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Analyses of constraints related to milk production in Liptako Gourma in Niger

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Livestock in Niger has great potentials. If well managed, this sector can significantly improve food security and boost poverty alleviation in the population. In order to encourage the development of local milk production in Liptako Gourma, the present study was undertaken to identify constraints related to milk production in the area. A questionnaire based survey was conducted to collect data from 360 dairy farmers. The study revealed that Liptako Gourma harbours a diversified cattle population comprised of 83.3% of Djelli in Niamey, 69.8% of Peul Zebus and 55.8% of Azawak in Tillaberi and 20.0% of Goudali in Dosso. The workhands is mainly constituted of Fulani farmers (77.3 ± 5.0% in Tillaberi) and Zarma agro- farmers (33.3 ± 16.8% in Niamey). They have traditional skills in milk production technology. The study also showed that animals' feeding is highly dependent on seasonality. The most prevalent animal diseases were fasciolosis (55.0, 36.6 and 51.7%, in Dosso, Tillaberi and Niamey, respectively), bezoars (15.0, 60.0 and 12.8% in Dosso, Tillaberi and Niamey, respectively) and respiratory problems (46.6, 40.0 and 35.8% in Dosso, Tillaberi and Niamey, respectively). The low level of education of farmers which is, for example, 16.2 ± 4.4% in Tillaberi, the low level of investment, the poor hygienic practices and difficulties associated with milk conservation and sale constitutes further constraints that thwart the development of the dairy sector. Findings of this study call for technical supports from veterinarians and hygiene services to dairy farmers so as to significantly control the aforementioned constraints.

Key words: Local milk, Liptako Gourma, Niger, milk valorisation, production constraints.

INTRODUCTION

Livestock plays an important role in the livelihood of populations around the world. It constitutes the main source of protein in human nutrition through its various products notably, meat, milk, cheese, eggs, etc (Laouali et al., 2014). In Sub-Sahara Africa countries, animal production contributes significantly to the improvement of food and nutritional security of households (Laouali, 2014). Niger is one of the major animal producing countries in sub- Saharan Africa, with a livestock size estimated at more than 42 million animals (all species

combined) in 2015, which could worth over XOF 3451 billion with an annual milk production of about 1161926 tons (MEL, 2015). Animal production is practiced in Niger by 87.0% of the active population (FAO, 2011). The number of cattle is estimated at 12059951 heads in 2015 with an annual cow milk production of 596, 968 tons (DGPIA, 2015). Apart from the numerical importance of its cattle population, Niger hosts a wide diversity of breeds with many adaptation features to specific environments. There are five main cattle breeds in Niger: Azawak breed which means "sandysoil" in Tamajeq language (MRA CCN/GRGAD, 2003), Bororo, Kouri in kanouri language (Zafindrajaona et al., 1999), Djelli (Peul) and Goudali which means "short horns and legs" in Hausa language (Assani, 2013) and many crossbreeds offering interesting variants (MEL, 2013). Azawak and Kouri are among the best milk producing breeds in Africa (Geesing et al., 2001). Furthermore, Niger has an old culture of milk and other dairy products consumption (SOW, 2005). People usually consume the raw and fermented milk (FAO/SFW, 2010). In spite of the high number of cattle in the country, the produced milk does not satisfy the national needs (Moussa, 2016). The systematic presence of calves is one of the reasons of the low milk productivity from cows since a part of the milk is consumed by these calves (Corniaux et al., 2012). Moreover, the quantity of milk collected is usually low as compared to the actual potential of the animals. The point is also stressed by the rudimentary milk transportation means (bicycles, carts, motorcycles) and the defective or non-existent road infrastructures that decrease the capabilities of production (Corniaux et al., 2005). The national milk production covers only 50.0% of the needs of an increasing population, especially in urban areas. The population of Niger, estimated at nearly 15.2 million inhabitants in 2010, an increase of just under 30% compared to 2000 (11.02 million), has one of the higher growth rate in the world (FAO, 2012). At the same time, milk consumption for the same period is of 53 L per person per year to 63.8 L of milk per person per year (Duteutre et al., 2013). To satisfy the remaining demand, Niger usually imports massively dairy products (Vias et al., 2009). However, in case of overproduction during the rainy season, it is very common to see farmers discarding the unused milk especially when the herds are far from the market and this constitutes a serious loss (ONUDI / AFD-PSEAU, 2007). Previous studies conducted on the dairy sector in Niger were essentially focused on Niamey (Sioussaran, 2003; Marichatou et al., 2005; Vias et al., 2003, 2006, 2010; Vias, 2008, 2013; ONUDI /AFD-PSEAU 2007; Sow, 2005). However, the Liptako Gourma area is a big animal production zone in Niger and regroups 3 regions out of the 8 of the country (Dosso, Niamey and Tillabéri). As a cross-border area, together with its high transit position, Liptako Gourma constitutes a sort of mingling area for cattle from Burkina Faso, Mali, Niger and other bordering communities.

