

Milk production and composition of 'Beni Arousse' North Moroccan local goat

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Abstract

The aim of this study was to investigate milk potential of 'Beni Arouss' North Moroccan local goat, under intensive and extensive nutritional regimes. During three years (2011-2013), Milk yield was measured once per month and milk samples were collected during the lactation period. Extensive system was followed in five farms. Feed of this livestock was based on forest resources. Intensive farming system was monitored in experimental field of INRA Centre of Tangier located at Bougdour. Livestock of goat "Beni Arouss" in this farm received in complementation of basic diet (forage "barley or bersim" and oat hay) a commercial compound feed ad-libitum for lactating goats. Studied lactation number was in order of 405 in extensive and 71 in intensive farming system. Milk samples collected were analyzed by infrared using MilkoScan™ Minor to determine fat, protein, lactose and defatted dry extract content. 280 samples of milk in extensive system and 62 in intensive were analyzed. Daily and by lactation milk yield were statistically similar in intensive and extensive systems ($P > 0.05$). Fat content in extensive system was significantly lower than intensive system (2.92% vs 5.21% respectively) ($P < 0.001$). Fat produced by lactation was higher in intensive system (3.21 kg vs 1.65 kg respectively) ($P < 0.001$). Average and by lactation protein content were significantly lower in extensive farms ($P < 0.05$) (3.76% vs 4.25% for average protein content and 2.21 kg vs 2.64 kg for protein per lactation). Lactose content was similar in both systems ($P > 0.05$). Defatted dry average was significantly higher in intensive system (9.54% vs 9.31%) ($P < 0.05$). While defatted dry per lactation was similar in both systems. In conclusion, milk production of local goat "Beni Arouss" is similar in extensive and intensive systems with a high fat, protein and defatted dry content in intensive system.

Keywords: local goat, milk yield, milk composition, production system.

Introduction

Northern Morocco is a goat region, goat population represents 37% of ruminant livestock and contributes to more than 70% in household income (Chentouf *et al.*, 2011). Currently, there are two generation systems in the region, an extensive system based exclusively on sylvopastoral resources which dominates the sector and semi extensive system with dairy production. Actually, northern goat farmers privilege import foreign races or crossing local goats with imported, because these races are characterized by high milk production. But unfortunately, these crossings are uncontrolled which may cause genetic erosion and extinction of local goat population (Nsoso & Morak, 1999). These local breeds are characterized by a good adaptation to harsh climatic conditions, and resistance to local pests and diseases. Therefore, the development of characterization, preservation and improvement program of local goats is necessary.

To contribute to local goats preservation and improvement, this work aims to identify and evaluate performance of dairy goats Beni Arousse North Moroccan local goat, under intensive and extensive nutritional regimes. It aims to generate information needed for the official knowledge of this population as a race like Atlas black, Draa and Barcha and setting up a program for the preservation and improvement.

Material and methods

For three years (2011-2013), a performance monitoring of milk production was installed in 5 herds goats Beni Arousse in the north of Morocco. There was a herd under intensive system while four were conducted under extensive conditions. The herd under intensive system was monitored at the experimental field of INRA - Centre de Tangier, located at latitude 35°66'N and longitude 5°85'W. Livestock of goat "Beni Arouss" in this farm received in complementation of basic diet (forage "barley or bersim" and oat hay) a commercial compound feed ad-libitum for lactating goats. Extensive herds were followed at 4 four farms with local goat population of northern Morocco "Beni Arouss", located in rural commune of Beni Arousse and Tazrout (Province of Larache) (35°29'N and 5°61'W). Feed of this livestock was based on forest resources. Monthly measurements of milk performance were to weigh 24 hours milk production during lactation period estimated at 120 days and to take samples of milk for laboratory analysis. Studied lactation number was in order of 405 in extensive and 71 in intensive farming system. Milk samples collected were analyzed by infrared using MilkoScan™ Minor to determine fat, protein, lactose and defatted dry extract content. 280 samples of milk in extensive system and 62 in intensive were analyzed. Data processing was carried out using table of Excel 2007 and ANOVA with single factor (ANOVA 1) and averages comparison were performed using SAS software 2001 (SAS, 2001).

Results and Discussion

1. Milk production

Daily milk output of north Moroccan local goat "Beni Arouss" was estimated at 516.73 ± 222.45 g / day in intensive farming system and 474.83 ± 174.17 g / day in extensive (Table 1). Increased driving mode does not allowed a significant improvement in milk production ($P < 0.05$). However, milk production level was a subject of great variability between individuals indicating that establishment of breeding program will significantly improve herds productivity. Daily milk production obtained was lower than cited by Hassani (1997) with 630 g / day in extensive system for western rif local population in Beni Idder.

