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Exploitation of milk by pastoral households in Niger: case of the department of Bermo.

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Abstract : The study conducted in the department of Bermo concerned milk trait and its distribution at the level of thirty-seven pastoral households. The data were collected using a questionnaire during the period from April to December 2017. This study, which is designed to provide comprehensive and up-to-date data on the sale of cow's milk in pastoral settings, is based primarily on the exploitation of milk by the household, including self-consumption, sales and donations. The produced milk is fully consumed at the level of 85% of the households surveyed. Households that market milk, range from raw sales (55%), self-consumption (38%) donation (7%). Through sales, cow's milk contributes to the economy of pastoral households. Milk cannot meet household needs. This explains its marketing only during the rainy season, when production is important in the farms. As a staple food for pastoral households, milk represents one of the levers for achieving food security.

Key words: Dairy production, self-consumption, donation, sale, recipe, Niger

1.Introduction

Pastoral farming plays an important role in the economy of African. It accounts for 25% of agricultural GDP and 10 to 44 % of the national GDP of West African countries (Union Internationale pour la Conservation de la Nature 2006). In Africa, transhumant pastoralism provides 70% of milk (M. Bahari and *al.*, 2018).
FAO estimates milk production in the UEMOA area at 3 million tonnes per year, including 42 % of cow's milk, 35 % for goats, 13% for camels and 10% for sheep (Duteurtre and Corniaux 2013). Thus, the majority of milk marketed is produced by cows and accounts for 3.5 to 11 % of the agricultural turnover of Sahelian countries (Duteurtre and Corniaux 2013).
Niger has a herd of about 19 million UBT, a value added of 3911,1 billion CFA francs (Ministry of Agriculture and Livestock 2018). Pastoralism, on the other hand, contributes 84% of the country's agricultural GDP (International Initiative for Environment and Development 2010). Cow's milk accounts for 48% of national production. With only 10 % of cattle, Niger produces 34 % of UEMOA's milk (CSAO-OCDE / CEDEAO 2008). National pastoral and agropastoral systems provide 40% and 15% of milk respectively (CSAO-OCDE / CEDEAO 2008). It should also be noted that at the household level some of the milk produced is destined for marketing.
However, the amount of milk marketed and the cash flows it generates are virtually unknown. Indeed, one of the problems of Niger's milk sector is the lack of comprehensive, recent and reliable data. Very few studies have addressed cash flows from dairy production in pastoral areas.
In the light of thèse findings, the aim of this work is to provide comprehensive and up to-date data on the parameters of milk production, the distribution of the milk produced and the sale of cow's milk, in a pastoral environment.

2. Material and method

2.1. Study area

The Department of Bermo covers an area of 6496 km2 with a population of 52274 inhabitants divided between 6972 households (National Institute of Statistics of Niger, 2012). It has two rural communes (Bermo and Gadbédji), located in the pastoral area, 210 km from the city of Maradi, between longitude 006'49,170 and latitude 15'08,872 degrees (Ministry of Agriculture and Livestock 2017). The climate is hot and dry Sahel-Saharan type, with an average rainfall ranging from 200 to 250 mm per year. Soils are usually dune types. The vegetation consists of clear tree savannah, with concentrations of trees in plateau depressions and inter-dune valleys. The herbaceous stratum is relatively well developed. Surface water resources are limited

to the permanent akadany pond (130 ha) and some semi-permanent ponds. Livestock farming plays a major role in the activity of the Bermo population, as evidenced by the numerical importance of livestock in the area (M. Bahari and *al*, 2018).
The department has a staff of 594,642 head, consisting of 29,484 asins, 193,082 cattle, 91,352 camels, 95,643 goats, 1,785 equines and 183,295 sheep (Ministry of Agriculture and Livestock 2017).
Figure 1 describes the study area

