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Chapter

Economics and Profitability of Goat Breeding in the Maghreb Region

Chniter Mohamed, Amel Dhaoui and Jamel Ben-Nasr

Abstract

This chapter presents a review of the North-African goats, with particular focus on their current state, constraints and research prospects and development. In recent years, goat milk and meat have become acceptable and recognized as the source of healthy nutrient in the Maghreb countries. However, goat populations are generally confronted with severe nutritional deficits during feed scarcity period which exacerbate disease and health troubles and consequently low performances. They are mainly elevated in small herds and their productions are commercialized throughout an informal sector. Thus, if the informal sector is to be convinced to market goats commercially through formal ways, then knowledge of the economics of goat farming should be provided in the Maghreb countries. Under the economics of farming goat, we will investigate the trend in the demand and supply of goat milk or meat, trend in the number of goats slaughtered, and the cost of raising goats in the Maghreb region. We are going to evaluate the economics and profitability of goats as farm animal and their marketing strategies in the Maghreb region.

Keywords: goats, breeding, productivity, marketing, North Africa

1. Introduction

Goat represents an important genetic resource reared worldwide for milk, meat and fibers. Goat herds are maintained under a variety of conditions, mainly in small scale farming systems [1]. Goat breeding farming is mostly described as low-input systems across the world, whether extensive or semi-intensive [2, 3]. In limited resource areas, dairy goats provide sustainable livelihoods and enable smallholders to accumulate assets, besides to their wholesome and nutritious milk-based products. Global dairy goat population was estimated to reach 218 million in 2017 [4]. Asia owns the biggest part of the world population (52%), and then Africa with 39%, Europe with 5%, Americas with 4%, and Oceania with less than 1%. Noting that the world dairy goat population increased by almost 22% from 2007 to 2017, Africa experienced the most rapid increase (+32%), followed by Asia (+19%), and Oceania (+3%), with a slight decline occurred in Europe (−0.9%) and Americas (−0.7%). Goat farming is concentrated in Asia with 58.2% of the world goat population, followed by Africa with 36.1% and finally in the regions of America and Europe, with respectively 3.4% and 1.5% [5].

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Goat milk and its products are preferred for their health and nutritional benefits, including greater digestibility and lipid metabolism, in addition to their taste, compared to cow milk [6]. Following to the growth of its population, global goat milk production increased (+62%) from 1993 to 2013. From 2007 to 2017, goat milk production increased by 16% [4] and reached 18.7 million tons in 2017. The largest increase in goat milk production (22%) is marked in Asia, followed by Africa (13%), Oceania (9%), Americas (5%), and finally Europe (4%) [4]. It was important to remember that Europe contributes with 15% of the total goat milk with only 5% of the population, considering its greater specialization and commercialization [7].

Farming represents the main activity of the North African people where meat was the major food product consumed together with wheat in an indigenous way. The domestic livestock of the North African is mostly beef, sheep, goat, camel, and poultry [8]. Goat is placed among the main popular domestic livestock in North African countries considering its ability to adapt to harsh environments and thrive with minimal food and water input [9]. In North African countries, the genetic diversity and origin of goats have not been properly and fully analyzed, where studies have been limited and little is known about the reared native goat populations [10]. Until now, goat sector is missing references on factors linked with the economics and profitability of its breeding and marketing strategies in the North African North African. In line with the current interest in domestic animals and their farming profitability, the present investigation was carried out to evaluate the economics and profitability of goats as farm animal and their marketing strategies in the Maghreb region.

2. Methodology

An appropriately literature analysis was conducted to assess economics and profitability of goat breeding in the Maghreb region. Papers reporting "Goats Breeding, Productivity, Marketing and North Africa" were mainly considered in our study. Journals in electronic data bases (Elsevier, Pubmed, CABI and Web of science) were consulted for an appropriate bibliography. A Total of 53 suitable references were considered for this chapter and only published ones up to the publication year 1984 were considered.