An improved use of the high cattle population of Liptako Gourma and its abundance in water resources and available large grazing spaces, could lead to a significant reduction of milk and dairy products importation. This area could serve as a zone of milk production susceptible to supply the local and regional dairy enterprises. The present study aimed to identify constraints related to milk production in Liptako Gourma in Niger in order to propose adequate solutions capable of improving the endogenous processes of milk processing and preservation.

MATERIALS AND METHODS

Study area

The study was carried out in Liptako Gourma, an area located astride the borders of Burkina Faso, Mali and Niger (Figure 1). It covers 9.7% of the total surface of Niger and covers 3 constituencies that are Dosso, Niamey and Tillabéri (Table 1). This area harbours important potentialities in energy, hydraulics and mines. However, it suffers from its hemmed-in position (Gado, 2007). The dominant economic activity is agriculture and animal production that are in serious difficulties due to the inaccessibility to water and the invasion of the rivers by water hyacinth. The dairy basins of the capital (Niamey) where the demand in dairy products is higher than the offer are located on both sides of this zone.

Selection of the investigated sites

The 3 regions of Liptako Gourma targeted by the study are constituted of 12 dairy basins. These basins are focal points of milk collection (high dairy production) for the supply of big cities and circumscribed in a radius of 100 km around the three regions located on a tarred road to facilitate a secured transportation of milk. A Dairy Basin (DB) is an area constituted of milk production units from which particular cities are supplied.

Sampling procedure

The study included individuals who produce and/or collect raw and fermented milk in the study area. This choice was made because of the non-existence of a database for dairy stakeholders in the area. Respondents were randomly selected based on their accessibility and availability to provide the required information. A total of 180 producers, 126 producer-

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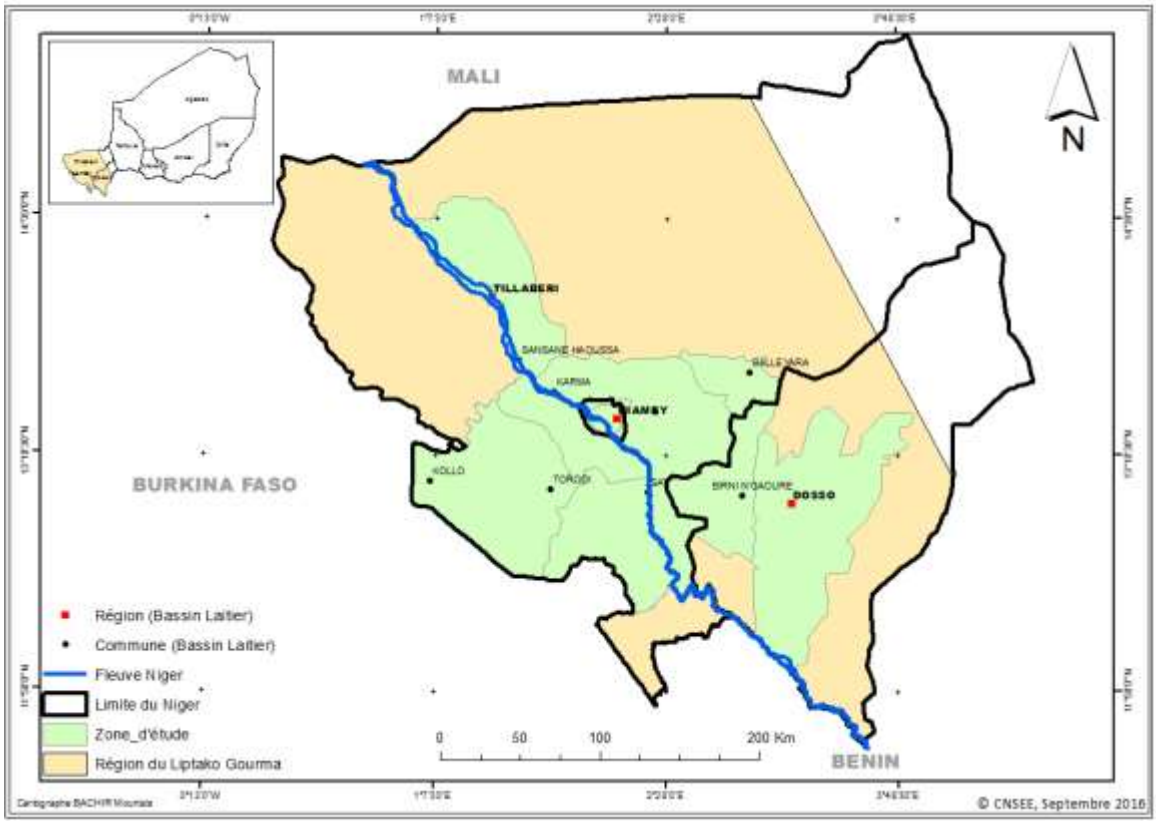

