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Livestock exploitation by herders in the pastoral zone of Niger: the case of the district of Bermo

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Abstract

The present study, carried out in the district of Bermo, consists in analyzing the zootechnical performance of forty (40) herds, by monitoring their demographic evolution.The herd exploitation rate was 16.48 ± 3.31% for cattle, 21.44 ± 17.7% for camels, 47.64 ± 13.59% for goats and 37.19 ± 8.06% for sheep. The growth rate is -0.28 ± 0.16 for goats, -0.17±0.09 for sheep, -0.14±0.15 for camels and 0.03±0.01 for cattle. Inflows consisted mainly of births (87.83%). As for exits, sales (56.09%) represent the most important modality. The herd is dominated by females (83.78%) and animals over two years old (39%). Given the frequency of pastoral crises in the area, the herds performed well. However, it is appropriate to control the samples taken from the animals, in order to preserve the reproductive nucleus.

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Introduction

In Niger, the livestock population is estimated at 19 million UBT all species combined, representing an added value of 3911.1 billion Fcfa (MAG/EL, 2018). Livestock contributes 11% of national GDP and 24% of agricultural GDP. Pastoralism contributes to 84% of the country's agricultural GDP and 76% of the national livestock belongs to pastoralists (Amadou, 2020). Pastoral livestock provides 30% of a pastoral household's income (INS, 2013).

The economy of households in the pastoral zone is essentially based on livestock marketing (Amadou *et al.*, 2018). The sale of animals provides important revenue for pastoral households. Indeed, herders regularly resort to the sale of livestock, to meet their needs. (Amadou, 2020).

However, despite its vital role in household operations, the movement of animals within the farm needs to be controlled, to avoid abusive off-take by herders. In this way, sampling by farmers provides information on the demographic situation of the herd. It therefore serves as an early warning of any risks to the herd. In fact, poor livestock harvesting mainly affects the reproductive core, which is likely to compromise the survival of the herd at pastoral farm level.

It is in this context that this study seeks to analyze the zootechnical performance of animals in a pastoral environment, in order to preserve the animal core necessary for the survival of pastoralists. It consists in monitoring the herd's demographic parameters and animal movements.

Materials and methods

Materials

The study was conducted in the decentralized entity of the district of Bermo. Forty (40) herds were surveyed at eight sites, with five herds per site. The sites selected for this study are : Bakoba, Effret, Intalak, Akadany, Tacha Ibrahim, Gadabédji, Oly and Bermo.

