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Effect of embryonic loss on small ruminant productivity in Chad

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Abstract

This study aims to assess the impact of embryonic losses on the productivity of small ruminants in Chad, based on an analysis conducted at the Farcha refrigerated slaughterhouse in N'Djamena. A prospective and descriptive approach was conducted from September to December 2017. The sample consisted of 1.741 uteruses collected after slaughter, of which 1,328 (76%) were found to be pregnant. The extracted fetuses and embryos were subjected to morphometric and biometric measurements (length, weight, sex, stage of gestation) according to established formulas (in particular Keller's). The data collected were statistically processed using Excel and SPSS, with a significance level of $p < 0.05$. The main objective of this study is to characterize the embryos and fetuses from slaughtered females and to evaluate the potential losses in productivity generated. The results show that the majority of the females slaughtered are pregnant, thus confirming a very high embryonic loss. Of the 1.328 pregnant women, 37% were female fetuses, 35% were male and 4% were undetermined. The mean length of the fetuses was 16.79 cm, with a mean weight of 792 g and a mean gestational age of 80 days. The majority of pregnancies observed were single (87%), compared to 13% double. These results reflect a significant impact of early slaughter on herd productivity, with direct losses of breeding females and potential hatchlings.

The study concludes that the slaughter of pregnant females poses a major threat to the sustainability of small ruminant farming in Chad. This phenomenon compromises the dynamics of reproduction, reduces meat production, and weakens farmers' incomes. It also reflects a lack of ante-mortem control and a lack of awareness among the actors in the sector (butchers, breeders, veterinarians). The implementation of rigorous veterinary control measures before slaughter, raising awareness among slaughterers of the importance of preserving pregnant females, and strengthening the regulations governing slaughter in the country's slaughterhouses would help reduce embryonic losses, improve animal productivity and support national food security.

Keywords: Embryonic Loss; Small Ruminants; N'djamena; Chad

1 Introduction

Livestock farming is one of the most important activities in the rural sector in Chad. It accounts for about 53% of the rural gross domestic product and provides the livelihoods of nearly 40% of the rural population (National Report of the Ministry of Economy, 2013). Among the farmed species, small ruminants (sheep and goats) are a strategic resource for food security, meat production and household income.

Also statistically, livestock farming accounts for 30% of Chad's exports and more than 50% of non-oil exports (Noudjalbaye, 2004). However, livestock productivity remains low due to multiple constraints, including climatic, sanitary and zootechnical constraints. One of the often-overlooked causes of this low productivity is the frequent slaughter of pregnant females, resulting in significant embryonic losses. The lack of control over pregnancy in

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slaughterhouses leads to a direct loss of future animal production, impacting both meat yields and reproduction. In Chad, few studies have been carried out on these different aspects.

In view of all these findings, we carried out this study to assess the impact of embryonic losses on the productivity of small ruminants in Chad.

Study area: The city of N'Djamena, the capital of Chad, is the study area. It is located in the Sahelian zone, between 12° 06' 59'' north latitude and 15° 04' 20'' east longitude. The altitude of this city varies between 294 m and 298 m. The Sahelian zone is between the 200- and 800-mm isohyets. The city of N'Djamena occupies an area of 1000.284 km^2 (or 1.87% of the territory's area). The average annual rainfall varies over time between 500 and 700 mm of water. The city has a population of 993,492 (INSEED, 2009) and is home to most of the public and private health facilities and agri-food industries, including slaughterhouses.

