

**Peri-Urban Breeding Practice of One-Humped Camel
(*Camelus Dromedarius*) in the Governorate Of Biskra
(Algeria); A New Option**

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Abstract

Since last decade, the Algerian State is encouraging either of ancient and young breeders of dromedary camels, to resuscitate this profession in the governorate of Biskra, by attributing it a more beneficial feature ; a peri-urban camels breeding practice, which the main purpose is to sale she-camel milk on accessible principal highways, especially that it have a good reputation when compared with milk of other ruminant species. Climate in the region of Biskra is characterized with hot temperatures. Inversely to exotic cattle and goats, camels are known to be resistant to hot climate, thus they are not exposed to heat stress with a similar degree to exotic ruminants. We devoted this survey through a questionnaire realized on a sample of camels breeders (n=10), to know the advantages of this activity, compared to cattle and small ruminants breeding, in an arid environment. Results of the survey had shown that herds are generally fed by pasture with negligible fodders fees, also herds are managed, mainly, by household. The application of bivariate correlation using SPSS Pearson test ($p < 0.05$) did not show any correlation between the variable «Number of she-camels per herd» and the variable «Medium daily income of milk per herd (USD) ».

Keywords: *Camelus dromedarius*, peri-urban breeding, she-camel milk, biskra, Algeria.

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Introduction

Livestock pastoralism remains a viable food production system in Africa's arid lands (Fratkin, E. and Smith K., 1994). The use of the dromedary camel as food and revenue should permit the pastoralists and ranchers in arid Africa to reduce their dependence on higher risk livestock enterprises (Raymond H. Morton., 1984). Camels as milk animals are more adapted to local conditions and are easier to manage than exotic dairy cows. Therefore the improvement of camels and the use of camel milk for home consumption are advocated (Knoess KH., 1980).

The Eastern Septentrional Sahara of Algeria is a very large area. It includes the governorates of Biskra, El 'Oued and Ouargla which are considered as an important economic and agricultural area in Algeria. There are about 160, 000 one-humped camels in Algeria (FAO, 2009) with highest density in the southern part of the country (Aichouni and Jeblawi, 2007). Camels breeding practice constituted a traditional inheritance since several centuries in the regions of El'Oued and Ouargla. Within the Eastern Septentrional Sahara area, the governorate of Biskra is the most populated by human (Anonymous, 2011) and includes a great part of domestic herds depending on a nomadic breeding system, especially for sheep and goats (D.S.V., 2012), while herders of this region had not been attracted, in the past, by camels breeding for many reasons.

However, we observed during last few years a spread of peri-urban practice of camels breeding in the governorate of Biskra. The Algerian authorities play a key role in supporting this sector through direct or indirect means. We conducted a field survey supported by a questionnaire. The aim of this study was to know the real advantages of peri-urban camel breeding practice compared to cattle and small ruminants breeding in an arid steppe environment.

Materials and Methods

Elaboration of the Questionnaire

Primarily, we obtained statistical data from the Veterinary Services Directorate of the governorate

of Biskra (D.S.V., 2012) concerning camel's herds distribution in the region of study. A primordial inquiry was necessary to help in questionnaire's conception. Then, we elaborated a full questionnaire to be completed while interviewing camel's breeders. Global subjects of questionnaire concerned feeding and management methods, camel's breeds existing in the region of Biskra, aspects of milk and meat production. A part of responses depended on breeders's declarations, while the others were estimated according to our observations on the field.

Conducting the Survey

Our survey began November 2012, and ended February 2013. Each breeder was interviewed for a period not exceeding one hour on average. Some photos were taken as a support data. We targeted to collect some information's concerning the advantages and difficulties of peri-urban camel breeding system compared to other ruminant species. Our hypothesis was that peri-urban camel breeding activity constitutes a new option comparing to cattle (milk) and small ruminants (meat/milk) breeding, especially when looking for weather and soil appropriateness in the region of study, also the absence of stable building charges.

Statistical Analysis

Microsoft Excel xp. 2007, was used to determine descriptive histograms and tables. Then, data collected from questionnaires were entered a computerized database and statistical analysis was performed by SPSS software. A bivariate correlation using Pearson test was applied with a significance level ($p < 0.05$) to detect any correlation between the variable «Number of she-camels per herd» and the variable «Medium daily income of milk per herd (USD)».