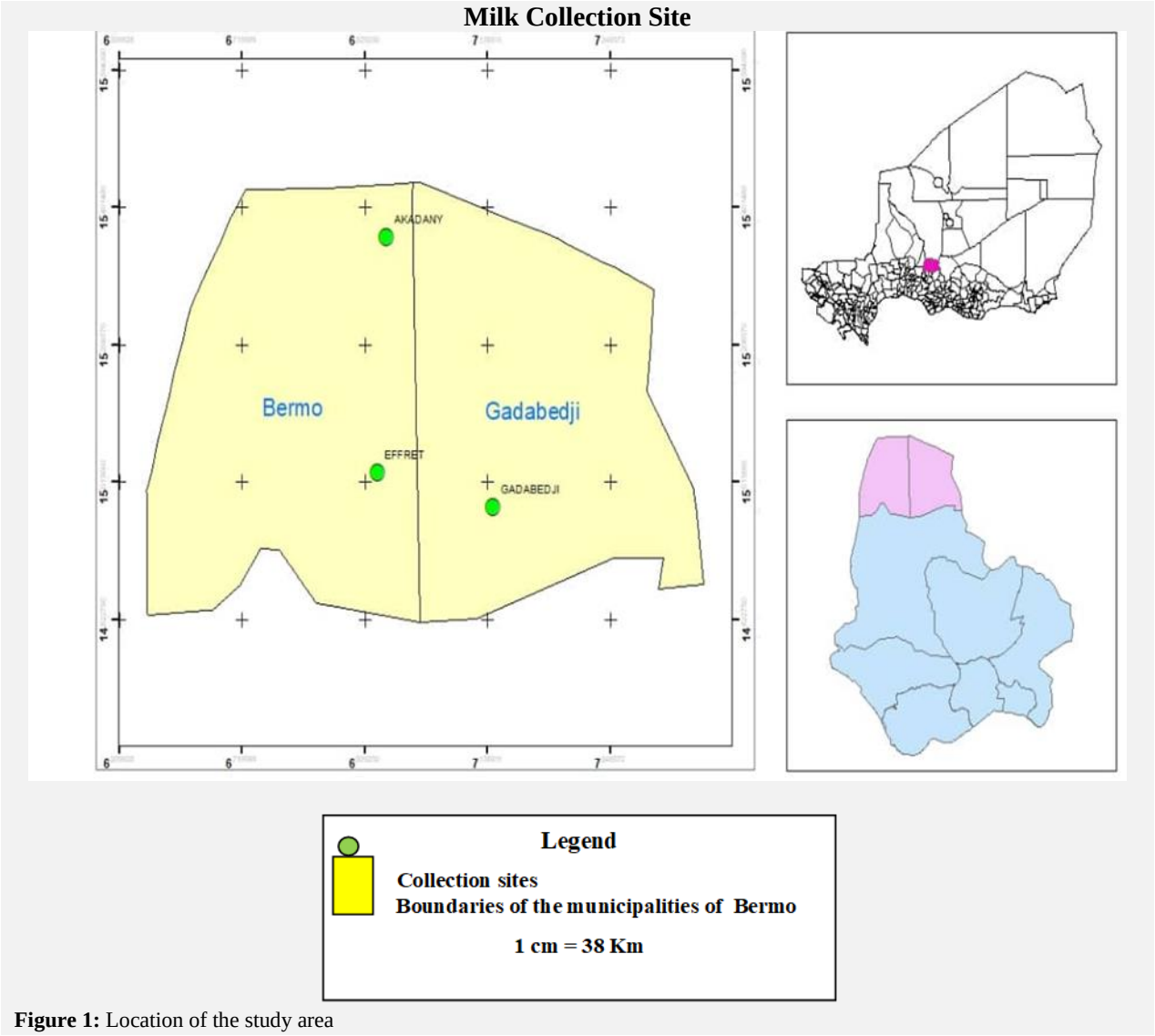

Figure 1: Location of the study area
source: Survrey data

2.2. Data collection

The collection took place during the period from April to December 2017. The study was conducted in the municipalities of Bermo and Gadabédji. The choice of survey sites was facilitated by the general meetings held within the two municipal entities. These assemblies have enabled the identification of the areas of concentration of animals and breeders available. This resulted in three sites: Akadany, Effret and Gadabédji. Given the accessibility of the sites and the availability of breeders at the time of the study, a sample of thirty-seven households, due to a cow/household, was selected for this study.
These selected households are part of the one hundred and sixty livestock farms monitored as part of a study on zootechnical and socio-economic parameters.
The data collected focused on household milk exploitation. The information contained in the survey sheets is based mainly on revenue from the sale of milk. Dairy production was followed during nine months of lactation, due to one check per month. The follow-up focused on the distribution of the quantities produced by cows and the flows generated by milk.
In this study, the following equipment is used for weighing milk:
- A Severin brand scale graduated to 10000 g;
- A bowl graduated to 2 liters;

- Five measuring cups each graduated to one (1) litre.