3. Current state of the North-African goats

Typical Mediterranean climate is the main characteristic of the Maghreb region [11], with a long summer period of intense drought and excessive heat (May to September), followed by irregular rainfall from autumn to spring (October to April). Since the early 1950s, Maghreb countries have experienced a rapid demographic growth following the significant rhythm of urbanization contributing to a marked increase in the demand of dairy products [12]. Maghrebian countries represent a rich potential of goat genetic resource, from which the main African breeds have been derived [13]. In these countries, goat milk is reared mainly for family consumption (liquid milk or white fresh cheese, the Jben) where there is no strong dairy tradition [14]. In marginal areas, the role of goats as mainstream protein sources remains unparalleled owing to their adaptability to harsh conditions and continuous climatic changes, then contributing to both the food and financial security of households, particularly the resource poor [15, 16]. Traditional meat products represent one of the earliest cultural heritages of the Tunisia, Algeria, Libya, Morocco and Egypt [17]. Maghrebian communities are particularly dependent on goat production [18] where the consumption of goat meat fluctuates with

the religious affiliations of the ethnic groups and demand increases during the Muslim holidays. Thus, an important cultural event named "Aïd El-Kebir or Aïd Al-Adha" affects timing and structure of goat movements, and due to the arid and semi-arid climatic conditions, the season can also influence these movement patterns [17, 19]. Maghrebian communities consider meat products as nutrient-rich that promise health and wellness, and serving meat to guests is a sign of respect and a way to honor them [17]. The regional cultural habits vary greatly within the Maghrebian communities, giving rise to different styles of food across Tunisia, Algeria, Libya, Morocco and Egypt. Due to the climate, the meat products prepared are usually dried or cooked and are rarely smoked [17].

4. Algerian goat population

In 2016, Algerian goat population accounts for 4.9 million heads [4]. It is mainly reared under low-input farming systems [20] in the arid and semi-arid regions extending more than 80% of the territory [21]. Algerian goat population is located in difficult areas characterized by an economic activity, mainly mountainous in the north and steppe and sub-desert regions in the south [22]. It is maintained in an extensive mode [23] and includes four native breeds (Arabia occupied the Laghouat region, Mekatia located in the highlands and in some districts of the North, M'Zabia breed located in the northern region of the Sahara, and Dwarf/Naine of Kabylia occupying the mountains of Kabylie: **Figure 1**(**1**, **2**, **3** and **4**).

These adapted goat breeds are focused on mixed breeding choice for meat and milk [24, 25]. Goat native breeds play a major role in valorizing resources available under extensive production systems and marginal area, contributing for environmental and socio-economic stability [25].

Algerian goat population includes also the exotic breeds (Saanen, Alpine, Murcia and Chami) and their crossbreds representing a source of income for about 800.000 small farmers of semi-arid regions. They are keys in livelihoods of less-endowed households, being a source of cash income, milk and meat [5]. The choice of crossbred is due to changing consumer habits, economic expectations of farmers and desire to work with highly productive animals that can respond to the demands of the growing population [26].



Figure 1.
The four Algerian native goats.

The most important of Algerian local goats is Arbia breed reared mainly in steppe zone, semi-steppe areas and in highlands and especially appreciated for its meat production [27]. This is due the capacity of Arbia breed to survive under low input systems and its disease resistance, and its ability to adapt to nutritional fluctuations and environmental conditions [28]. The recent evolution of the price and the nutritional importance of kids' meat cause major change in goat farming [29] contributing to the regression of extensive system. While the demand for goat milk foresees the intensification of breeding system, the diversification of conduct mode and orientation of kids production [20].

5. Moroccan goat population

According to FAO [4], Moroccan goat population currently numbers for 5.23 million head and is composed of resilient local breeds well adapted to local climatic conditions, and is mainly concentrated in difficult and mountainous areas [30]. In Morocco, goat farming represents an input sector of agriculture and its flexible function, regardless its socio-economic importance and dynamic role in the development of economic activity in rural areas. In the north Morocco, goat herd is estimated to be 788,000 [31]. This sector plays an important socio-economic role for the local population providing food and contributing with more than 70% of income in rural mountain communities [32]. Exogenous and heterogeneous goat populations represent the main livestock from the north of Morocco and prove some phonotypical similarity when they were compared to Spanish breeds such as the Murciana-Granadina, the Malagueña or others Andalusian breed [33].