Figure 1. Map of Liptako Gourma.

Table 1. Respondents sampling in Liptako Gourma, Niger.

Region	Dairy basins (DB)	Producers	Producer-collectors	Collectors	Total
Dosso	DB of Dosso	15	11	4	30
	DB of BirninGaouré	11	15	4	30
Niamey	DB of Niamey	17	10	3	30
Tillabéri	DB of Hamdallaye	8	20	2	30
	DB of Kollo	16	8	6	30
	DB of Karma	15	12	3	30
	DB of Say	18	9	3	30
	DB of Torodi	17	6	7	30
	DB of Baleyara	16	10	4	30
	DB of Tillabéri	16	6	8	30
	DB of Dembou	17	11	2	30
	DB of Sansane haoussa	14	8	8	30
Total		**180**	**126**	**54**	**360**

collectors and 54 milk collectors distributed in the 12 retained dairy basins were interviewed (Table 1). Furthermore, key informants were interviewed from the Ministry of livestock, Departmental Directories of livestock, Local Directories of livestock, NGOs and farmers' associations, as well as, milk collection centers and dairy industries.

Data collection methods

This was across-sectional study in which investigations were based on face-to-face interviews with milk producers, producer-collectors and collectors. Structured pre-tested questionnaires were administered to respondents to probe information regarding

Table 2. Identification of dairy operators.

Variable		Dosso		Niamey		Tillaberi		Significance test
		%	CI	%	CI	%	CI	
Sex	Women	18.3[a]	9.7	10.0[ab]	10.7	3.0[b]	2.0	***
	Men	81.6b	9.7	90.0[ab]	10.7	96.9[a]	2.0	***
Ethnic groups	Haoussa	5.0[a]	5.5	-	-	4.9[a]	2.6	NS
	Kanouri	-	-	-	-	0.7[a]	1.0	NS
	Peul	68.3[a]	11.7	66.6[a]	16.8	77.3[a]	5.0	NS
	Zarma	26.6[a]	11.1	33.3[a]	16.8	16.9[a]	4.5	NS
Level of education		36.6[a]	12.1	53.3[a]	17.8	16.2b	4.4	***

%: Percentage; CI: Confidence interval; ***: significant at 1‰; NS: Not Significant; Percentages of the same raw followed by the same letters are not significantly different at 5%.

farms' management, the conduct of the dairy herds, the reproduction and milk production techniques, the quantitative and qualitative milk production, animal health and milk delivery.

Statistical analyses

The collected data were recorded in Microsoft Excel and analysed with SAS (2006) software. One way ANOVA was used and the parameter "region" was the only source of variation. The procedure Proc GLM was used for the analysis of variance. Proportions were computed by the procedure Procfreq of SAS and compared using Chi-Square and bilateral Z test. For each relative percentage, a confidence interval (CI) at 95% was calculated using the formula as follows:

$$ICP = 1.96\sqrt{\frac{[P(1-P)]}{N}}$$

Where P is the relative percentage and N the sample size.