Results

Visited camels herds were geographically distributed beside three principal highways; national road (N.R) n° 1 (Oumache, Saâda, Ain El' Karma, Chaiba, Doucen, Sidi Khaled, Bir Nâam), and N.R. n° 3 (Loutaya). However, herds of Western Ziban region (Chaiba, Doucen, Sidi Khaled, Bir Nâam)

seemed to be more accessible to clients than others (Table 1).

Table 1: Geographic distribution of visited camel herds according to regions of the governorate of Biskra.

Region	Number of herds (n)
Saâda	1
Ain El'Karma	1
Oumache	2
Loutaya	2
Chaiba	1
Doucen	1
Sidi Khaled	1
Bir Naâm	1
Total	10

A proportion of 50 % of breeders had a scholarship level higher than fundamental level (Table 2). Among all inquired breeders, 30 % had a professional experience exceeding 40 years as

specialist in camels breeding, while 20 % had an experience exceeding 10 years, 20 % more than 5 years and 30 % lesser than 5 years (Table 2, Fig.1).

Table 2: Summary of breeders's responses concerning herd's management and socioeconomic aspects.

Questions	Yes	No
Adequate scholarship level	Secondary level (n=2) Fundamental level (n=3) (n=8)	Lesser than fundamental level (n=5) (n=2)
Camel breeding is the principal occupation		
Breed other ruminant species added to camels	Cattle (n=1) Sheep /Goat (n= 1)	(n=8)
High experience in camel breeding	> 40 years (n=3) > 10 years (n= 2) (n= 2)	> 5 years (n=2) < 5 years (n= 3) Governmental (n= 5) Tribal (n= 3) Semi-intensive (n=9)
Pasture area is a breeder's property	(n=1)	
Practice only traditional breeding system		
Always change camels pasture's location	(n=4)	(n=6)
Lack of pasture and water is the only cause of changing location	(n=3)	Contagious disease (n=4) Hot climate (n=3)
Transhume camels only by foot	(n=1 0)	
Buy camels only into limits of the governorate of Biskra	Kinship's circle (n=3) Hold camel's progeny to herd's reformation (n=2)	G.A.M. El 'Bayadh (n=1) G.A.M. El 'Oued (n=2) G.A.M. Djelfa (n=2) G.A.M. Ouargla (n=1)
Sell camels only into limits of the governorate of Biskra	Governmental slautherhouses (n=4)	

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	Kinship's circle (n=1) Animals's markets (n=1)	G.A.M. El 'Oued (n=2) G.A.M. Ghardaïa (n=1)
Owner is the only keeper of camels	Owner only (n=1)	Owner's household and labour (n=9)

G.A.M.: Governorate Animals Market.

