female (50%) and male (50%) fetuses that were evacuated. Similar reports have been reported in other Abattoirs in Nigeria (Bello *et al.,* 2008; Odeh *et al.,* 2015).

From this study, it was observed that the size of organs and appearance of morphological features increased as the fetuses developed. The full complement of the morphological features was noticed in the second and third semesters. The fluctuation in fetal amniotic fluid progesterone and total protein levels in this study is contrary to the earlier reports (Melampy *et al.,* 1958; Khadjeh *et al.,* 2007). The non-significant levels of sodium and potassium observed in this present study were not in tandem with the report of Prestes *et al.* (2001). Their study reported a significant reduction in sodium and potassium levels in the amniotic fluid of pregnant sheep. The glucose from maternal circulation is the main energy source for fetuses during pregnancy in farm animals (Bauman and Curri, 1980). The non-significant increase in the level of glucose from the first to third trimester of gestation was similar to previous reports in different ruminants (Aidasani *et al.,* 1992; Tangalakis *et al.,* 1995). However, there were contrary opinions by other researchers (Bradley and Mistretta, 1973; Reddy *et al.,* 1995; Prestes *et al.,* 2001). Prestes *et al.* (2001) argued that the reduced glucose concentration in their study results from fetal intake of glucose consequent to fetal swallowing reflex.

Fetal wastage occurs in most of the Abattoirs in Nigeria (Bello *et al.,* 2008; Abdulkadir *et al.,* 2008; Oduguwa *et al.,* 2013; Odeh *et al.,* 2015). The annual loss of 302,400,000 naira from slaughtered cattle in this present study is higher than those in the previous reports from different Abattoirs (Alhaji 2011; Mshelia *et al.,* 2015; Dunk *et al.,* 2017). This production loss could impact future animal protein sources security when the human population increases as predicted (Onteru*, et al*., 2010; Zakia *et al.,* 2016). The high number of evacuated fetuses might be due to low ante-mortem inspection levels at the abattoir and the prevailing rainy weather conditions at the time of the study.

Conclusion

Fetal characteristics remain a reliable biometric parameter in the determination of gestation age in cattle. Unfortunately, fetal wastage due to pregnant cattle slaughter has negative reproductive and economic implications.

References

Abdulkadir, U., Jiya, E.Z. and Kosu, S.A. Survey of foetal wastages: a case study of Makurdi Abattoir in Benue state from 1997 to 2002. *Pakistan Journal of Nutrition*. 7(3): 450-452 (2008).

Aidasani, R., Chauhan, R.A.S., Tiwari, S and Shukla, S.P. Some metabolic constituents of caprine foetal fluids and foetal serum. *Indian J. Anim. Sci*. 62: 335-336 (1992).

Alhaji, N.B. Prevalence and economic implications of calf foetal wastage in an Abattoir in North Central Nigeria. *Trop. Anim. Hlth. Prod*. 43(3): 587-590 (2011)..

Ardakani, M.S., Toosi, B.K., Azizzadeh, M. and Rajabioun, M. Estimation of gestational age using ultrasonography in Beluchi sheep. *Vet Res. Forum.* 13(2): 257-263 (2022).

Babatunde, O.A., Andrew, B.F., Amanda, C. and Voster, M. The Potential of Animal By-Products in Food Systems: Production, Prospects and Challenges. *Sustainability.* 9(7): 1089 (2017).

Bauman, D.E. and Curri, W.B Partitioning of nutrients during pregnancy and lactation: a review of mechanisms involving homeostasis and homeorhesis. *J. Dairy Sci*. 63: 1514-1529 (1980).

Bello, M.B., Garba, H.S. and Sonfada, M.L. Fetal wastage in camels slaughtered at Sokoto municipal Abattoir. *Sokoto Journal of Veterinary Science.* 7(1): 46-49 (2008).

Bellows, R.A., Staigmiller, R.B., Orme, L.E., Short, R.E., and Knapp, B.W. Effects of sire and dam on late – pregnancy conceptus and hormone traits in beef-cattle. *Journal of Animal Science.* 71(3): 714-723 (1993).

Bénard, C., Bonnet, B. and Guivert, B. Demand for farm animal products in Nigeria: An opportunity for Sahel countries? *Grain de Sel.* 51: 14-15 (2010).

Bradley, R.M. and Mistretta, C.M. Swallowing in fetal sheep. *Science.* 179: 1016-1017 (1973).

Cadmus, S.I., Adesokan, H.K. Bovine foetal wastage in southwestern Nigeria: a survey of some Abattoirs. *Trop. Anim. Hlth. Prod*. 42(4): 617-621 (2009).