RESULTS

Typology of the dairy operators

In this study, dairy operators are the milk producers, producer-collectors and collectors. Majority of them (96.9 ± 2.0% in Tillaberi) are men (Table 2). However, a number of women are also involved in this activity mainly in Dosso (18.3 ± 9.7%). Statistical analyses revealed a significant difference between the 3 regions based on the sex of the operators ($p < 0.001$). Most of them are from Peulh ethnic group (77.3 ± 5.0% in Tillaberi), followed by Zarma agriculturists natives of Liptako Gourma. More than half of the operators do not have school education except in Niamey where 53.3 ± 17.8% of them are educated. Included in schooling, any level of education combined. There was a significant difference between the 3 regions with respect to the education of the operators. Livestock production is the main activity at around 80.0 ± 14.3% in Niamey (Table 3) or secondary activity at over 50.0% in association with successively agriculture and trade. The development of a business network around milk production makes this activity more attractive than it has ever been. Civil servants and other socio-professional groups are also involved in cattle farming. About 10.0 and 6.7% of civil servants in Dosso and Tillaberi respectively; 14.2, 9.0 and 1.4% of craftsmen and other workers in Dosso, Niamey and Tillaberi respectively are also implicated in milk production.

Characteristics of the dairy farms

In all the investigated regions most of the dairy farms use domestic work hand (85.0%). Only selected operators notably retired or active civil servants (10.0% in Dosso) and traders (6.6% in Niamey) use salaried work hand. The main activities in these farms consist of feeding and serving water to the animals, milking and delivery of milk and treatments of sick animals. The required small material (feeding dish, drinking trough) common for all dairy operators is found in all farms. These materials are mostly constituted of recycled household containers like plastic or metallic buckets and bowls or barrels. Barrows are found in 16.6 ± 9.4, 20±14.3 and 26.7 ± 5.3% of the farms and carts were found in 16.6 ± 9.4, 13.3 ± 12.1 and 17.3 ± 4.5% of farms in Dosso, Niamey and Tillaberi, respectively. Animals are tied to a peg. Calves are kept away from cows at night. A very few operators (less than 2.0%) had cowsheds, feeds stores and cars.

Characteristics of the dairy herd

The most preferred cattle breeds used in the investigated dairy farms were Djelli breeds (83.3% in Niamey) and Peul Zebus (69.8% in Tillaberi) (Figure 2). Azawak breed occupied the 3rd position (55.8% in

Table 3. Activities of the dairy operators.

Variable		Dosso		Niamey		Tillaberi		Significance test
		%	CI	%	CI	%	CI	
Main activity	Agriculture	13.3[a]	8.6	13.3[a]	12.1	7.9[a]	3.2	NS
	Trade	3.3[a]	4.5	6.6[a]	8.9	6.4[a]	2.9	NS
	stock farming	73.3[a]	11.1	80.0[a]	14.3	78.1[a]	4.9	NS
	Teaching	5.0[a]	5.5	-	-	5.2[a]	2.6	NS
	Entrepreneur	-	-	-	-	0.7[a]	1.0	NS
	Soldier	3.3[a]	4.5	-	-	0.3[a]	0.7	NS
	Custom officer	1.6[a]	3.2	-	-	0.3[a]	0.7	NS
	Policeman	-	-	-	-	0.7[a]	1.0	NS
Secondary activity	Agriculture	21.4[a]	15.2	27.2[a]	26.3	16.9[a]	8.7	NS
	Trade	7.1[a]	9.5	9.0[a]	16.9	-	-	NS
	stock farming	57.1[a]	18.3	54.5[a]	29.4	81.6[a]	9.0	NS
	Guardian	7.1[a]	9.5	9.0[a]	16.9	1.4[a]	2.7	NS
	Tailor	3.5[a]	6.8	-	-	-	-	NS
	Carpenter	3.5[a]	6.8	-	-	-	-	NS