The measurement of the technical parameters is based on the estimation of the following production parameters: The total quantity, the average daily production, the standard production and the peak production or maximum production;

The methods for determining these parameters are as follows:

Total quantity (QT) = The total quantity milked during 9 months (270 days) was calculated for each cow by applying the Fleishman method (Meyer et al., 1999) which states that:

QT= (A x n1) + n2*(A+ B)/2 + n3*(B+ C)/2 + …. +F*14

A, B and C are the quantities of milk; n1 is the interval from calving to first check in days; n2, n3, … are the intervals, in days, between two checks; F the quantity obtained at the last inspection.

The determination of the total daily production (QTj) = the quantity treated in the morning (QTm) + the quantity treated in the evening (QTs).

The average daily production is calculated by the average of the monthly checks.

The standard production = It is equal to the daily production × 305

Household income = income from the sale of animals and animal products.

Tableau 1: Survey sites.

Commune	Site	Number Cows	Race	
			Bororo	Metis
Bermo	Akadany	16	13	3
	Effret	11	9	2
Gadabédji	Gadabédji	10	9	1
Total		**37**	**31**	**6**

2.3 Statistical Analysis

The collected data is first recorded in the Excel spreadsheet and then imported into Minitab version 14 for processing. During the analysis, there was a discussion of assessing the quantities of milk produced and consumed, as well as those sold. This made it possible to estimate the revenues generated by the sale of milk. The variance analysis is based on the application of ANOVA to a factor for the averages tested.

3. Results and Discussion

3.1 Dairy production parameters

Performance varies significantly by site for all production parameters studied (P<0,001, Table 2).For all the parameters studied, the best performance is obtained at the Gadabédji level.
In terms of production parameters, the effect of the breed is also highly significant on performance (P< 0,001, Table 2). Thus, the analysis of Table 2 reveals a much better performance in the Metis.

Table 2: Comparison of averages and standard deviations from milk production parameters.

Factors	Number	Daily production (kg)	Peak lactation (kg)	Standard production (kg)	Total production (kg)
Overal average	37	**1,8 ± 1,4**	**2,3±1,6**	**560,5± 428,1**	**490,3±373,1**
Site					
Akadany	16	1,6 ± 0,7^{a}	1,9±0,85^{a}	480,5±206,0^{a}	423,7±179,6^{a}
Effret	10	0,8 ± 0,2^{b}	1,0±0,17^{b}	241,0±51,2^{b}	207,8±43,7^{b}
Gadabédji	11	3,2 ± 1,8^{c}	3,7±2^{c}	967 ±547^{c}	844±476^{c}
			Race		
Bororo	31	1,7 ± 1,3^{a}	2,1±1,5^{a}	512,0 ±401,1^{a}	447,8±348,3^{a}
Metis	6	2,7 ± 1,7^{b}	3,3±2,1^{b}	811±514^{b}	710±454^{b}

***Caption**: The numbers followed by different letters (a, b and c) in the same line indicate a significant difference to the p < 0,05 threshold.*

The results obtained in this study for dairy production are similar to those of FAO (2017), which reports daily production of 2kg for the bororo breed. Oumarou (2004) observe higher amounts (3 to 4 L/day) for the same breed. The production obtained by Adamou (2017) on the Kouri (2,7 ± 1.4 L) exceeds that of the bororo at the Bermo level. Studies conducted on Djelli in Niger have revealed a production of 2-3 litres per day (Issaka 2015). Other work reveals a milk production between 180-300kg per lactation about bororo (Belli 2008).
Ousseina (2004) observes in Azawak, a production (1678, 87±341kg) significantly higher than that of bororo (512,0±401kg) during the 305 days of lactation. The production of the Métis is higher than that of the pure breeds; as evidenced by the results of this study. These results are consistent with those of Ndeye (2005) which also revealed this superiority in crossbred cows (6,5 L per day) in Kaolack and Fatick in Senegal.

The study revealed variations in milk production depending on the environment, including the site. This result is comparable to that of Adamou (2017) which records differences in productions per collection site (Toumour, Gueskerou, Kabelawa and N'Guigmi) in the Diffa region.
The superiority of winter milk production revealed by these results is explained by the availability of forage and water during this season. This is why breeders direct calving mainly during this period. Kassa and al (2016) and Dambaki (2014) observe high milk production during the rainy season. Moustapha (2018) reports higher milk production in the winter season, compared to the dry season, on the Kouri in Diffa. This situation is more noticeable in livestock farms conducted in real-world settings; because in the resort, in addition to natural grazing, the animals benefit from a food intake.