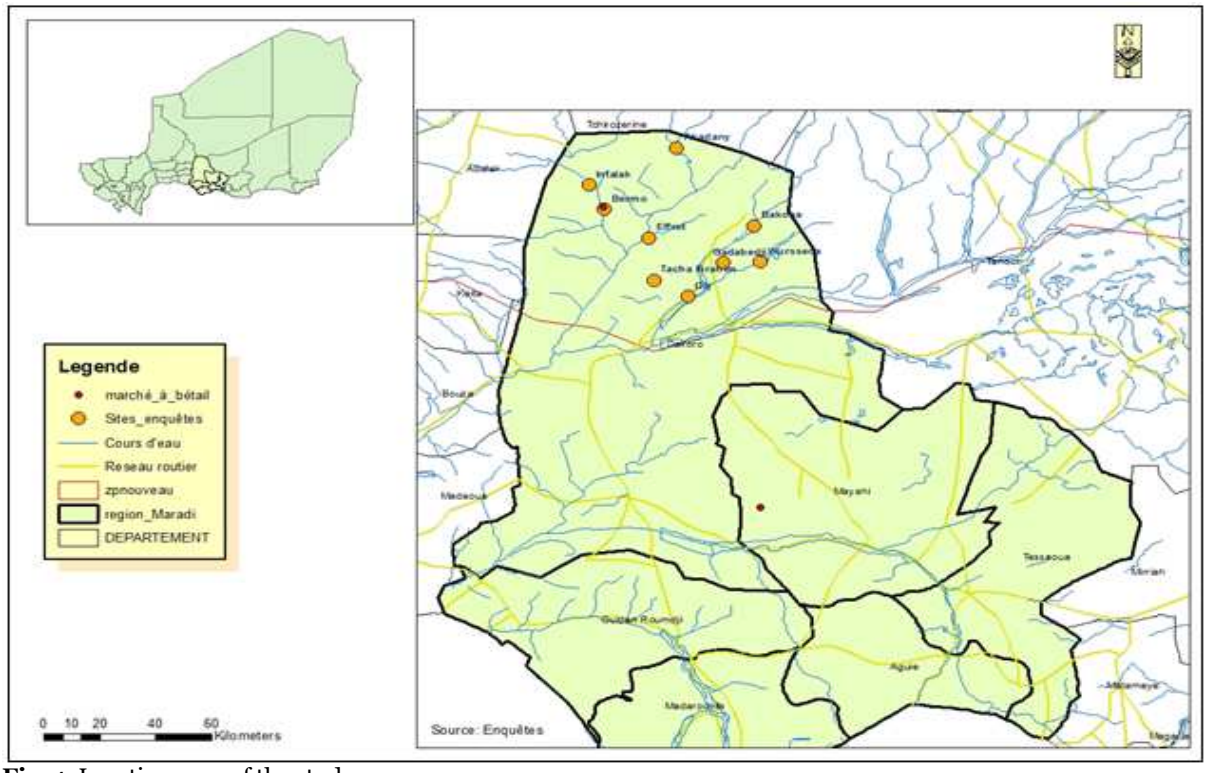

Fig. 1. Location map of the study area.

A form was used to monitor the herd's demographics. It consists in collecting the various demographic events occurring in the herd (animal entries and exits). Fig. 1. describes the study area. It is located in

the department of Bermo, divided between the communes of Bermo and Gadabédji.

Data collection methods

Data collection focused on animal movements in and out of livestock farms. Study of productivity and breeding system performance. The study of zootechnical parameters made it possible to characterize the numerical productivity of the herds.

The method described by Lesnoff (2011) for herd monitoring without individual animal identification was used to analyze numerical productivity. For the purposes of this study, it consisted in making a visit to the herd every 3 months, by monitoring the herd's demographic evolution.

Herd demographic parameters

The herd's demographic parameters were estimated on the basis of demographic rates, herd exploitation and growth rates, and herd numerical productivity (productivity rate and numerical yield). Parameters were estimated using the formulas of Lhoste (2001):

Demographic rates

- Farrowing rate (%) = number of births*100/number of females bred;

-Prolificity rate (%) = number of live births*100/number of females birthing;

-Fertility rate (%) = number of live births*100/number of females bred;

-Mortality rate (%) = number dead *100/Average number present;

- Fertility rate (%) = number pregnant*100/number of females bred.

Herd utilization and growth

-Numerical exploitation rate (EN) = Total number of animals removed from the herd (slaughter, sale, loan, donation, etc.) *100/ Average number of animals in the herd;

-Gross growth rate: CNB = (Headcount end of year - Headcount start of year) *100 / Average headcount;

-Net growth rate: CNN = (Headcount end of year - Headcount start of year - purchases, donations, etc.) *100 / Average headcount.

Herd numerical productivity

-Numerical productivity rate = number of animals weaned*100/number of females bred.

-Numerical yield (NR) = exploitation rate (EN) + net numerical growth (CNN).

The data obtained were analyzed using an Excel spreadsheet. The results of the analysis provided herd exploitation rates, growths and numerical yields by species (cattle, sheep, goats and camels) and by site.

Results

General herd composition

Headcount

A total of 5078 head, divided into 824 males (16.23%) and 4254 females (83.77%), were affected by the herd demographic survey.

Table 1. Cattle demographic rates.

Site	Bakoba	Gadabédji	Wurssena	Effret	Oly	Akadany	Intalak	Tacha Ibrahim
Herd demographics								
Farrowing rate	83	58	81	95	83	77	83	73
Prolificity rate	92	92,86	92,86	94,59	87,80	84,62	93,55	94,12
Fertility rate	76,67	53,94	75,58	89,74	73,17	65,09	77,96	68,38
Fertility rate	93,33	66,39	90,12	94,87	89,43	82,84	94,09	76,92
Mortality rate	1,85	2,42	5,06	5,15	4,76	8,49	7,75	4,93
Farming and herd growth								
EN	13,89	12,73	21,52	17,53	18,25	19,81	15,49	12,68
CNB	0,10	0,04	0,14	0,24	0,13	0,05	0,04	0,13
CNN	0,06	0,01	0,06	0,13	0,06	-0,08	-0,03	0,05
Numerical productivity								
Rate Numerical productivity	70	51,87	69,77	82,05	69,11	62,13	69,89	64,10
RN	13,94	12,73	21,58	17,66	18,31	19,74	15,46	12,73

Structure and age

The number of females increases as they get older (Fig. 2.). Females are generally reserved for reproduction. The low number of males in the last two age classes (13-24 and ≥ 25 months) is due to the high numbers taken at this level for sale and slaughter. The classification of species by age is shown in Fig.3. and 4.