Milk production was about 62.01 ± 26.69 kg / lactation in intensive and 57.26 ± 20.56 kg / lactation in extensive farming system. The estimated milk production per lactation was similar than that recorded by Hassani (1997) with 59 kg / lactation at western rif local population. However, Abader *et al.* (1985) and Balafrej (1999) with northern local population in Chefchaouen recorded 96kg and 100kg respectively that superior to milk production obtained with "Beni Arousse" goat in intensive and extensive systems.

Compared to Moroccan goat races, dairy production of Beni Arousse was lower than Draa (142 Kg; Hossaini-Hilali & Mouslih, 2002), northern Morocco local goat (202 kg; Chentouf *et al.*, 2006) and higher than Atlas Black (46 kg; Hossaini-Hilali & Benlamlh, 1995). As daily milk production, milk production per lactation was not affected by driving mode intensification.

Table 1. Mean values of milk production per day and per lactation period in intensive and extensive system ($n_{extensive} = 405$, $n_{intensive} = 71$)

	Milk production (kg / lactation)	Daily milk production (g / day)
Extensive	57.26±20.56	474.83±174.17
Intensive	62.01±26.69	516.73±222.45
Probability	0.09	0.07
Signification	NS ¹	NS ¹

¹NS : Not significant (P>0.05).

2. Milk composition

Fat and protein content in milk produced in intensive system were significantly higher than milk produced in extensive system respectively 5.21% vs. 2.92 % (P<0.000) and 4.25% vs. 3.76% (P<0.000) (Table 2). These differences allowed a higher fat and protein production in intensive system respectively 3.21kg vs. 1.65 kg (P<0.000) and 2.64kg vs. 2.21kg (P<0.01) (Table 3). This significant difference of fat and protein content between systems was result of feeding livestock. Protein content is favored by energy level from quickly fermentable sugars presence (Fabry, 2006) which explained the high content in goats receiving compound feed in intensive system. While fat is favored by cellulose content (Fabry, 2006). Despite extensive feed was richer in cellulose, fat was less compared to intensive receiving oat hay and forage. Fat content obtained in intensive was higher than that reported for Saanen race (2.7%; Bouloc, 1992), for Alpine milk and average of goat milk respectively 3.43% (Marnet *et al.*, 2005) and 3.8% (Park *et al.*, 2007). Compared to Moroccan goat races, fat content of Beni Arousse milk in intensive system was greater than that reported by Chentouf *et al.* (2006) for local goat in the north (3.3%), than Draa races (4.1%; Hossaini-Hilali & Mouslih, 2002) and Atlas Black (4.2%; Hossaini-Hilali & Benlamlih, 1995). Protein content obtained was higher than those reported for Saanen (2.8%; Weppert & Heyes, 2004), for Alpine (2.4%; Zeng *et al.*, 1997; 3.06%; Marnet *et al.*, 2005) and average of goat (3.4%; Park *et al.*, 2007). Protein content obtained was higher than local goat of north (3.3%; Chentouf *et al.*, 2006), but comparable to Draa (3.7%; Hossaini-Hilali & Mouslih, 2002) and Atlas Black (4%; Hossaini-Hilali & Benlamlih, 1995).

In contrast, lactose content in milk produced was not affected by livestock system intensification. Lactose content in extensive was higher than that reported by Naji (2010) which was 3% while it was lower than Kouniba *et al.* (2007) which was 5% with northern local population in extensive system. The obtained lactose content in "Beni Arousse" goat milk was higher than the Alpine race (4.16%; Zeng *et al.*, 1997), Saanen (4.15%, Trujillo *et al.*, 1997) and the average of goat (4.1%, Park *et al.*, 2007).

A significant difference was observed regarding defatted dry extract content (Table 2) but no difference was recorded for defatted dry extract production per lactation (Table 3). Park *et al.*, (2007) reported lower defatted dry extract content as an average of goat milk (8.9%) than that we obtained.

Table 2. Mean values of composition of intensive and extensive system milk ($n_{extensive} = 280$, $n_{intensive} = 62$)

	Fat (%)	Protein (%)	Lactose (%)	Defatted dry extract (%)
Extensive	2.92 ^b ±1.46	3.76 ^b ±0.66	4.70±0.48	9.31±0.71
Intensive	5.21 ^a ±2.18	4.25 ^a ±0.76	4.57±0.37	9.54±0.72
Probability	0.000	0.000	0.05	0.02
Signification	VHS ³	VHS ³	NS ¹	S ²

^{a,b}: values followed by different letters are statistically different at 5%.