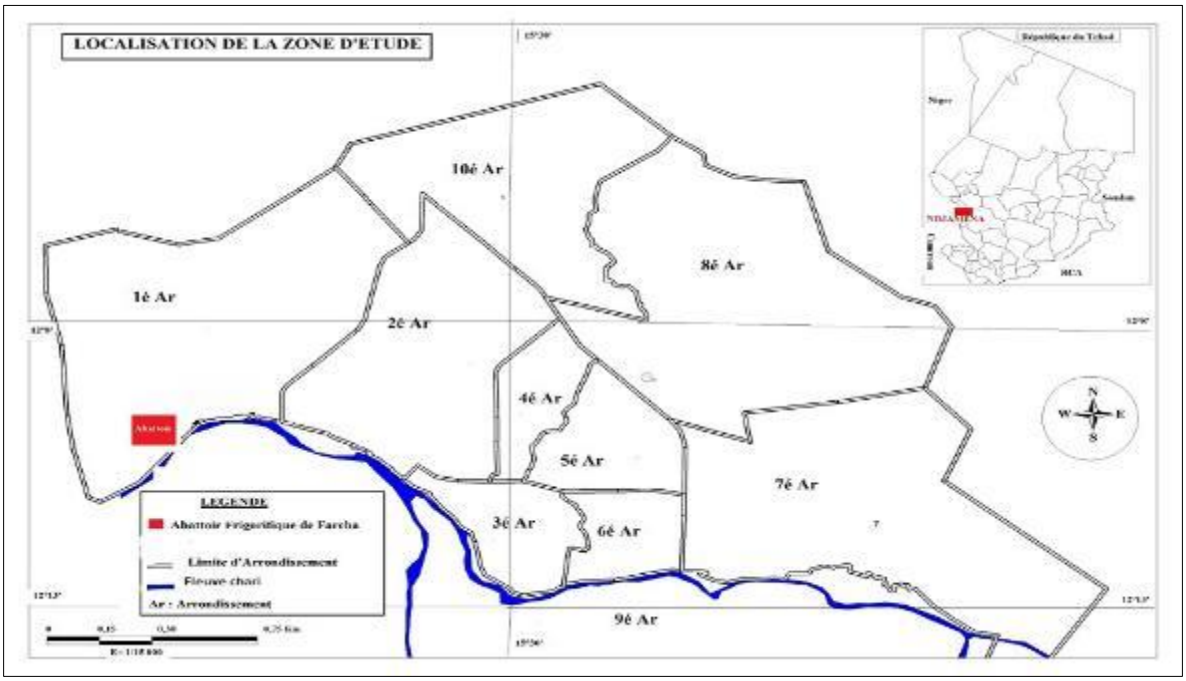

Figure 1 MAP: Study area (CNRD, 2018)

2 Methodology and data collection

2.1 Experimental equipment

2.1.1 Biological material

The biological material consisted of the uteruses, fetuses and embryos of these small ruminants (sheep and goats).

2.1.2 Technical equipment

- A camera for taking pictures,
- Blouse
- Gloves
- Tape measure for taking measurements
- A scale with a maximum capacity of 5 kg allowing the measurement of weight,
- Sterile Stool Jars
- Masks
- Bags.

Figure 2 Scale (5 kg max) Tape measure

2.2 Sample collection

The study was carried out at the Farcha refrigerated slaughterhouse, located in N'Djamena. It took place over a period of three months, from September 25 to December 25, 2017. A total of 1,741 uteruses of small ruminants (sheep and goats) were examined. The uteruses were collected after the females were slaughtered and subjected to a macroscopic examination to determine the presence or absence of pregnancy, the number of fetuses, their sex, their weight and their size.

The method of calculating gestational age was based on Keller's formula: L = X (X + 3.5) with L the length of the fetus and X the gestational age. The statistical analysis was carried out with the SPSS software version 2009.

At 4 a.m., after the skinning and dehydration process, we collect the bellies, the females, each type and each head are collected separately, placed in numbered bags. After bleeding and evisceration of the animals, the uteruses were harvested in the case of the females according to the breed. Using a sharp knife, we separated the uterus and recorded its contents in an investigation sheet. Uteruses of the same breed are observed in a bag and then subjected to a systematic examination to determine pregnant uteruses. The examinations focused on the state of development of the uterus, the presence of fetal fluids in the uterus, the presence of one or more embryos and also the determination, sex, weight.