Table 2. Demographic rates for Camelina species.

Site	Bakoba	Gadabédji	Effret	Oly	Akadany
Herd demographics					
Farrowing rate	45	41	49	44	53
Prolificity rate	100	69,23	71,43	57,14	100
Fertility rate	45,00	40,63	49,00	43,75	52,63
Fertility rate	68,18	53,13	63,38	62,50	78,95
Mortality rate	2,09	1,24	2,82	2,94	3,33
Farming and herd growth					
EN	45,45	3,73	7,04	17,65	33,33
CNB	-0,18	0,05	0,03	0,06	0,00
CNN	-0,36	0,01	-0,03	-0,09	-0,25
Numerical productivity					
Rate Numerical productivity	43,75	34,38	42,25	37,50	26,32
RN	45,09	3,73	7,01	17,56	33,08

Analysis of the pyramid (Fig. 2.) reveals the significant presence of older animals (over 25 months) on the farm. This category is mainly made up of females and a few males, all of which are reserved for breeding. The number of animals increases from 1st to 2nd class, then decreases to 3rd class. This could be explained by the high off-take of weanlings or animals in the early stages of maturity, particularly small ruminants.

Table 3. Demographic rates for goats.

Site	Bakoba	Gadabédji	Wurssena	Effret	Oly	Akadany	Intalak	Tacha Ibrahim
Herd demographics								
Farrowing rate	85	70	86	85	89	85	67	65
Prolificity rate	103	106	106	100	96	106	89	114
Fertility rate	87	75	91	85	86	90	71	74
Fertility rate	92	81	98	96	95	98	75	76
Mortality rate	7	5	7	7	7	9	5	6
Farming and herd growth								
EN	59,35	35,24	43,64	44,14	69,68	59,62	32,21	37,24
CNB	-0,30	-0,10	-0,11	-0,07	-0,38	-0,31	-0,07	-0,11
CNN	-0,37	-0,14	-0,19	-0,20	-0,52	-0,43	-0,15	-0,20
Numerical productivity								
Rate Numerical productivity	83,10	73,68	88,97	84,15	82,14	83,61	68,22	70,80
RN	58,98	35,10	43,45	43,95	69,16	59,19	32,06	37,04

The structure of the animal population is illustrated in Fig. 2, 3, 4 and 5.
Figure 2 is a description by age of male and female sheep.
Figure 3 gives the categorization by age of male and female goats.
Figure 4 gives the categorization by age of male and female cattle.
Figure 5 gives the description by age of male and female camels.

Herd demographics

The results obtained for each herd (cattle, goats, camels and sheep) and each site are summarized in tables 1, 2, 3 and 4.

Tables 1, 2, 3 and 4 present respectively the demographic rates of bovine, camel, goat and sheep species.

Table 5 describes the average demographic rates at the level of the department of Bermo. For all sites, the prolificacy rate for cattle ranged from 84.62% to 94.59%. Numerical yield was highest at Wurssena and Akadany.

Table 4. Demographic rates for sheep.

Site	Bakoba	Gadabédji	Wurssena	Effret	Oly	Akadany	Intalak	Tacha Ibrahim
Herd demographics								
Farrowing rate	86	86	91	84	84	89	85	78
Prolificity rate	94,55	95,31	108,20	100,00	96,08	100,00	102,44	100,00
Fertility rate	81,25	82,21	98,80	84,14	80,86	89,13	87,32	77,99
Fertility rate	96,88	98,38	95,81	93,85	95,71	97,83	96,67	98,89
Mortality rate	5,79	3,65	5,56	5,51	6,25	9,59	6,30	6,49
Farming and herd growth								
EN	42,11	26,64	35,35	33,47	40,63	52,05	34,44	32,90
CNB	-0,15	-0,03	0,01	-0,07	-0,10	-0,23	-0,01	-0,06
CNN	-0,21	-0,08	-0,08	-0,17	-0,21	-0,34	-0,10	-0,15
Numerical productivity								
Rate Numerical productivity	75	75,47	89,82	76,05	70,96	76,09	74,84	69,64
RN	41,90	26,56	35,28	33,31	40,41	51,72	34,35	32,75

EN= exploitation rate; CNB= gross numerical growth and CNN= net numerical growth.

The camels surveyed had a prolificity rate ranging from 57.14% to 100%. The species' numerical yield is highest in Bakoba and Akadany, at 45% and 33% respectively (Table 2).