Draa goat (**Figure 2**(**5**)), breed derives its name from an oasis located in the southeast of the country the Draa Valley, is among the indigenous breeds with a satisfactory milk yield of 142 kg in 5 months of lactation, which is its most important feature [34]. Further, the demand for meat from kids is increasing because of its nutritional quality [35].



Figure 2.
The four Moroccan local goats.

The Barcha and Noire de l'Atlas breeds (**Figure 2**(**6** and 7)) are very well adapted to the climatic and edaphic in the Atlas Mountains and conditions of that region. Compared to the Noire de l'Atlas, the Barcha goat is specified by white hairs on its dorsal line, the ears, and the snout. Milk produced by both breeds is exclusively used to suckle kids. The average milk production of these breed is low with an average of 68 kg/head/year and milk contains 16.2% of dry matter, 6.8% of protein and 6.3% of fat concentrations. Laaroussia goat (**Figure 2**(**8**)) is native breed to the north of Morocco that inhabits the western Rif Mountains and reared exclusively to valorize lands of forests. The average milk production of Laaroussia goats averages 53.2 kg during their 120 days of lactation.

The creation of co-operative cheese units and projects of dairy goat development were encouraged in the northern regions by the Moroccan public authorities [14, 36]. Although the success of such projects with the certification of the PGI (Protection Groupe Industriel; "Fromage de Chefchaouen"), some cooperative cheese units have difficulties to increase their productions and develop marketing. Several small units have been created around the Moroccan cities but the specificity of goat milk is not enhanced and cheeses are often made with mixed milks. These initiatives are based on goat milk which seems to have more potentialities than sheep milk. Better control of the technical management of farms, better monitoring of health problems and a good selection of successful broodstocks are necessary to have better productivity of goat farming in the province of Agadir [37].

6. Tunisian goat population

In Tunisia, the goat population has increased by 18.7% from 1997 to 2007, reaching more than 1.5 million heads. The growth of population has been followed by the increase of goat production, where the annual (2007) goat milk production was 12,200 tones and goat meat production 9500 tones (+9.8% and + 12.6%, respectively, in comparison with data of 1997) [4]. Almost (60%) of the Tunisian Arbi goats are located in the Centre and in the South and mainly reared in small herds in extensive mixed systems with sheep. Although these agricultural systems are changing, owing to socio-economic development, maintenance of this farming design is guaranteed by national projects for development of the small ruminant sector [1]. The native goat breed from Tunisia named Arbi, which means local, is well adapted to its natural environment (**Figure 3**).



Figure 3.
The Arbi native goat associated to Barbarine sheep.

The Arbi goat is mainly reared for meat production but also milk is produced only for home consumption. Under semi-arid conditions of the South, milk production measured in the first 6 weeks of lactation for goats suckling single ranged between 1.14 and 0.69 kg/head/day, while goats with twins produced 0.86–1.64 kg/goat/day [38]. In the North, milk production ranged from 1.2 to 0.75 kg/goat/day [39]. The Arbi goat is small-sized, long and haired with a pure black prevailing color. Both sexes are horned and adult body weight varies from 50 to 60 kg for males and from 35 to 40 kg for females [40]. The Arbi goat is long haired and the prevailing color is pure black and is horned; it is small-sized, adult body weight ranges from 35 to 40 kg for females and from 50 to 60 kg for bucks [40].

The breeding season of local goats occurred between September and March [38], where 80% of females exhibited oestrus at least once and 53% of cycles were associated with ovulations. The ovulation rate increased progressively to reach 100% from September to December, and then decreased during March to make a minimum of 14%. This season precedes a period of anoestrus (March–August) [41]. The sexual behavior for the local Tunisian goat is similar compared to that exhibited in the Algerian Bedouin goat characterized by a seasonal anoestrus occurred during spring and summer [42].