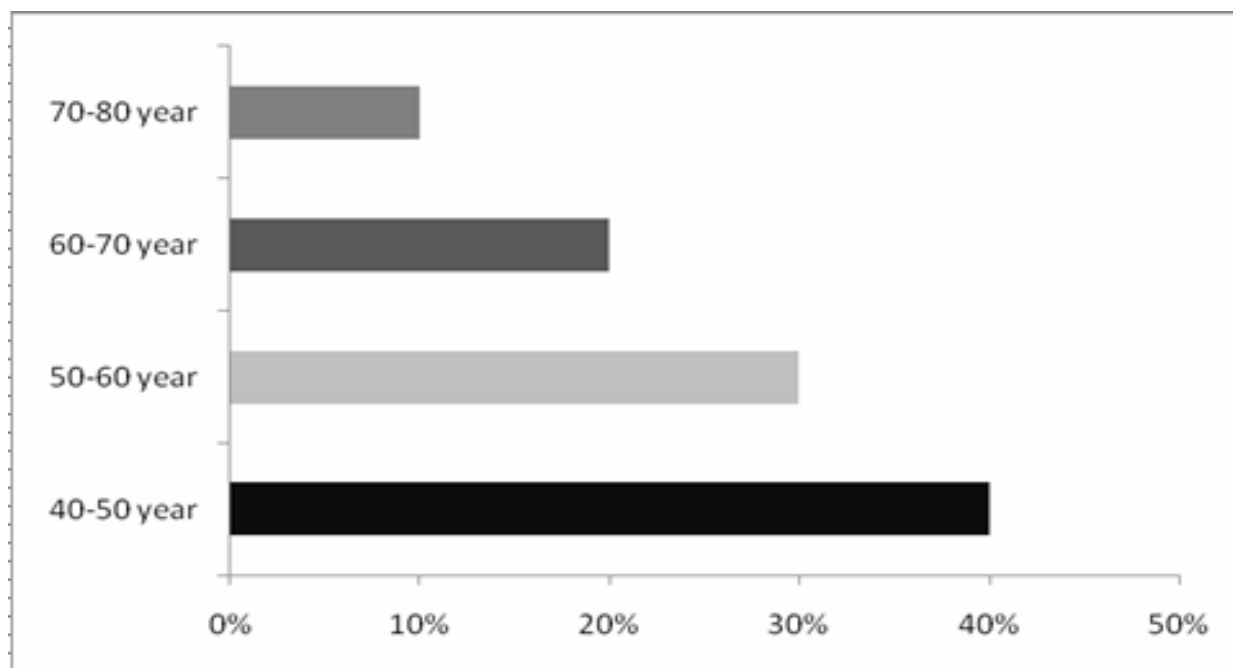


Fig. 1: Percentages of inquired camel breeders according to age's categories.

The majority of breeders (80%) practiced camels breeding as a principal occupation, while 20 % considered it as a secondary activity (Table 2). Also, 20 % of total breeders raised other ruminant species added to camels (Table 2). On another part, pasture areas were an owner property (20 %), or submitted to tribal agreement (30 %) and to governmental rules in the main times (50%) (Table 2). 90 % of breeders practiced a semi-intensive breeding system, 60 % were changing camels pasture location every time (Table 2). According to 10 % of breeders, lack of pasture and water was the only cause of changing location, while 40 % considered avoiding contagious diseases as a principal cause of changing location and for 30 % avoiding high temperatures. In all cases, breeder's transhumed camels only by foot (Table 2). Owner was the only keeper of camels, according to 10 % of respondents. In the opposite, 90 % of respondents

declared keeping their herds in community including owner's household and recruited labour (Table 2). Concerning camels's herds reinforcement, 20 % of respondents hold camel's progeny to herd's reformation, while 30 % bought camels through the kinship's circle of commerce that occurred into the limits of the governorate of Biskra, the rest of respondents (50 %) bought their camels from animals's markets situated within limits of other governorates (El 'Bayadh, El 'Oued, Djelfa) (Table 2). To sell their camels into limits of the governorate of Biskra, 40 % of respondents proceeded to governmental slaughterhouses, 10 % to animals's markets, 10 % preferred to sell product within kinship's circle of commerce, while the rest of respondents (40 %) resorted to animals's markets situated within limits of other governorates (Ouargla, El 'Oued, Ghardaïa) (Table 2).

Concerning herd reproduction and milk production aspects, neither of questioned breeders practiced artificial insemination (Table 3). Totality of respondents used only manual milking method, with a milking frequency of twice a day according to 60 % of respondents and once a day for the rest (40%). Accordingly, 60 % of respondents have always cleaned milking vessel twice a day, 40 % only once a day. In 50 % of cases, milking period did't exceed three minutes in medium for one she-camel (Table 3). All questioned breeders have always washed udder before milking, however only

40 % have always washed udder after milking. Neither of breeders used sterilizant solution during washing udder, in fact 50 % used only tepid water, 40 % added soap to water and 10 % did not use any product (Table 3). According to 80 % of respondents, generally, storage period of milk before to be sold did not exceed 24 hours, but it may go up to 12 days (20%). Totality of questioned breeders sold raw milk directly to consumers, although a part of daily milk production had been always self-consumed (Table 3).

Table 3: Summary of breeders's responses concerning herd's reproduction and milk production aspects.