Multiple births are frequent in small ruminants, particularly goats (Table 3), which justifies their prolificacy rates of over 100%. In general, goats are the first species to be harvested when needed. This results in high numerical yields at all sites, especially Bakoba, Akadany and Oly. Like goats, sheep have high prolificacy rates and numerical yields (Table 4). Sheep also record multiple litters and are the first species to be harvested after goats.

Analysis of Table 4 reveals a higher numerical yield in Akadany and Bakoba. Numerical growth is almost negative for small ruminants, reflecting over-exploitation of the herd, characterized by a reduction in the size of the animal population over the 15-month collection period. It is also negative at Akadany for all large ruminants monitored. Growth is also negative in Intalak for cattle, and in Oly and Bakoba for camels.

Average demographic rates for the department are shown in Table 5.

Table 5. Average demographic rates for the department.

Species	Bovine	Ovine	Goat	Camel
Herd demographics				
Farrowing rate	79,12±10,61	85,38±3,85	79±9,81	46,4±4,66
Prolificity rate	91,55±3,49	99,57±4,45	102,5±7,55	79,56±19,63
Fertility rate	72,56±10,49	85,21±6,56	82,38±7,81	46,20±4,68
Fertility rate	85,99±10,02	96,75±1,63	88,88±9,89	65,23±9,41
Mortality rate	5,05±2,28	6,14±1,65	6,62±1,3	4,88±3,56
Farming and herd growth				
EN	16,48±3,31	37,19±8,06	47,64±13,59	21,44±17,7
CNB	0,11±0,06	-0,08±0,07	-0,18±0,12	-0,01±0,09
CNN	0,03±0,01	-0,17±0,09	-0,28±0,16	-0,14±0,15
Numerical productivity				
Rate Numerical productivity	67,36±8,58	75,98±5,96	79,33±7,41	37,18±7,41
RN	16,52±3,31	37,03±7,97	47,36±13,45	21,29±17,54

Results on animal movements

The results obtained in the context of herd demographic monitoring reveal a superiority of sales made in the post-harvest period, for all survey sites.The number of animals entering the farm peaks at the end of July, then gradually declines until April.

There are two peaks in the number of animals leaving the farm, the first in October and the second in April.

Births are higher in the winter and cold seasons, and lower in the warmer months, as breeders schedule births when forage and water are available and accessible to the animals.

Fig. 6 shows the ratio of animal exits to recorded entries. The average exit rate was 47% for all herds monitored. Table 6 shows the average number of animals entering and leaving the herd.

Table 6. Cumulative animal entries and exits.

Entrance	Livestock farming	Average	Output	Livestock farming	Average
Birth	40	104,25 ± 40,81	Sale	40	31,28 ± 12,09
Purchase		1,54 ± 1,76	Trust		5,4 ± 2,79
Donation		1,63 ± 1,58	Mortality		7,15 ± 2,24
Dowry		1,28 ± 1,65	Theft		1,63 ± 2,18
Héritage		1,03 ± 1,96	Loss of sight		1,38 ± 2,04
Trust		3,25 ± 3,24	Héritage		2,65 ± 2,78
Barter		1,15 ± 1,48	Barter		0,87 ± 1,12
			slaughter		4,5 ± 3,74
			Donation		1 ± 1,49
			Dowry		2,40 ± 1,14
			Zakat		1,87 ± 2,23

Entries are mainly dominated by births, followed by confiage, with respective averages of 104.25 ± 40.81 (87.83%) and 3.25 ± 3.24 (2.74%). As for exits, removals are influenced firstly by sales, then by mortalities, with respective averages of 31.28 ± 12.09 (56.09%) and 7.15 ± 2.24 (12.83%).

Discussion

Sex structure

The dominance of the female sex (83.77%) is linked to its reproductive function. Especially since females are the last species to be harvested for sale. The herd structure therefore seems normal for females.

As for the male sex, the structure is abnormal, as males aged 0-6 months and 7-12 months clearly outnumber females in the same category. This suggests that the number of males is higher than the recommended ratio. In the third age group (13-24 months), the low number of males is linked to the high off-take of adult males. This is mainly due to the financial needs of the household, sacrifice and

consumption. Males aged over two years far outnumber those between 13-24 months. This category (≥ 25 months) is dominated by large ruminants, particularly cattle, as most small ruminant males are sacrificed before this stage. The presence of large ruminants is explained by the practice of fattening in the area. These are particularly male cattle fattened for marketing purposes.