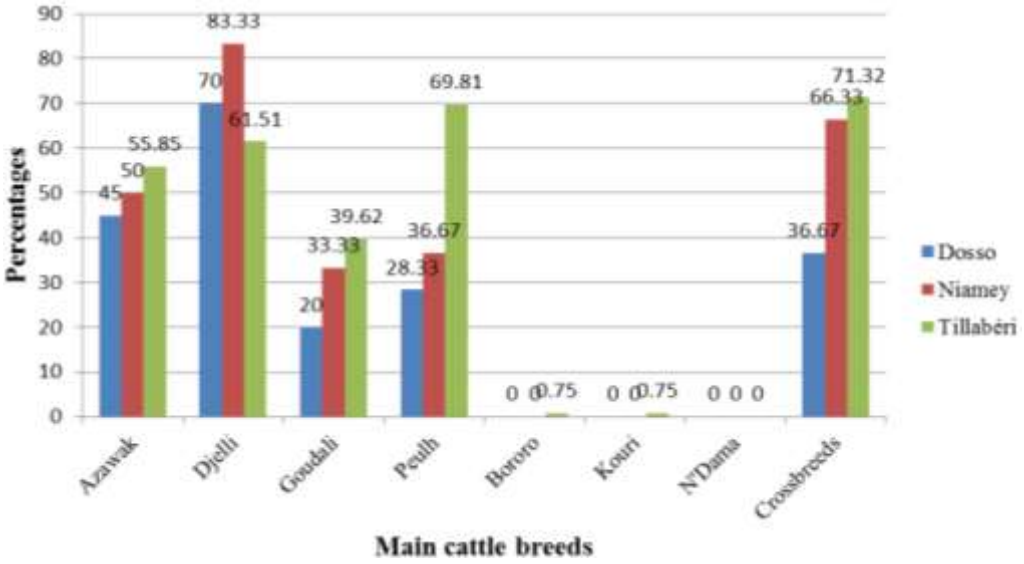

Figure 2. Main cattle breeds used in the study area.

Tillaberi) followed by Goudali (39.6% in Tillaberi). In the herds, more than half (57.8%) of the animals are cows with 14.7% of heifers. Furthermore, there were relatively more male calves (13.5%) than females (12.9%).

Management of dairy farms

Feeding

In peri-urban areas, feeding takes place on natural pastures within distances ranging between 3 and 5 km across the year. After a grazing of about 3 to 6 h, animals receive agricultural by-products (cereals' stems and haulms) and a complementation with brans (millet, wheat or rice bran). The distributed quantities depend on the season, the size of the cow and its milk production and also the operator's income: 0.9 to 1.8 Kg per cow per day in rainy seasons and 1.8 to 2.7 Kg in cold seasons. The distribution is made two times a day before milking.

In urban areas, there is almost no available grazing space and feeding in rainy seasons is based on a

supply of green fodders that are sold along the roads in addition to some small natural pastures. Animals in this condition, receive an important extra-feed mainly brans like to 3.6 kg per cow per day. In dry seasons, the green fodder is replaced by hay, bush straw and bourgou (*Echinochloa stagnina*). In rainy seasons, animals drink water from dams, streams and rivers, while in dry seasons they basically use water from wells, borings and sometimes rivers. Animals drink water 2 times per day (85.0%) and *ad libitum*. In urban areas, operators buy water for their animals throughout the year. The different modes of conduct of the herds determine the different production systems that are of 2 types in the considered area (Dosso, Niamey and Tillaberi):

1. The intensive system (that was not investigated). It concerns dairy farms of big traders, high commissioners and dairy cooperatives; animals are maintained in free stalling and exclusively fed at the trough.
2. The semi intensive system within which different modes of herd managements are employed:

i. The peri-urban and urban livestock keeping practiced by 22.3% of the operators whereby settled keepers or small civil servants get settled around big cities in camps or small farms. The main objective is milk production that is delivered directly to the collection point or to retailers. Milk is generally sold raw or traditionally pasteurized. This mode is characterized by the proximity of the production zones and the consumption centers, the existence of processing units that influences the organization of the collection circuits.
ii. The agro-pastoral livestock keeping practiced by 28.9% of the operators; crop production constitutes the main activity of this system with a low amount of milk produced; this system is frequently found among autochthonous zarma producers of the study area.
iii. The pastoral, nomadic or transhumant livestock keeping is practiced by 48.8% of the operators: mostly Peulhs. It can be practised alone or combined with other activities. Milk production is the main objective and used for sale and to feed the family. This system is very efficient with regard to the use of space and pastoral resources.

Management of the reproductions

The management of reproduction within the dairy farms is based on various crossings between the existing local breeds (65.0% of the operators), aiming to get better crossbreeds for enhanced milk production. The mating is either free or directed. However, artificial insemination and the introduction of exotic breeds is considered expensive by the operators and thus not practiced.