Questions	Yes	No
Practice artificial insemination	(n = 0)	(n=10)
Use only manual milking method	(n= 10)	(n= 0)
Frequency of milking is always twice a day	(n=6)	Once (n=4)
Always clean milking vessel day	twice a (n= 6)	Once (n= 4)
Milking period exceed 3 minutes in per one she-camel	medium Up to 5 mn (n = 4) Up to 6 mn (n = 1)	≤ 3 mn (n= 5)
Always wash udder before milking	(n=10)	(n= 0)
Always wash udder after milking	(n= 4)	(n= 6)
Always use sterilizant solution during udder washing	(n= 0)	Only soap (n=4) Tepid water (n=5) None (n=1)
Storage period of milk before to be sold don't exceed 24 hours	(n= 8)	Up to 12 days (n=2)
Sell raw milk directly to consumers or collectors	Consumers (n= 10)	Collectors (n=0)
A part of daily milk production is self-consumed	(n= 10)	(n= 0)

Visited camels herds included various breeds. The camels belonging to the two populations Sahraoui and Ouled Sidi Chikh (Table 4, Fig. 3), were more abundant than those belonging to the

population Targui that is largely diffused but with lesser abundance (Table 4, Fig. 2). The camels of breed Chaambi were rarely founded. Some herds included few crossbred camels (Table 4).

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Table 4: Structure of visited camel herds according to breed, sex and age classes.

Herd code	Principal Breeds	Total of camels	Adult Males	Total of she-camels	Calves
H1	-Sahraoui - Targui -Ouled Sidi Chikh	180	04	138	38
H2	-Crossbreeds	250	04	120	126
H3	-Targui -Ouled Sidi Chikh	40	01	20	19
H4	-Targui - Crossbreeds	200	01	-	-
H5	- Chaambi -Ouled Sidi Chikh	12	00	06	06
H6	-Sahraoui	23	01	12	10
H7	- Sahraoui - Targui -Ouled Sidi Chikh	124	06	59	59
H8	- Sahraoui - Targui -Ouled Sidi Chikh	52	02	25	25
H9	- Sahraoui - Targui -Ouled Sidi Chikh	60	02	29	29
H10	- Sahraoui - Targui -Ouled Sidi Chikh	65	01	32	32



Fig. 2: She-camel breed Targui.