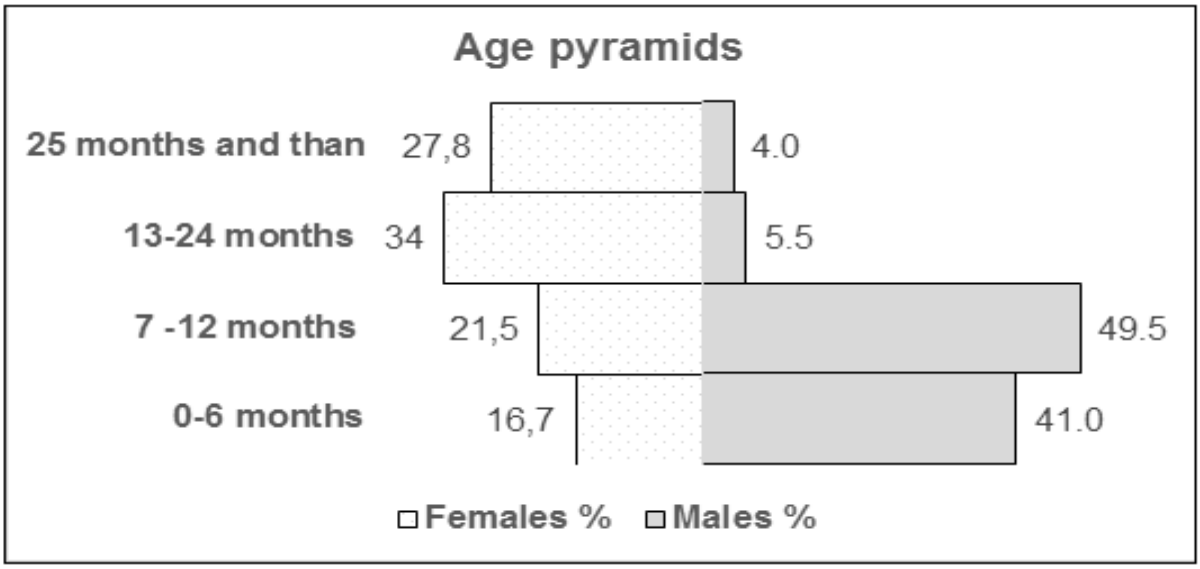

Fig. 2. Age pyramid for sheep.

The large number of older small ruminants (≥ 25 months) is explained by the strong presence of breeding females. Recheptellisation activities have been carried out by the Association for Redynamisation livestock in Niger and Oxfam for livestock breeders in the department. These operations may also justify the increase in the number of older large ruminants. The structure presented by the three pyramids reflects poor herd management by farmers. This is the result of herd withdrawals carried out hastily or haphazardly, in response to pastoral crises.

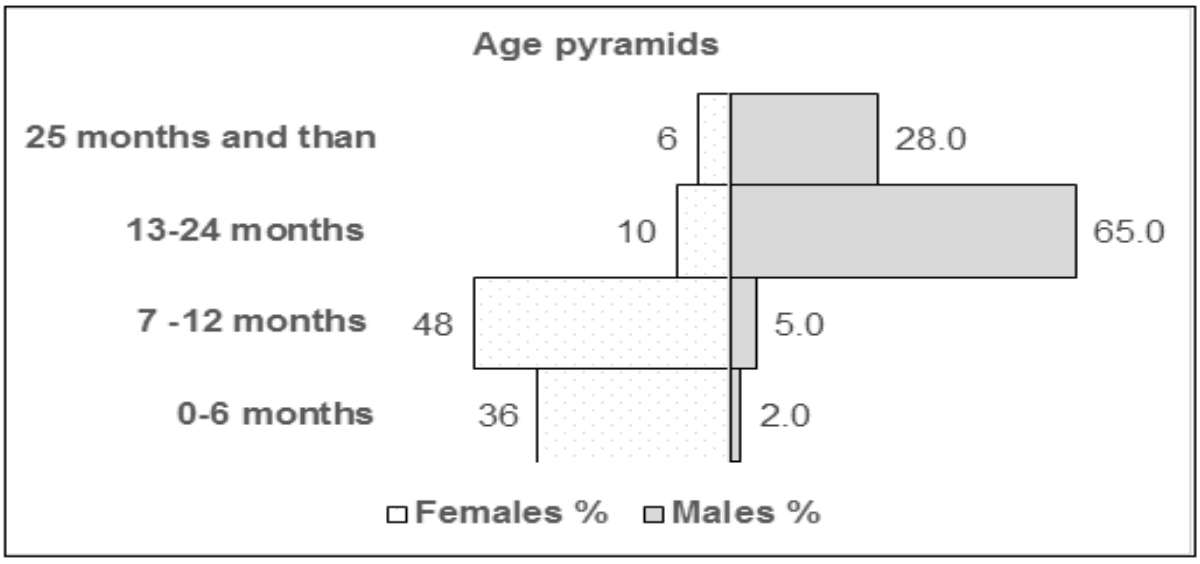

Fig. 3. Age pyramid for goats.