3.2. Destination of the produced milk

Milk is used in the daily diet of pastoral households. This product is eaten alone all day long, or combined with a cereal (milk, rice) as a meal (touwo). It also fits into the ball preparation (furra). In addition to the self-consumption of the household, the chief operating officer distributes 7% of his production in the form of a donation to needy households (Figure 2). The amount of milk reserved for marketing in the winter season is important, as it accounts for up to 55% of household production. This is confirmed in 55% of breeders followed in this study. The study reveals the marketing of milk by only fifteen (40, 5%) Households. It appears that at the household level (85%), the transformation of milk into butter, cheese and curd. These derivatives are sometimes used in sauce, ball or consumed as they are. In all the households followed, the management of milk provided by women, who sell it in raw state or in the form of curd or cheese. The analysis also reveals the distribution of financial resources from the sale, so most of these resources are directed into the purchase of tea, sugar, dates, salt and some ingredients for the sauce. Figure 2 illustrates the distribution of milk produced at the household level.

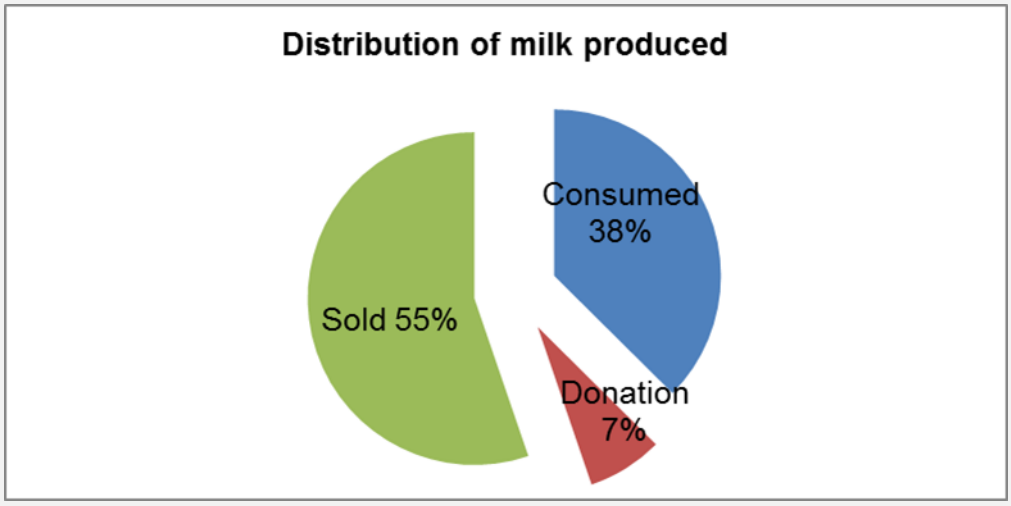

Figure 2: Breakdown of milk milk by the household.

3.3. Receipts from the sale of dairy products

In this pastoral area, the sale of dairy products is mainly in capital of the rural commune of Gadabédji. Still, there are some traces of cheese sales in Akadany.
Dairy production is more abundant in the winter season; which justifies the importance of dairy sales during the months of July to September. Table 3 illustrates the revenues recorded by the sale of dairy products at the level of the households surveyed.

Table 3: Annual revenue from the sale of dairy products.

		Income (FCFA)			
Site	**Dairy products**	**July**	**August**	**September**	**October**
	Raw milk	71625	129750	9750	5415
Gadabédji	**Cheese**	57000	123740	69020	
	Butter	2760	7680	1500	4140
Akadany	**Cheese**		1260		

The qualitative analysis suggests that raw milk, cheese and butter provide 0,96%, 1,10% and 0,07% of overall household receipts in Gadabédji, respectively. These revenues are 0,01% for the sale of cheese, at the level

of Akadany. Table 4 shows the contribution of milk produced during a lactation (nine months) to total household income.

Table 4: Dairy Sales Contribution (FCFA).