Management of the production

Dairy production depends highly on a nutritional feed and therefore strongly subjected to seasonality. The periods of cereals and legumes harvesting correspond to the peak of lactation and availability of milk that decreases overtime across the year. The quantities collected per cow per day are more important in the rainy season with an average of 3.5 ± 0.8 L. On the other hand, in the dry season, there is a decrease of dairy production and consequently a decrease of the quantities of milk collected (1.5 ± 0.4 l per cow per day). Milking is carried out 2 times per day in the presence of the calf. The quantity milked very early in the morning is exclusively and directly sold (at collection point, to potential customers and collectors) by operators who are close to urban centers. The evening milk is sold by door to door or at a determined retail outlet and also serves for domestic consumption. The remoteness of urban centers and the lack of conservation methods are the reasons why such milk is usually consumed fresh or sometimes processed or given to people or completely discarded. The high heats of the region that can reach 45°C sometimes makes milk more perishable and the storage at the shade of trees is not sufficient for its preservation. Some operators try to prolong the shelf life of their milk by covering the containers with moistened bags. For morning milking, 98.0% of the operators deliver their products within 2 to 4 h. The delivery is made by the operators with the means that they have (motorcycles, bicycles) in 45.3% of the cases and by collectors (54.6%).

Production hygiene and health of the dairy cows

Utensils used for milking are calabashes (79.1%), followed by plastic (12.6%) and metallic (8.1%) utensils such as bowls, cups, buckets, sieves. For milk collection and transportation, the respondents use plastic cans of 5, 40 or 50 L. The used utensils are systematically washed except for the calabash in all the regions with soap by 90.9% of operators. However, hygiene practices are only limited to the washing of collection and milking utensils, whereas the preparation of cow's udder and personal hygiene are not respected among peri-urban operators. Hand washing is significantly ($p < 0.001$) practiced by all dairy operators in peri- urban areas of Niamey as compared to Dosso and Tillaberi (26.6 ± 11.1 and 16.2 ± 4.4%, respectively) (Table 4). Nevertheless, this hand washing is only done with plain water in all respondents of Niamey. Some few operators of Tillabéri and Dosso

Table 4. Hands washing and cow's teats cleaning.

Variable	Dosso		Niamey		Tillaberi		Significance test
	%	CI	%	CI	%	CI	
Hands washing	26.6[b]	11.1	100.0[a]	-	16.2[b]	4.4	***
Water	23.3[b]	10.7	100.0[a]	-	12.4c	3.9	***
Water + soap	1.6[a]	3.2	-	-	3.4[a]	2.1	NS
Cow's teats washing	5.0[a]	5.5	3.3[a]	6.4	4.9[a]	2.6	NS
Water	1.6[a]	3.2	3.3[a]	6.4	3.7[a]	2.2	NS
Water + soap	-	-	-	-	-	-	NS
Cloth	3.3[a]	4.5	-	-	1.1[a]	1.2	NS

%, Percentage; CI, confidence interval; ***, significant at 1‰; NS, Not significant; Percentages of the same raw followed by the same letters are not significantly different at 5%.

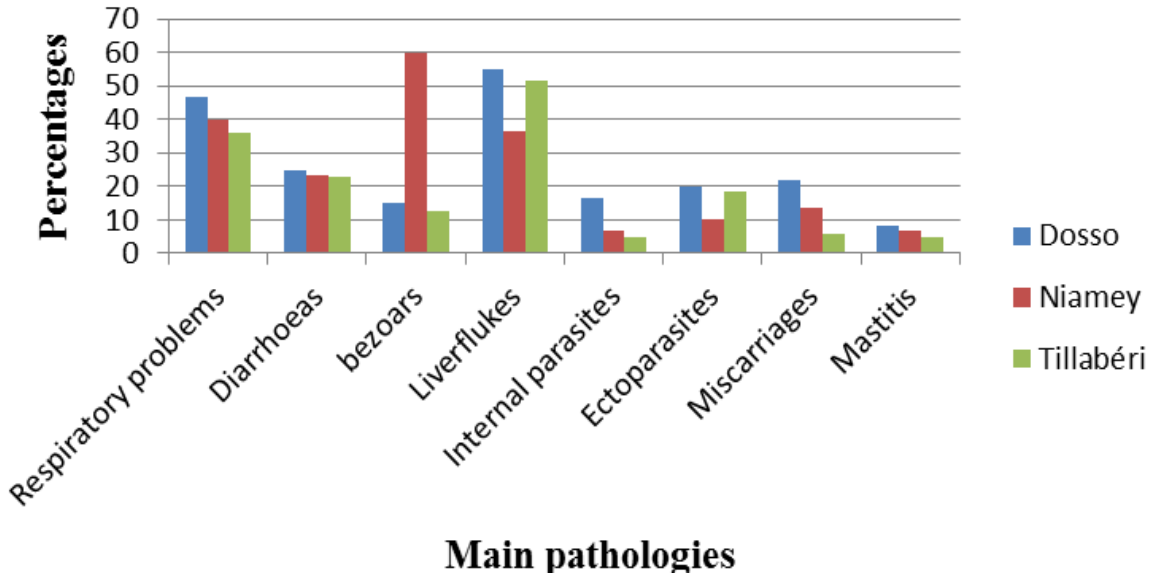

Figure 3. Major animal pathologies per region.