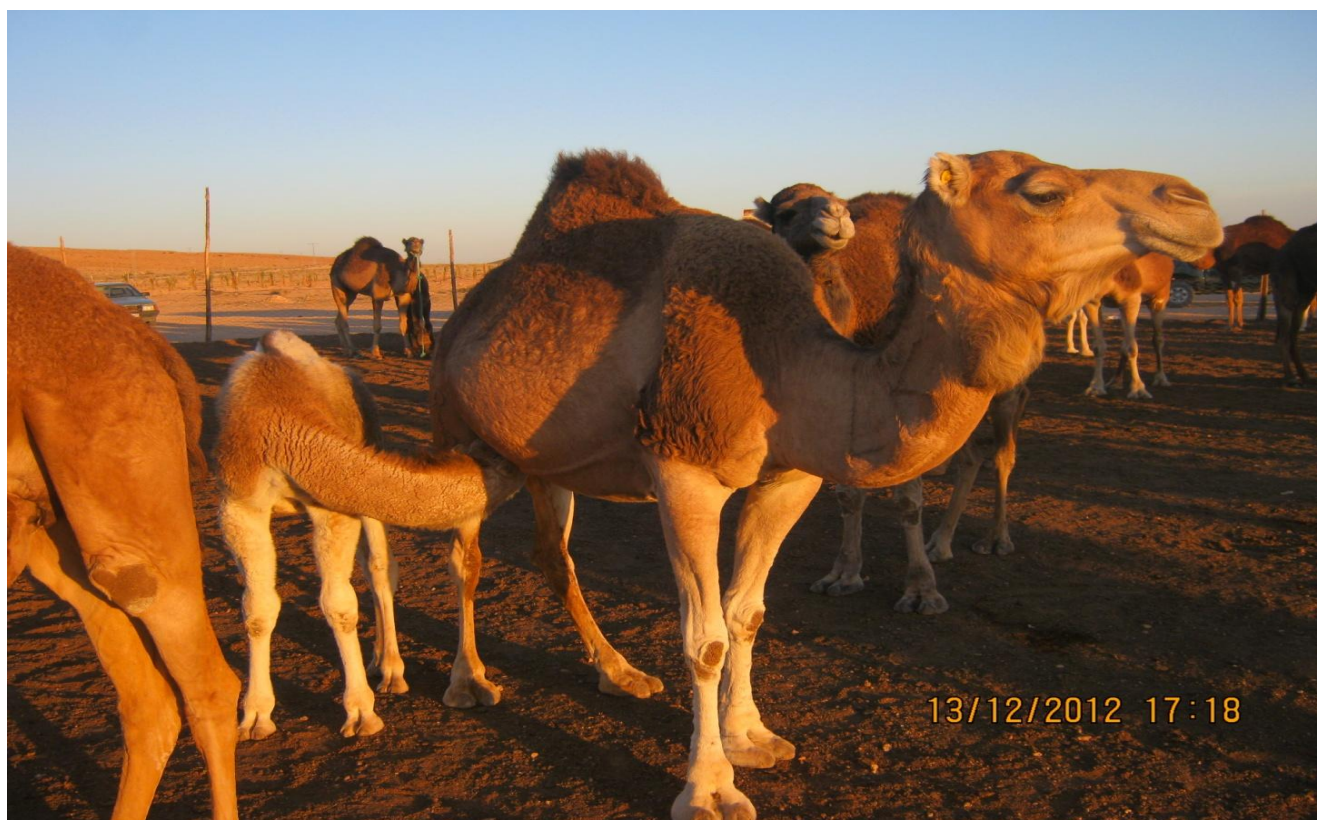


Fig. 3: Camels breed Sahraoui in enclosure.

During survey we observed that pasture areas were so various and rich. Summary of grazed plants by the dromedary camel, dominant in visited sites during survey (Table 5), showed that 31 plant species were identified among those reported by other authors (Bouallala M, *et al.*, 2011).

When looking into table of herds feeding characteristics (Table 6), we could observe that total daily quantities of fodders distributed, only for she-camels, were negligible and that not exploited soils' pasture was the principal source to feed camels. Also, barley and wheat bran were the dominant fodders used by breeders.

Medium daily milk yield per she-camel oscillated from 0.36 liter to 3.81 liter, this extensive difference influenced directly the medium daily total yield of milk per herd and thus the medium daily income of milk per herd (USD) (Table 6). The application of bivariate correlation using Pearson test ($p < 0.05$) didn't show any correlation between the variable «Number of she-camels per herd» and the variable «Medium daily income of milk per herd (USD)» (Table 7).

Table 5: Summary of grazed plants by the dromedary camel dominant in visited sites.

Vernacular denomination	Scientific denomination
Djell	<i>Salsola bayosma</i>
Tarfa	<i>Tamarix gallica</i>
Ghetaf	<i>Atriplex halimus</i>
Lekdad	<i>Astragalus armatus</i>
Remth	<i>Haloxyton scoparium</i>
Rtem	<i>Retama retam</i>
Nedjem	<i>Cynodon dactylon</i>
Adjram-Baguel	<i>Anabasis articulata</i>
Sedra	<i>Zizyphus lotus</i>
Drinn	<i>Stipagrostis pungens</i>
L'arta	<i>Caclligonum comosum</i>
Souide	<i>Sueda fructicosa</i>
Damrane	<i>Traganum nudatum</i>
Zeïta	<i>Limoniastrum guyonianum</i>
Ghardak	<i>Nitraria schoberi</i>
Bougriba	<i>Zygophelum Album</i>
Lalma	<i>Plantago ciliata</i>
Akrich	<i>Aerolopus littoralis</i>
Remram	<i>Chenodium murale</i>
Arfage	<i>Anvillea radiata</i>
Khayata	<i>Teucrium polium</i>
Jaada	<i>Marrubium deserti</i>
kalga	<i>Pergularia tomentosa</i>
Belbel	<i>Salsola tetragona</i>
El'Oud	<i>Farsetia aegyptiaca</i>
Djefna	<i>Gymocarpus decander</i>
Lak	<i>Rhamnus frangula</i>
Chih	<i>Artémisia herba-alba</i>
Btoun	<i>Pistacia atlantica</i>
Talma	<i>Taraxacum laevigatum</i>
Chouk	<i>Centaurea pungens</i>

Table 6: Summary of breeders's responses concerning herds feeding characteristics compared to daily milk yield (l) and income (USD).