Several studies confirm the numerical superiority of females on livestock farms (Alkoiret and al., 2010; Bassirou 2011; Manoli and Hiernaux and al, 2012; Assani, 2013; Chabi, 2016).

Natural rates

The calving rate recorded in the Bermo district varies from 58-95% for cattle, 41-53% for camels, 65-89% for goats and 78-91% for sheep. The results of national studies show lower calving rates for sheep and camels (RGA/C, 2007). However, this study shows similar calving rates for cattle and goats. Chabi (2016) also finds a similar farrowing rate for cattle. BA (2011) and Corniaux (2016) report lower annual calving rates for cattle. In West Africa, small ruminants showed a higher farrowing rate (Corniaux and al., 2012).

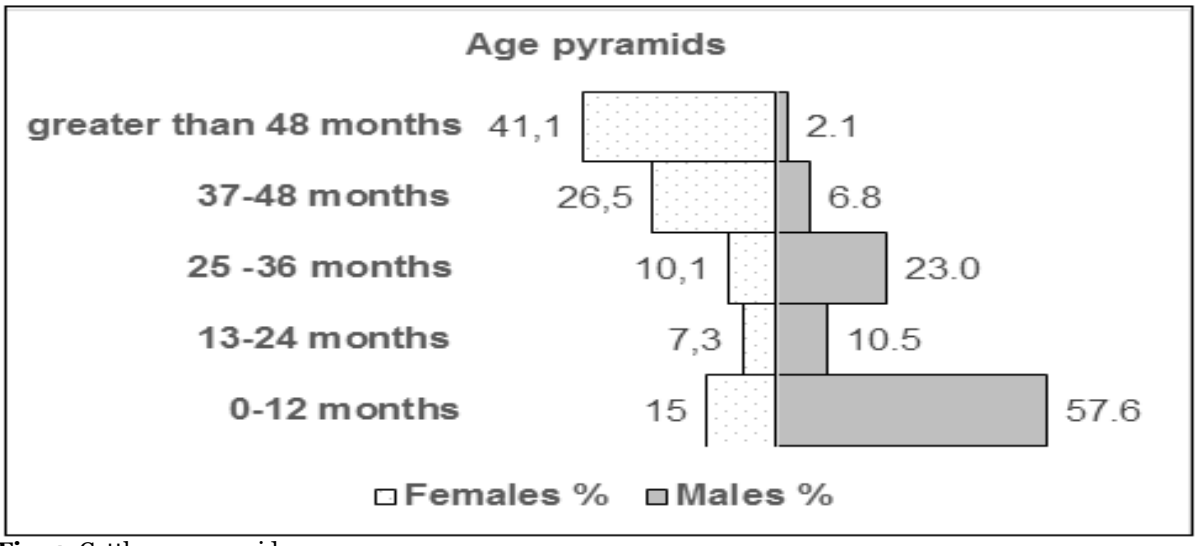

Fig. 4. Cattle age pyramid.

High calving rates were observed in the Goudali zebu (Assani,2013).

The calving rate of mobile herds is much higher than that of sedentary herds (IIED, 2010).

Prolificity rates for large ruminants (cattle and camels) are lower than the results obtained at national level by the general census of agriculture and livestock (RGA/C, 2007), with the exception of camels at the Bakoba and Akadany sites. However, for small ruminants (goats and sheep), these rates are higher than those obtained by the same study.

Camel mortality is highest in Akadany and Bakoba. The livestock multiplication center has much higher mortality rates for sheep, cattle and goats (MEL, 2022).

Alkoiret and al., 2010; Assani, 2013; Chabi, 2016 report a lower mortality rate for cattle. Diawara and al (2017) record high mortality rates for small ruminants (sheep and goats).