The measurements were carried out by 2 people.

One person was in charge of taking the measurements and another of recording the data.

2.2.1 The main measurements

- Body Length (L): Distance from the tip of the shoulder to the tip of the buttock
- Body weight
- Visible characters: A set of notations on external phenotypic characters was visually assessed.
- The sex of the fetus
- Type of birth

All the information collected was recorded in an investigation sheet. Data were entered with Microsoft Excel and analyzed with spss-pc (2009), which allowed for comparison of variances of quantitative parameters and frequency comparison for qualitative parameters (chi-square test). The materiality threshold was set at $P < 0.05$.

3 Results

This study made it possible to examine 1741 uteruses, 1328 of these pregnant uteruses, i.e. 76% of the animals examined pregnant, only 24% non-pregnant.

Table 1 Distribution of small ruminants slaughtered by pregnancy

Animals slaughtered	Actual	Percentage
Pregnant	1328	76%
Non-pregnant	413	24%
Total	1741	100%

There were 638 pregnant uteruses containing samples from female fetuses, or 37%, and there were 615 male fetuses, or 35%, and 77 fetuses of unknown sex, 4%.

Table 2 Distribution of fetuses collected by sex

Sex	Male	Female	Unknown	Total
Staff	615	638	77	1328
Percentages	35%	37%	4%	76%

The fetuses and embryos lost as a result of the slaughter of pregnant ewes are unevenly distributed according to their sex. The percentage of female fetuses s lost by slaughter is slightly higher than that of male fetuses.

Figure 3 The percentage of female fetuses lost by slaughter is slightly higher than that of male fetuses

Figure 4 The number of t single, double or triple birth types

Table 3 The number of single, double or triple birth types

	SIMPLE	DOUBLE
Staff	1172	177
Percentages	87%	13%

Out of 1289 uteruses studied, 1172 uteruses of single continents, fetuses or embryos (single) or 87%, 177 uteruses of double fetuses or 13% and no uterus of triple fetuses was recorded.

Table 4 Relationship by length, weight and age (cm, days, g)

	Length	Age2	Age3	Age4	Average Age	Weight
Medium	16.79	94. 27	70,96	74.46	79.90	792.23
AND	6.41	23.87	13.47	13.82	17.02	686,24
Max	32.00	142.34	102.90	107.24	117.49	3600.00
Min	2	21.96	39.90	42.59	34.82	10.00
N	1328	1328	1328	1328	1328	1320

The total population studied 1328 fetuses has a mean body length of 16.79 cm, an average weight of 792.23g with a mean age of 79.90 days

3.1 Study of two species

3.1.1 Sheeps

The number of sheep studied is 701, the maximum length is 32 cm, the minimum length is 3 cm, and the maximum weight is 3600gm and 10g for the minimum weight.

Table 5 shows the relationship between length, age and weight for sheep

Sheep species	Long	Age2	Age3	Age4	Average Age	Weight
Medium	17.02	95.37	71.45	74.97	80.60	8.20
N	701	701	701	701	701	700
Std. Deviation	6.09	2.25	1.28	1.31	1.61	6.83
Maximum	32.00	142.34	102.90	107.4	117.49	3600,00
Variance	37.16	507.04	163.89	172.616	259.94	4.67
Minimum	3.00	30.00	42.00	44.74	38.91	10.00

3.2 Goats

Numbers is 44 fetuses

Table 6 shows the relationship between length, age and weight for goats

Goat species		Long	Age2	Age3	Age4	Average Age	Weight
	Mean	15.70	89.32	68.68	72.12	76,71	6.45
	N	44	44	44	44	44	42
	Std. Deviation	7.44	2,. 5	1.56	1.60	2.00	6.26
	Maximum	30.00	137.03	98.70	102.93	112.89	2800.00
	Variance	55.47	81322	244.61	257.64	400.90	3.92
	Range	28.00	115.07	58.80	60.34	78.07	2760.00
	Minimum	2.00	21.96	39.90	42.59	34.82	40.00

For goats the maximum length is 137.03 cm and the min is 2cm, the maximum weight is 276g and the min is 3.92.