Herd code	T.D.D.Q. of fodders (Only for she-camels)	Lactating She-camels	M. D. M.Y. per she-camel (l)	M. D. M.Y. per herd (l)	M.D.M.I. per herd (USD)
H1	- Barley (2-3 kg) - Wheat bran (2-3 kg) - Straw (10 bales) - Pasture	38	2.24	85	424.15
H2	-None - Pasture only	40	1.2	48	239.52
H3	- Barley (5-6 kg) - Wheat bran (5-6 kg) - Pasture	20	1.7	34	169.66
H4	- None - Pasture only	40	0.45	18	89.82
H5	- Wheat bran (? kg) - Pasture	06	2.33	14	69.86
H6	-Wheat bran (? kg) - Pasture	10	2.2	22	109.78
H7	- Barley (2-3 kg) - Wheat bran (2..3 kg) - Pasture	59	2.07	122	608.78
.H8	- Barley (6-8 kg) - Wheat bran (6-8 kg) - Pasture	25	0.36	09	44.91
H9	- Barley (? kg) - Wheat bran (? kg) - Pasture	24	3.5	84	419.16
H10	- Barley (70 kg) - Wheat bran (70 kg) - Pasture	27	3.81	103	513.97

T.D.D.Q.: Total Daily Distributed Quantities- M. D. M.Y.: Medium Daily Milk Yield- M. D. M. I.: Medium Daily Milk Income.

Table 7: Results of the bivariate correlation using SPSS Pearson test between the variable «Number of she-camels per herd » and the variable « Medium daily income of milk per herd (USD) ».

		Number of she-camels per herd	Medium daily income of milk per herd (\$)
Number of she-camels per herd	Pearson Correlation	1	,598
	Sig. (2-tailed)		,068
	N	10	10
Medium daily income of milk per herd (\$)	Pearson Correlation	,598	1
	Sig. (2-tailed)	,068	
	N	10	10

*Test is significant at $p < 0.05$.

Discussion

Mainly, it is observed that occupied areas by peri-urban camel breeding, have virgin not

exploited soils that constitute a comfortable environment for camels. This refers to be large lands far of urban agglomerations (Table 1) accordingly to be rich of preferred plants by the dromedary camel (Table 5). In the opposite, cattle and small ruminants breeding requires sufficient grassy areas often irrigated through costly made unnatural water source, with the obligatory presence of a submerged water pump and an adequate electric source.

During survey, we met some young breeders who chose this activity, when looking for its income, despite they lack experience (Table 2, Fig. 1). Also, it was found during our survey, that the secrets of camels breeding activity were often transmitted through the oldest persons from household. Livestock pastoralism in Africa is predominantly a household enterprise in which labour is recruited from the local family group. The head of the household is responsible for herd management and family subsistence and makes decisions to adjust to changing conditions in natural resources, livestock, and labour (Fratkin E, Smith K, 1994). In our survey, the fact that basic principles of camels breeding are stored only in aged breeders's memories, didn't stop young breeders having no relationship with camel's world and possessing an adequate scholarship level, to profit from the means of mass media or the internet, in order to expand their knowledge about camels breeds and feeding methods.

The majority of not exploited soils used as a pasture areas to camels are a governmental property (Table 2). Generally, camels may be fed gratuitously or after inexpensive fees payment, because these salty soils are mainly inadequate to agriculture simultaneously to include plants that could'nt be exploited well only by dromedary camel (Table 5). Dromedary camels have a natural tendency to graze even if they receive supplementary feeding. In our survey, according to breeders's observations, two plants are more favoured by dromedary camels; *Tamarix gallica* and *Astragalus armatus* (Table 5). The *Retama retam* is abundant in sandy pastures. It is reputed to be poisonous to sheep and caprine races, though it is grazed by dromedary in certain conditions (Bouallala M, *et al.*, 2011). The presence

of such floral diversity would improve therapeutic benefits of she-camel milk.

Only 10 % of respondents adopt a traditional free breeding system, while the rest (90 %) use a semi-intensive system by making permanent enclosure overnight and when milking she-camels (Table 2, Fig. 3), this mode facilitates the assurance of the catch of she-camels and permits a best public exhibition of herds and milk products near the national roads. Dromedary camels are only enclosed in an iron fence (Fig. 3), this minimizes considerably the costs of lodging and guarantees a permanent settlement location of dromedary camel herds, fact that could facilitate selling of collected milk as soon as possible. Also, this system is so practical and easy when changing location. In the opposite, stable building of cattle is often costly made and don't permit in the main times changing lodgment location.