Site	Income in FCFA				Income rating	Total household income
	Raw milk	Butter	Cheese	Income assessment		
Akadany	0	0	1 260	1260	low	10 272 600
Effret	0	0	0	0		16 064 500
Gadabédji	216 540	16 080	249 760	482380	medium	22 663 750
Total	**216 540**	**16 080**	**251 020**	**483640**	**medium**	**109 478 750**

Dairy production is paltry in the dry season, which explains the absence of sales of dairy products during this period. The sale of dairy products is mainly at the level of Gadabédji, where the marketing of cow's milk and camel is growing. The trade in milk products (cheese, butter) is exclusively owned by women.

These results are similar to those of the work conducted by Iyayi et al (2003) in Nigeria, in which the sale of cow's milk is practiced by 59% of housewives and 41% of girls. In the winter season, women sell or barter small quantities of raw and curdled milk and cheese in weekly markets. However, during the welding period, especially during the dry season, the milk produced fails to meet the food needs of pastoral households; which limits the possibilities of sale. Added to this is the stiff competition with the Fako Ranch, which is overseeing an association of cheese women to sell its dairy production.

These production units are a hindrance to the marketing of cheeses and raw milk by households, as customers are looking for quality products; indeed the Ranch is in great demand from all sides to provide cheese and milk. Unlike pastoral households, state farms are equipped with technicians to meet the production standards (hygiene, health, food, packaging, etc.) of dairy products. Despite the drop in milk production since 2005, this product is an important source of income for many rural households (Zibo 2017). The sale of milk is subject to certain pastoral traditions which consider milk to be a "food" and cannot be sold to neighbours. Thus, the sale of raw milk is prohibited in some pastoral societies (Sadler et *al*. 2010).

On the other hand, in the UEMOA zone with the fixation of pastoralists around urban centres imposing dietary changes on them, the turnover provided by the sale of milk represented 40% of the total household revenue (Duteurtre et al 2013). The sale of the milk produced is also practiced by 76% of farmers, of which 40% of the quantity produced is self-consumption, 54% sold and 5% destined for donation, at the level of traditional cattle farms in northern Benin (Chabi 2016). The same study reveals that 24% of households do not sell milk, but the share between self-consumption (90%) donations (10%). Milk consumption of 35% and 75% were obtained respectively in the Gambia (Somda et al 2004) and western Zambia (Moll et *al*. 2007). Majekodunmi et al (2014) observed the sale of 28% of the milk produced among agropastors in the Jos plateau (Nigeria). Revenues from the sale of dairy products are higher in the rainy and cold dry season. Thus, they are 2,41% in the cold dry season, 0% in the hot dry season and 2,77% in the rainy season in Loga in the Dosso region of Niger (Zibo 2017).

This variation is explained by the seasonality of raw milk and dairy products resulting from its processing. In Kouro Béri (Dosso region), the contribution of dairy products to household income is very low; it is 0,36% in the cold dry season, 0,28% in the hot dry season and 0,51% in the rainy season (Zibo 2017). The seasonality of milk production and its quantitative inadequacy are at the root of this variation. For Chabi (2016), the sale of dairy products accounts for 23% of household revenues during the rainy season. The dairy trade provides 21000 CFA francs a year for the household. Dairy products provide 0,20% of household income in the cold dry season, 0,31% in the hot dry season, 0,36% in the rainy season at Dereki. Their contribution is estimated at an annual turnover of 50057 FCFA (Zibo 2017). Inadequate milk production even forces mobile farmers to consume powdered milk. At the city level, although some of it is provided by peri-urban livestock, much of it is imported (MAG/EL 2018). However, the supply of milk remains problematic in these pastoral areas, especially with the frequency of crises and the lack of production in the dry season.

As a result, competition is taking place between men and calves. Indeed, a considerable number of animals is needed to overcome this natural conflict. Bernus's (1983) work corroborates this. This author observes in the Sahelian zone a competition between the breeder and the domestic animal.

4. Conclusion

This study confirms the significant effect of the site and breed on milk production parameters. The study also reveals that despite the lack of milk production, a certain amount is marketed by women in raw or processed state. The proceeds are most often reinvested in the household, through the purchase of condiments, tea and sugar. They are the second largest source of household income, after the sale of livestock. Most of the milk

produced is mainly for self-consumption, which makes it the staple food for pastoral households. Milk contributes to the strengthening of social relations between communities and is the pillar of maintaining the food balance of the pastoral household. It is therefore an indispensable product for the expectation of food security among farmers.

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