4 Discussion

The results of the study show that the rate of pregnant RA slaughtered at the Farcha slaughterhouse is very high, 76%. This rate of pregnant females slaughtered is much higher than that obtained by Tchoumboue in 1988 (55.7%) and Mancheli et al in 1996 in Cameroon; it is also higher than the rate reported by Kulo and Seme (2010) in Togo (40.4%), as is that of Pitala *et al.* in 2012 (69.3%), Nana et al (2014) in goats in Cameroon. (49 %), 19.2%, (Ngona et al., 2012).

The mean age max is 177.49 days and the min is 34.82 days. This result is lower than the result found by Ngona (2008) and J. kouamo1, S. ouyak diagai1 and J. p. kilekoung (2015), from 7 months of age than to 84 months of age (about 7 years). This result is also different from that observed by Addass et al. (2010) in goats in Nigeria, by Pitala et al. (2012) in ewes in Togo, Kazadi et al. (2015) in pregnant goats in the DRC where the pregnant goats slaughtered were mostly between 3 and 4 years old.

The maximum weight of the animals is 3600g and the minimum weight is 10kg. These values are higher than those of J. Kouamo1, S. ouyak diagai1, J. P. Kilekoung (23.5 ± 3.79 kg (13-38 kg), Kouamo et al. (2019) (21.9, 12-34 kg) in the Djallonké goat, Ngona et al. (2012) (20.5 kg; 7.9-41.1 kg) in the African dwarf goat breed at the Lubumbashi slaughterhouse in the DRC; by Ndlovu and Simela (1996) in the Mashona goat in Zimbabwe (27 kg; 26.3-27.7 kg).

The study shows 1172 uteruses containing single fetuses or single (single) embryos (87%), 177 uteruses containing double fetuses or 13% and no uteruses containing triple fetuses were recorded. This result is higher than the proportions of quadruple, triple, twin and single pregnancies by Kouamo et al. (2019) in the Djallonké goat in Ngaoundéré in Cameroon with percentages of 1.8%, 13.1%, 44.7%, 40.2% respectively for quadruple, triple, double and single pregnancies; Ngona (2012) in the DRC finds himself with percentages of 3.7%; 43.2% and 53.1%; Kazadi et al.

(2015) in the DRC in the African dwarf goat obtained the percentages of 0.43%, 47.0% and 52.2% respectively for triple, twin and single pregnancies.

The breed can affect the pregnancy rate and the number of fetuses lost, which influences their productivity if the breeder has a preference for a specific breed.

This high culling rate of pregnant females is strongly linked to the high rate of culling females. In addition, the results of this study show that the majority of gravid females slaughtered are in the second half of gestation.

The results of this study show a high slaughter rate of pregnant females, estimated at 76%. This phenomenon constitutes a considerable loss for the Chadian livestock sector, with a direct reduction in the potential for livestock renewal. Prenatal losses, especially in female fetuses, strongly compromise the reproductive dynamics of herds. These slaughters are often motivated by economic reasons (financial pressure on farmers), by the lack of pregnancy diagnosis or by a lack of awareness.

The implications of such losses are multiple

- Slowing down the renewal of herds.
- Loss of potential reproductive genotypes.
- Decrease in meat and milk productivity in the medium and long term.

5 Conclusion

The study carried out at the Farcha slaughterhouse highlights the extent of embryonic losses caused by the slaughter of pregnant females. With a pregnancy rate of 76% among slaughtered females, these losses seriously jeopardize efforts to improve animal productivity in Chad. It is imperative to put in place awareness-raising measures and pregnancy diagnostic systems to limit these losses and ensure the sustainability of small ruminant farming.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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