use soap. Farmers also consider Islamic prayer ablutions as hand washing regardless of the time that separates that act and the milking. Teats washing interests only 5.0% of the operators from all regions and this is made with plain water or by wiping the teats with a cloth. However, this washing cannot be effective if there is no clean water. The water supply, even though it is from a potable water source, is carried in dirty and sometimes unclosed cans that could compromise the quality of the water.

With regard to the health of the dairy cows, respiratory problems, diarrhoeas, bezoars (especially in Niamey) and liver flukes constitute the major handicaps to the health of the dairy cows (Figure 3). Despite these health situations, only government subsidized vaccines against contagious bovine peripneumonia (CBPP), pasteurellosis and anthrax are given to the animals. The use of veterinary services and laboratory analyses are often rejected for financial reasons (Table 5).

DISCUSSION

Dairy activities in Liptako Gourma in Niger are essentially practised by operators of Peulh ethnic group. The high level of involvement of this ethnic group in the diary sector was previously reported by many authors (FAO, 1995; Meyer et al., 1999, Vias et al., 2003, Marichatou et al., 2005, Assani, 2013). These populations have traditional skills in cattle management that are transmitted from one generation to the other (Allsopp et al., 2007), mainly regarding the virtues of medicinal plants (Ayantunde et al., 2009), the assessment of pastures' qualities (Soumana et al., 2010; Soumana, 2011), and the management of pastures and herds (Oba and Kaitira, 2005; Soumana,

Table 5. Animal health care.

Variable	Dosso		Niamey		Tillabéri		Significance test
	%	IC	%	IC	%	IC	
Vaccinations	95[a]	5.5	100[a]	0.0	98.1[a]	1.6	NS
Veterinary services	8.3[a]	6.9	13.7[a]	12.5	9.0[a]	3.4	NS
Lab analyses	8.3[a]	6.9	16.6[a]	13.3	8.3[a]	3.3	NS

%, Percentage; Cl, confidence interval; NS, Not Significant; Percentages of the same raw followed by the same letters are not significantly different at 5%.

2011; Soumana et al., 2012).

Cattle production is the main activity of Peulh populations who have lately adopted other secondary activities because of a number of constraints that have affected the traditional dairy system (Schneider et al., 2007). Nevertheless, Zarma and Haoussa producers adopted livestock keeping as a secondary activity to enhance their incomes. When they settle, former nomadic keepers often develop crop production, wheres agriculturists opt for extensive animal production as a mean of diversifying their productions. In addition, the animals serve as workforce and provide manure for their crops. On the other hand, traders and civil servants use livestock activities as investment opportunities.

Technically, the integration crop-animal production is mutually profitable. In fact, the livestock provides workforce and manure to crop production and receives in return agricultural by-products as feed. Economically, such integrated production systems provide a favourable strategy of risks management according to Somda et al. (2004). The low enrollment rate of education of dairy farmers constituted in majority of Fulani was mentioned by Barry (2006).

Furthermore, the low income of most operators is the cause of their inability to appropriately equip their farms. Drinking troughs and feeding dishes constitute the sole equipment found in most of the farms because they are indispensable. The habitats of animals were just a small space around households and camps. Such housing condition can be a threat to animals' health because of the lack of hygiene and space capable of leading to various contaminations. In these dairy farms, money is not the key element for the business to keep running. Farmers share similar needs in terms of housing and small material resulting in low production cost. This low level of hardware investment confirms that production factors in the dairy exploitations are still traditional. Among the used cattle breeds, Djelli is the most preferred probably because of its resistance. Although Azawak is well reputed as a good dairy breed, it is not highly used certainly because of its feeding requirements for effective performances expression. Goudali is only used as a matter of breed heritage.