Camilla, H.K., Jorgen, S.A. and Soren S.N. Fetal age assessment for Holstein cattle. *PLoS ONE.* 13(11): e0207682 (2018).

CBN Annual Report of Central Bank of Nigeria, 10(4) (1999).

Chaudhari, S.U.R. and Paul-Bokko, B. Reproductive status, pregnancy wastage and incidence of gross genital abnormalities in cows slaughtered at Maiduguri Abattoir, Nigeria. *Pakistan Vet. J*. 20(4): 203-205 (2000).

Chavatte-Palmer, P., De Sousa, N., Laigre, P., Camous, S., Ponter, A.A, Beckers, J.F. Ultrasound fetal measurements and pregnancy-associated glycoprotein secretion in early pregnancy in cattle recipients carrying somatic clones. *Theriogenology.* 66: 829-840 (2006).

Church, D.C. The ruminant animal: digestive physiology and nutrition, Prentice-Hall, Upper Saddle River. 564 (1993).

Djallel, E.G., Afri-Bouzebda, F. and Zoubira, B. Gestational age estimation of Sahraoui Dromedary Camel based on fetomaternal measures and phenotypic characteristics. *Journal of Animal and Veterinary Advances.* 16(2): 32-39 (2017).

Dunka, H.I., Buba, D.M., Gurumyen, Y.G., Oragwa, A.O., Oziegbe, S.D. and Patrobas, M.N. Economic losses associated with the slaughter of Pregnant Animals in Jos Abattoir. *International Journal of Advanced Research.* 5(7): 1047-1052 (2017).

Essawi, W.M., Mostafa, D.I.A. and El-Shorbagy, A.I.A. Comparison between biochemical analysis of cattle amniotic fluid and maternal serum components during pregnancy. *World Veterinary Journal*. 10(1): 67-73 (2020).

Evans, H.E. and Sack, W.O. Prenatal development of domestic and laboratory mammals: Growth curves, external

features and selected references. *Anat. Histol. Embryol*. 2: 11-45 (1973).

FAO. Stocks of Cattle, Sheep and Goats for Nigeria; from http://faostat.fao.org (2014).

Ferreira, J.C.P., Martin, I., Irikura, C.R., Gimenes, L.U., Fujiraha, C.J., Jorge, A.M. and Oba, E. Ultrasonic monitoring of early pregnancy development in Murrah buffalo heifers (bulbalus bulbalis*). Journal of Animal and Plant Sciences.* 22: 377-383 (2012)..

Ibironke, A.A. Incidence of foetal wastage in cattle slaughtered at the Oko-Oba Abattoir and lairage, Agege, Lagos, Nigeria. *Vet. Res*. 3(3): 54-57 (2010).

Idahor, K.O., Omeje, J.N., Agu, V.E., Audi, P., David, S.R., Luka, B.D. Awareness of foetal losses from ruminants slaughtered at Lafia Abattoir. *Journal of Life Phys. Sci*. 3: 44-48 (2009).

Khadjeh, Gh.H., Ranjbar R., Salehi, M. and Banankhojasteh, S.M. Biochemical evaluation of amniotic fluid during different stages of gestation in the goat. *Iran Journal of Veterinary Research, University of Shiraz.* 8(3): 266-269 (2007).

Kouama, A.M.N. and Zoli, A.P. Determination of age and weight of bovine foetus (Bos indicus) by biometry. *Journal of Livestock Science*. 9: 9-15 (2018).

Liu, D.C. Better utilization of by-products from the meat industry. Department of Animal Science. *National Chung-Hising University Taichung Taiwan.* 2-15 (2009).

Mao, W.H., Albrecht, E., Teuscher, F., Yang, Q., Zhao, Q.R. and Wegner, J. Growth- and Breed-related Changes of Fetal Development in Cattle. *Asian-Aust. J. Anim. Sci*. 21(5): 640-647 (2008).

McDonald, L.E., Nichols, R.E. and McNutt, S.H. Studies on corpus luteum ablation and progesterone replacement therapy during pregnancy in the cow. *Am. J. Vet. Res*. 13(49): 446-451 (1952).

Medugorac, I., Medugorac, A., Russ, I., Veit-Kensch, C.E., Taberlet, P., Luntz, B., Mix, H.M. and Forster, M. The genetic diversity of European cattle breeds highlights the conservation value of traditional unselected breeds with a high effective population size. *Mol Ecol* 18: 3394-341 (2009)..