The one-humped dromedary camel as a meat source present a viable alternative to cattle. This is particularly true in desert regions where camel husbandry is much more economical than that of cattle due to the unique adaptation of the camel to the harsh environmental conditions of arid and semi-arid zones, which are very difficult for all other livestock (Gheisari HR, *et al.*, 2009). Comparatively to be in the third world, there is sufficient evidence to indicate that the dromedary camel possesses practical and unique attributes for meat and milk production under intensive and extensive management in the arid and semi-arid regions of Pakistan (Ahmad S, *et al.*, 2010). Artificial insemination in camels is not widespread yet in Algeria, in the opposite of other ruminants species as cattle and sheep, but this didn't stop at any time dromedary camel progeny.

Eyassu Seifu (2009) reported that transport of people, goods and mobile houses of the pastoralists during their seasonal migration in search of feed and water for their animals was the second important contribution rendered by dromedary camels in eastern Ethiopia. It is logical that all enquired breeders of our survey transhume their camels only by foot (Table 2), first because dromedary camel is considered itself as a cargo animal and secondly because of its huge carcasse

so that it could be difficult to transport the herd entirely in one truck. This fact could be considered as an important advantage when looking for high risks of injuries that camels are exposed to during transport, also for damages of truck's motors on environment and nature and for expensive fees of mechanical transportation.

Milking is done in a manual way, in all visited herds. It is performed at a frequency of once or twice a day depending on production capacity of she-camel. Mechanical milking is not used in the case of camel breeding in the region of study. Comparatively, camels in Africa's horn are also milked by hand. It has been reported that camels lack a milk cistern and therefore do not store milk in the udder, so the duration of milk letdown is short (Yagil, R. *et al.*, 1999). Presence of new born is also recommended in the cases of camel, cattle and small ruminants, to stimulate milk letdown. Generally, milk yield is lower in camel than in cattle, thus hand milking seem to be easier in the case of she-camel, especially when realized by men. Methods of washing udder before and after milking are comparatively similar in she-camels and cows of our study area (Table 3).

In our study, the collected milk does not stay according to 80 % of respondents more than 24 hours before to be sold, as long as consumers's demand is increasing fast. Due to prevailing droughts and the trend towards decreasing production of other animals, the camel has gained more attention as a way of bridging the gap between demand and supply (S. Ahmad *et al.*, 2010). Generally, camel milk has a sweet taste, but sometimes can also be salty. The type of feed and the availability of drinking water cause the changes in taste (Farah Zakaria, 1993), thus, she-camel milk could be more able to satisfy various sensorial desires of consumers according to variability of pasture floral composition, than other ruminant species. In a study realized by E. M. El Zubeir Ibtisam and I. Ibrahim Marowa (2012), authors concluded that higher keeping quality of longer shelf fermented milk product can be produced from camel milk using heat treatment and stored at refrigeration.

In a study realized by Eyassu Seifu (2007), author reported that all inquired Ethiopian

pastoralists generate income from sale of camel milk. The average price of one liter of camel milk was 4.8 Ethiopian Birr (At the time of this survey, 1 US Dollar was equivalent to 8.25 Ethiopian Birr) (Eyassu Seifu., 2007). Comparatively, in our study, the sale of milk is done directly to individuals and not to collection organisms, as long as humans suffering from various diseases are ready to pay 400 DZD (Algerian Dinar) per liter that is equivalent to 4.99 USD according to bank conversion rate of July, 1st 2013 (Anonymous, 2013). In this context, the great majority of herders try to convince consumers to buy she-camel milk because of its benefits on human health. The milk of she-camel would possess an antimicrobial effect against GRAM positive and negative bacteria, among these bacteria we find *Escherichia coli*, *Listeria monocytogenes*, *Staphylococcus aureus* and *Salmonella typhimurium* (El- Agamy *et al.*, 1992, Benkerroum *et al.*, 2004). The lactoferrine, which would be present in great quantities in the milk of she-camel, plays a role recognized in the treatment of certain cancers and its anti-tumoral effects were studied in particular at the rat (Jouan P., 2002). Also, it seems that the regular consumption of she-camel milk has a hypoglycemic and regulating action of the glycemia at the insulin-dependent patients (Agrawal *et al.*, 2005b). Besides, the plentiful presence of certain vitamins in the milk of she-camel could give attestation of the pertinence of its effects as a reconstituting substance (Konuspayeva *et al.*, 2004). In the study realized by Eyassu Seifu (2007), the majority of the respondents reported that camel milk is used to treat jaundice, malaria and constipation. Also, according to the Ethiopian pastoralists view, the claimed therapeutic property of camel milk is attributed to the fact that camels browse on various plant species and active agents with therapeutic properties from these plant species are secreted into the milk of camels (Eyassu Seifu., 2007).