Exploitation rate, growth rate and numerical yield

Large ruminants

For cattle, exploitation rate (EN) and numerical yield (RN) are higher in Wurssena and Akadany. On the other hand, numerical growth (CNN) is negative at Akadany and Intalak; this situation is explained by a high offtake and also a high mortality rate at both sites. This means that the herd at Akadany and Intalak is in full decline, and therefore threatened with extinction. For the Bakoba, Wurssena and Oly sites, the growth rate obtained is in line with the national norm of 6% for cattle; that of Tacha Ibrahim is close to the norm. In Effret, on the other hand, the rate is well above the national norm.

It is below average in Gadabédji. Lower operating and growth rates have been obtained at the station (CMB, 2022). Higher annual exploitation and growth rates have been reported (BA, 2011). At national level, a lower exploitation rate is observed for cattle (MAG/EL, 2020). Numerical yields obtained in Bermo department are on the whole higher than those obtained in Senegal (Corniaux and al., 2010).

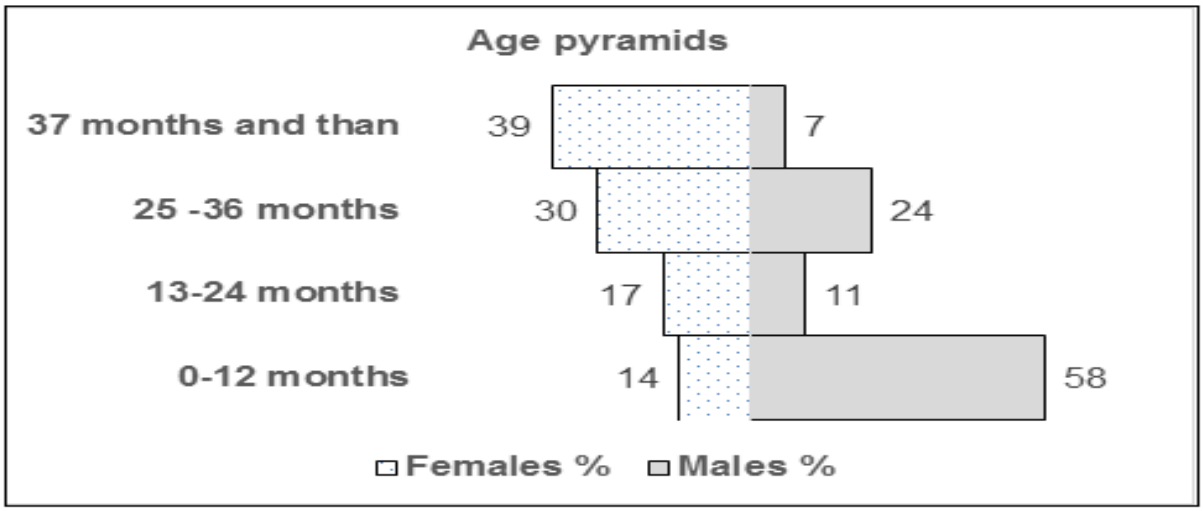

Fig. 5. Camel age pyramid.

Positive growths have been reported in small ruminants in Benin (ANOPER, 2014). Alkoiret and al (2010) observed for Borgou cattle, numerical growth rates, numerical yields and exploitation rates lower than the results of this study. The work of Assani (2013) reveals high net numerical growth. On the other hand, Diallo and al., 2005 note a lower exploitation rate for cattle.

As for camels, EN, RN are higher in Akadany and Bakoba. Apart from Gadabédji, the CNN is negative at all sites. The rate is therefore below normal. On the other hand, the mortality rate is below the national average.

Diallo and al (2005) reveal a lower exploitation rate for camels.

Small ruminants

RN and EN are higher for goats in Oly, Akadany and Bakoba respectively. On the other hand, the CNN is negative at all sites, as goats are the primary species exploited for sale and slaughter.

For sheep, Akadany, Bakoba and Oly have the highest EN and RN. The CNNs are all negative. This situation characterizes flocks in difficulty. On the whole, sheep mortality rates are acceptable.

Growth rates for small ruminants are all negative, below the national norm of 4% for goats and 3.5% for sheep.

Hombori reveals lower exploitation rates for sheep and goats. On the other hand, it also distinguishes positive growth for goats (Diawara and al., 2017).

The exploitation and growth rates of small ruminants in livestock multiplication centers are significantly lower (MAG/EL, 2020). Lower exploitation rates have been reported for sheep, goats and cattle (HC3N, 2021).

Work carried out at national level by the RGA/C (2007) reveals growth rates of 6% for cattle, 1.3% for camels, 4% for goats and 3.5% for sheep.

These performances (prolificacy rates) are achieved despite the frequency of forage deficits one year out of two in the Bermo department.