Melampy, R. M, Emmerson, M.A., Rakes, J.M. Hanka, L.J. and Eness, P. G. The effect of progesterone on the oestrous response of estrogen-conditioned cows. *J. Animal Sci*. 16: 967 (1957).

Moura, M.R.P., Lanna, L. and Junior, A.P. On cytology of amniotic and allantoic fluids in the cow at the first, second and third trimester of pregnancy. *Arquivo Brasileiro de Medicina Veterinaria e Zootecnia*. 61: 1443-1445 (2009).

Mshelia, G.D., Maina, V.A. and Aminu, M.D. Foetometrics and economic impact analysis of reproductive wastage in ruminant species slaughtered and North-Eastern Nigeria. *Journal of Animal Production Advances.* 5(4): 645-653 (2015).

Ngbedea, E.O., Hena, S.A., Oguntoye, O.O., Tarhyel, R. and Bulus, C. Bovine foetal wastage and its economic implication: a six-year (2003-2008) retrospective study in an Abattoir in northwestern, Nigeria. Scientific *Journal of Veterinary Advances.* 1(2): 42-46 (2012).

Noakes, D.E., Parkinson, T.J. and England, G.C.W. Veterinary Reproduction and Obstetrics. 9th edn. Saunders (2009).

Odeh, S., Dawuda, P.M., Oyedipe, E.O. and Obande, G.E. Incidence of Foetal Wastage in Slaughtered Cattle at Wurukum Abattoir, Makurdi, Benue State. *Vom Journal of Veterinary Science.* 10: 41-50 (2015).

Oduguwa, B.O., Raimi, C.O., Talabi, A.O. and Sogunle, O.M. Fetal losses from slaughtering pregnant cows at Lafenwa Abattoir in Abeokuta, South Western Nigeria. *Global Journal of Biology, Agriculture and Health Sciences.* 2(2): 38-41 (2013).

Onteru S.K., Ampaire, A. and Rothschild, M.F. Biotechnology Developments in the livestock sector in developing countries. *Biotechnol Genet Eng Rev.* 27: 217-228 (2010).

Orourke, P.K., Entwistle, K.W., Arman, C., Esdale, C.R. and Burns, B.M. Fetal development and gestational changes in bos-taurus and bos-indicus genotypes in the tropics. *Theriogenol*. 36: 839-853 (1991).

Prestes, N.C., Chalhoub, M.C.L., Lopes, M.D. and Takahira, R.K. Amniocentesis and biochemical evaluation of amniotic fluid in ewes at 70, 100 and 145 days of pregnancy. *Small Ruminant Res.* 39: 277-281 (2001).

Prior, R.L. and Laster, D.B. Development of the bovine fetus. *J. Anim. Sci*. 48:1546-1553 (1979).

Reddy, A.P., Reddy, V.S.C., Rao, A.S., Sharma, G.P., Reddy, G.U.N., Reddy, T.J. and Reddy, V.S. Biochemical studies in the ewe (*Ovis aries*) amniotic fluid during different phases of gestation. *Indian J. Anim. Sci.* 10: 321-323 (1995).

Singh, N.S., Gawande, P.G., Mishra, O.P., Nema, R.K., Mishra, U.K., Mohan, S. Accuracy of Ultrasonography in Early Pregnancy Diagnosis in Doe. *Asian-Australian Journal of Animal Science.* 17(6): 760-768 (2004).

Sosina, A.O. Livelihood and income of dairy farmers in Ibadan/ Ibarapa East area of Oyo state, Nigeria. International Journal of Forest, Animal and Fisheries Research. 4(2):2456-8791 (2020).

Singh, S., Sengar, O.P.S. and Singh, S.N. Prenatal development of buffalo (Bos bubalis L). Agra. Univ. J. Res. 12: 197-245 (1963).

Tangalakis, K., Moritz, K., Shandley, L. and Wintour, E.M. Effect of maternal glucocorticoid treatment on ovine fetal fluid at 0.6 gestation. *Reprod. Fertil. Dev*. 7: 1595-1598 (1995).

Van Eetvelde, M., Kamal, M., Hostens, M., Vandaele, L., Fiems, L.O., Opsomer, G. Evidence for placental compensation in cattle. *Animal volume*. 10(8): 1342-1350 (2016).

Van Hanh, N., Sousa, N.M., Beckers, J.F. and Bui, X.N. The prenatal development in swamp buffalo (Bubalus carabanensis). *Iranian Journal of Veterinary Research, Shiraz University.* 14(4): 313-319 (2013).

Zakia, L.G. and David, W.P. Brucellosis Vaccine for Livestock. *Veterinary Immunology and Immunopathology.* 181: 151-158 (2016).