Ethiopian pastoralists prefer camel milk to milk of other domestic animals, because cow's milk tends to cause obesity, rather camel milk gives strength, endurance and stamina, an attribute that pastoralists need in order to pursue a nomadic life style. Unlike cow's milk, camel milk has medicinal values and can be used to treat a number of ailments

in human beings. Besides, the pastoralists believe that camel milk keeps for a long time, it has high nutritional value, it contains higher levels of vitamins, it is easier to digest, and it quenches thirsty (Eyassu Seifu., 2007).

The diversity of camel's breeds existing in the region of study (Table 4) allows to profit from specific uses of each breed. The results of a comparative study concerning phenotypic variability of two principal Algerian camel's populations (Targui and Sahraoui) (Figure 2 and 3) reported the existence of subpopulations even within each population. And the discriminant analysis direct us to the parameters related to the uses of these two populations (A. Oulad Belkhir *et al.*, 2013). Regardless the genetic phenotypic variability, the camel's breed Targui (Figure 2) is known to be more adequate to long March and transportation of goods and humans, while camel's breed Sahraoui (Figure 3) is more adapted to milk production, according to Algerian pastoralist society.

The application of bivariate correlation using Pearson test ($p < 0.05$) did not show any correlation between the variable «Number of she-camels per herd» and the variable «Medium daily income of milk per herd (USD)». This could mean that, in addition to the variable «Number of she-camels per herd», one or more other variables interfere to be the cause of variability of daily milk yield from one herd to another and could influence directly the medium daily income of milk per herd. In a comparative study, she-camel milk yield was positively correlated with age and variable according to breed, season and country in African continent (Babiker E. A *et al.*, 2011). Also, pasture floral composition seem to be a limitant factor in milk yield level determination (M Bouallala *et al.*, 2011). According to (Table 6), fodders may have a negligible effect on milk yield, when looking to their limited distributed quantities. Season factor could'nt have an important influence in results of our study, because all herds were visited during winter period. Also, medium age of she-camels in production was comparatively convergent. In our study, only camel's breed and pasture floral composition seem to be a limitant factors causing the observed variability of milk

yield according to geographic localisation of each herd (Table1). This suggests that some existing camel's breeds are more suitable than exotic cattle to give a highest milk yield within harsh climatic conditions coupled with lesser fodders supplies. Despite the main breeds of small ruminants existing in the region of Biskra are naturally resistant to heat stress, they don't exploit very well, as well as exotic cattle, some thorny plants as camels do. This suggests that she-camel is the only creature, existing in the study area, able to have a part or the whole of therapeutic substances contained in some thorny plants in its milk.

Conclusion

Despite relatively high price of she-camel milk, ascending demand of this product is recorded in the region of Biskra. She-camel milk possesses a good reputation among human population as an effective substance against several diseases and with authentic organoleptic and nutritional properties, this fact could encourage camel's young breeders, especially that some therapeutic effects of she-camel milk are proven by science. Only overabundance of camels herds could minimize the prices of she-camel milk to be within reach of all economical classes of consumers.

The region of Biskra is more suitable to dromedary camels breeding than northern governorates, since its steppic lands are rich of various plants favoured by camels. Research studies should be done in the region of Biskra to obtain a statistical determination of she-camel's breeds with highest milk yields and also to allocate the most suitable lands allowing a maximum production of camel herds.

Peri-urban practice of one-humped camels breeding (*Camelus dromedarius*) represents a new option comparatively to climate appropriateness in the region of Biskra, in the opposite of exotic cattle and goats often coming from birth countries characterized with cold weather, so they are exposed to heat stress influencing almost milk production yield. It is also characterized with negligible fodders and stable building costs, in comparison to other ruminants's species.

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