¹NS : not significant (P>0.05)

²S : significant (P<0.05)

³VHS : very highly significant (P<0.001)

Table 3. Mean values of fat, protein, lactose and defatted dry extract production per lactation period in intensive and extensive system ($n_{extensive} = 280$, $n_{intensive} = 62$)

	Fat/Lactation (kg/lactation)	Protein/ Lactation (kg/lactation)	lactose/ Lactation (kg/lactation)	Defatted dry extract / Lactation (kg/lactation)
Extensive	1.65 ^b ±1.02	2.21 ^b ±0.93	2.74±1	5.44±2
Intensive	3.21 ^a ±2.31	2.64 ^a ±1.51	2.69±1.24	5.77±2.93
Probability	0.000	0.006	0.78	0.31
Signification	VHS ³	HS ²	NS ¹	NS ¹

^{a,b}: values followed by different letters are statistically different at 5%.

¹NS : not significant (P>0.05)

²HS : Highly significant.(P<0.05)

³VHS : very highly significant (P<0.001)

Conclusion

Beni Arousse goat present interesting levels of milk production in extensive system based only on pastoral resources. The intensification of driving system improve fat and protein of milk. However, milk production performance is a subject of considerable variability between individuals, indicating that the establishment of a breeding program will significantly and rapidly improve livestock productivity.

References

- Abader M., 1985. Caractérisation de l'élevage caprin dans la province de Chefchaouen performances et système de production. Memory 3th cycle in agronomy, option: animal production. ENA Meknès.
- Balafrej M., 1999. Conduite et productivité des élevages caprins dans la région de chefchaouen. Memory 3th cycle in agronomy, option: animal production. ENA Meknès.
- Bouloc N., 1992. Courbes de lactation des chèvres : quelque élément sur leur forme. La chèvre.193 : 15-17.
- Chentouf M., B.Boulanouar, J.L. Bister & S. Zantar. 2006. Evaluation des performances de production de la chèvre locale du Nord du Maroc. Al Awamia 118/119, 3 :137-153.

- Chentouf M., S. Zantar, M.R. Doukkali, L.B. Farahat, A. Joumaa & H. Aden. 2011. Performances techniques et économique des caprins dans le nord du Maroc. Options méditerranéennes, 100: 151 – 156.
- Fabry L. 2006. Alimentation du bétail et qualité du lait. *3*
- Hassani A., 1997. Impact de l'élevage et des populations sur les ressources naturelles dans le Rif Occidental : Cas de la commune rurale de Béni Idder. Memory 3th cycle in agronomy, option: animal production. ENA Meknès.
- Hossaini-Hilali J. & S. Benlamlih. 1995. La chèvre noire marocaine. Capacités d'adaptation aux conditions arides. Animal Genetic Resources Information 15 : 51-56.
- Hossaini-Hilali J. & Y.Mouslih. 2002. La chèvre Draa. Potentiel de production et caractéristiques d'adaptation aux contraintes de l'environnement aride. Animal Genetic Resources. Food and Agriculture Organization of the United Nations. 32 : 49-56.
- Kouniba A., M. Berrada & A. El Marakchi. 2007. Étude comparative de la composition chimique du lait de chèvre de la race locale Marocaine et la race alpine et évaluation de leur aptitude fromagère. Revue Méd. Vét. 158- 03 : 152-160.
- Marnet P.-G., B. Gomis, J. Guinard-Flament, M. Boutinaud & V. Lollivier. 2005. Effet d'une seule traite par jour (monotraite) sur les performances zootechniques et les caractéristiques physico-chimiques du lait chez les chèvres Alpine à haut potentiel. Renc.Rech, Ruminants. 12 : 225-228.
- Naji M., 2010. Caractérisation génétique de la population caprine « Beni Arouss » de la région Tanger-Tétouan. Memory 3th cycle in agronomy, option: animal production. ENA Meknès.
- Nsoso S.J. & G.T. Morake. 1999. A critical look at the use of exotic bulls and a proposed breeding strategy under traditional farming in Botswana. South African Journal of Animal Science. 29:100-104.
- Park Y.W., M. Juarez, M. Ramosc & G.F.W. Haenlein. 2006. Physico-chemical characteristics of goat and sheep milk. Small Rum. Res. 68:88–113.
- SAS. 2001.SAS user's guide. Statistics (Version 8.01). Cary, NC: SAS Institute, Inc. SAS.
- Trujillo A., B.Guamis & C. Carretero. 1997. Las proteínas mayoritarias de la leche de cabra. Alimentaria. 285: 19-27.
- Weppert M., and J. Hayes.2004. Direct genetic and maternal genetic influences on first lactation production in four breeds of dairy goats. Small Rum. Res. 52:173-178.
- Zeng S., E. Escobar and T. Popham. 1997. Daily variations in somatic cell count, composition, and production of Alpine goat milk. Small Rum. Res. 26 : 253-260.