Dairy cows' feeding is based on fodders and agricultural by-products. Ngongoni et al. (2006) reported that fodder represents 90% of the available cattle feed in rainy seasons in Zimbabwe. However, the seasonal variability of fodder, the mobility of animals and the difficulties to obtain concentrated feeds constitute some of the constraints that hinder dairy cattle feeding (Duteutre, 2007). Feed complementation is only practiced in dry season while it would have been more beneficial on the zootechnic and economic parameters of the exploitations if it were also practised in rainy seasons where there are peaks of lactation through a well- balanced diet. Some elements of similarities do exist with respect to the quality of the feed given regardless of the financial status of the farmer as they basically rely on natural grazing and agricultural by-products. Differences are only found in the rationing where the distributed quantities are mostly lower than the required standards since the producers do not have any training in dairy cow feeding. Watering is an essential aspect of the breeding system and increases the production cost especially in farms that use public water supply (Boudon et al., 2013). However, any restriction due to this high cost can be fatal to the production. The recuperation of runoff water in pits and rain water from the roofs in appropriate recipients could somehow alleviate water scarcity challenges during dry seasons.

As the main dairy breeds are local breeds with some random crossbreeds, any nascent dairy development plan should consider genetic improvement with a compulsory resolution of feed related problems. This could significantly enhance the quantities of milk harvested. Araba (2006) confirmed that the production of milk that tripled in the last thirty years in Morocco was mainly due to genetic improvement of the breeds. Even when these production performances are improved, it will be necessary to reorganize the milk collection system in order to effectively obtain adequate profits from the dairy cows.

The quality and hygiene of milking utensils, personal hygiene during milking, hands washing and the safety of the milking environment constitute important factors in the reduction of health risks. With respect to hygienic practices, the milkmen are all at risk. During milking, farmers do not wash their hands; however, they

lubricate their hands during the process by soaking their hands in the already harvested milk. Nevertheless, hand washing has become systematic in peri-urban dairy farms of Niamey because of APROLAN project (Project of support to the promotion of the peri-urban dairy sector in Niamey) that addresses issues of good hygienic practices. Moreover, milking utensils are not effectively washed. They are mostly rinsed without disinfectant and exposed to the open air with all the cross-contaminants (wind, dust, flies and other bugs). The use of small material that can be easily handled and washed such as bowls, cups and aluminium buckets should therefore be encouraged.

The predominance of bezoars can be attributed to the pollution by plastic garbage from urban centres. Most of the dairy cows of the study area suffer from worms. The high prevalence of these parasites is probably due to the presence of a river in the study area. This high vulnerability to diseases shows that the peri-urban dairy operators do not use veterinary inputs/services despite the presence of veterinary and para-veterinary services in the nearby cities. This situation exposes their animals to low milk production because the presence of diseases and absence of adequate prevention techniques reduce the milk production capabilities of cows (Coignard et al., 2014).

Possibilities for technological and organizational improvements of the dairy production exist. Technically, it is possible to improve the feed of dairy cows. Feeding practices have moved from transhumance to settlement and from exclusive grazing to grazing complementation. A thorough study on feed complementation practices could establish suitable production technologies. Since the raw material already contains many hazards, it would be healthy to prevent the initial contamination so as to increase the delay bacterial growth in the milk. A serious organization of the collection should also be considered to improve the economic performances of the dairy sector.

Conclusion

The study revealed a number of constraints that hamper the development of the dairy sector in Niger. Dairy operators are confronted with technical problems (health, feed, genetic, etc.), as well as political, institutional and environmental problems that limit the performances of the dairy production. These constraints are worsened by the impacts of climate change. Dairy herds often experience dramatic fodder and water scarcity in dry seasons. Various animal diseases continue to be a serious limitation for their productivity. The low level of valorisation of the genetic potential of local breeds limits the expression of their performances. The majority of investigated dairy operators does not have school education and lack professionalism resulting in low or no investment in their farms. Infrastructures and facilities are almost non-existent with a limited and old material. Dairy producers, who have links with milk collection centers are not many and are not specialized. The herds are not organized to produce only milk as priority but used for all possible options (meat, milk, traction). The production systems are seriously affected by land insecurity. In order to secure milk and dairy products supply, it will be necessary to have fodder stocks and effectively use agricultural by-products (especially stems). The genetic potential of local dairy breeds can be improved by the use of critical mass of genetically selected dairy animals. Future studies on this topic will have to consider all this dynamics so as to solve the constraints adequately.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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