The situation augurs well for a herd threatened with extinction, if the cyclical crises do not abate in the short and long term. The breeders' survival therefore seems to be threatened. On the whole, however, the results are satisfactory. Among the species, cattle seem to be adapting better to the situation. Especially since Bermo, commonly known as Bororo, is the preferred area for the breed of the same name.

Animal movements

Animal arrivals are dominated by births. These take

place mainly in the rainy and cold seasons. Confiage is the second most common reason for animals entering the farm.

The main reasons for animals leaving the farm are sales, mortalities and confiage, respectively.

Diawara and al (2017) distinguish animal exits dominated by sales and slaughter respectively. Denise (2016) notes entries dominated by births. The author also observes that sales represent the main cause of animal exits.

Removal rates are well above the level for small and large ruminants (MOAAF, 2015). With the increasing needs of households and their animals, and the drop in calving during the lean season, offtake becomes significant. The outmigration rates observed in the post-harvest period and in the cold dry season can be explained by the need for herders to stock up on cereals and the organization of wedding ceremonies (Amadou and al., 2018).

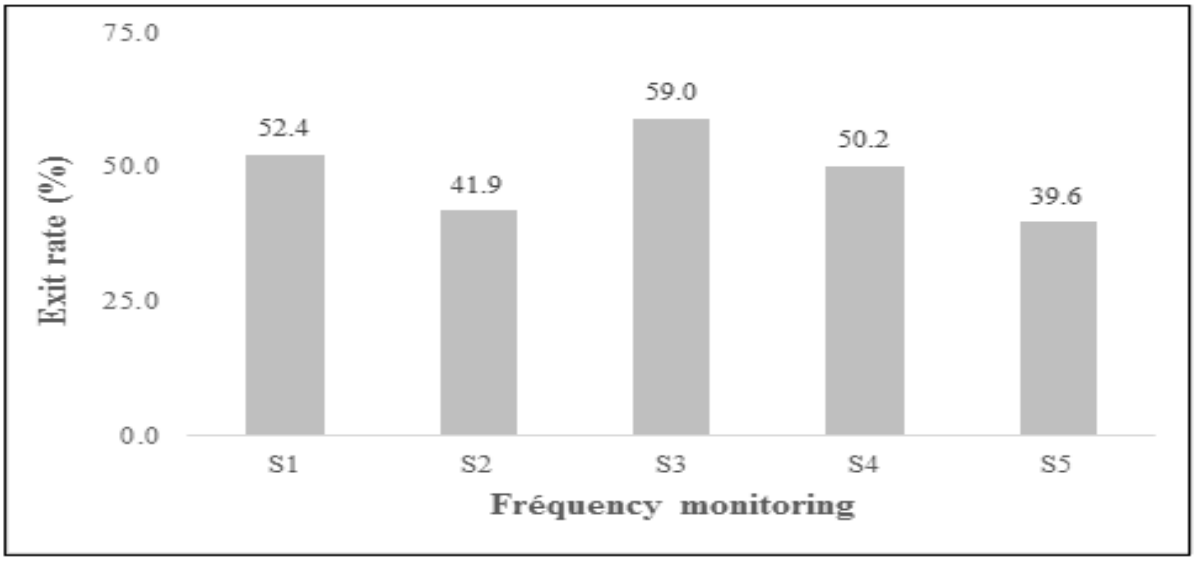

Fig. 6. Animals removed from breeding farms.
Nb : S= follow up

The prolificacy rates observed reveal the herd's performance in a pastoral environment, which enables breeders to carry out the necessary sampling. These withdrawals, especially during the lean season, reveal the importance of livestock to pastoral households, whose survival is highly dependent on them; indeed, through various uses (sale, slaughter, entrustment, etc.), herders manage to provide for the needs (food and financial) of their households.

Conclusion

The present study has enabled us to understand the level of livestock exploitation carried out by herders in pastoral environments.

The rate of herd exploitation was highest among small ruminants (47.64 ± 13.59% for goats and 37.19 ± 8.06% for sheep). In fact, they are the first to be harvested for sale.

Among the species, only cattle (0.03±0.01) showed positive growth. This augurs well for an endangered herd. This situation is corollary to the resurgence of pastoral crises in the Bermo department.

In view of the context characterized by the frequency of pastoral crises in the study area, the animal performances recorded reveal the hardiness of the breeds bred by the farmers.

However, a mechanism for alerting and monitoring pastoral crises needs to be put in place, in order to preserve the survival of the breeding herd.

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