In Tunisia, genetic improvement was undertaken through crossbreeding indigenous goat with imported breeds and the results of on station evaluations have shown the superiority of the Alpine and the Damascus breeds in improving indigenous goat milk and meat production, respectively. Nowadays, in some regions (Gabès), the OEP (Office de l'Elevage & des Pâturages, Ministry of Agriculture) makes accessible Alpine and Damascus bucks to farmers in the oasis. Artificial insemination technique is used to disseminate improved germplasm [38].

7. Goat marketing and profitability

The young Maghrebian villagers, often from poor small farms, tend to emigrate in the big cities or in Europe and send money to their parents, than stay breeders when they cannot become artisan or find a rare public opportunity [43]. Consequently, less than 15% of small ruminants feed is from pastoral origin with the abandonment of pastoral practices in Maghreb area [44]. Goats and sheep farming can play a dynamic role in the development of economic activity in these rural areas considering its socio-economic importance for agriculture and its versatile function [45]. Goat contributes significantly to both food and financial security of the resource poor, particularly in marginal environments such as those within the Maghrebian countries.

Goat farming is preferably suited to poor economies as it needs a low capital investment in housing and equipment. Many of goat-farming projects tested were beneficial and provided employment opportunities. Farmers were unable to rear larger ruminants as they involved only held small amounts of land. Goats produce more meat and milk per unit of weight or feed input than sheep, camels or cows and they generate an economically viable option for poor farmers with no resources and for laborers without land [46].

Three criteria were used to categorize the operators in the industrial processors dairy sector in the Maghreb countries; the industrial capacity (quantity of milk processed yearly), the status (personal, private, co-operative) and the type of products they flow (drink milk and/or dairy derivatives). The organic label is also a good way to identify the agro-ecological characteristics of the product. But these characteristics require a very strict records and monitoring. Other proposals could be associated with the tourism in the area with creation of guest ranches or farm house inns, local supermarkets, exhibitions, regional labels [47].

Numerous artisanal dairy units were identified in the Maghreb countries. The aim of these initiatives is not only to characterize the products but also to attract the consumers by their roots in the territory. It means also that these promotions have not to be only a show but to be associated with larger operations and requiring the support of local organizations [48]. For example, GIPLAIT is an old state group managing some 14 units distributed throughout the country considering as the leading public company in Algeria [49]. GIPLAIT mainly operates with imported milk powder and milk fat and is undergoing restructuring with the aim to privatize some of its plants. GIPLAIT supplies the market with almost 70% of the total amounts of subsidized drink milk and 30% of the dairy derivatives, mainly yogurts and cheeses [12].

In Laghouat area of Algeria for example (**Table 1**), goats are mainly elevated for kids selling (90.57%), but some others objectives of production were justified as milk and/or meat for self-consumption, money profits from selling of goats and kids and practice tradition [50].

In Tunisia, a cheese unit nucleus (SOTULAIFROM Company) has been developed around the region of Béja in Tunisia which considered an example among the few cases of sheep milk industry in Northern Africa. After the 90s, the herd of dairy Sicilo-Sarde ewes decreased dramatically, then several projects try to reactivate this action with the creation of a new small scale unit "From art Béja" [47].

In northern Morocco, smallholders initiate to intensify goat production through commercialization of its dairy products, under the encouragement of Moroccan public authorities [51]. However, although dairy production provides an additional rather than alternative income for commercial dairy herds, the requirement to supply supplementary feed resulted in greater costs [51].

In the regions where the forage stock is still high, the lack of collective association and the loss of traditional collective management practices leads to overgrazing stressed by the higher frequency of drought periods due to climate changing [52]. Availability of additional feed restrains reproductive achievement and milk yield which, in turn, limit gross margin and restrict the financial viability of commercial dairy farming in northern Morocco [51]. Otherwise, goat is the only species able to take advantage of the agro-pastoral resources of the argan tree in South-West Morocco [53]. Considering the predicted effects of climate change on pasture areas, the adequate sustainable production way seems an evolution to semi-intensive mixed meat and dairy systems which valorize local alternative feeding resources in northern Morocco. This needs the development of co-operatives highly beneficial with the active support of participatory approach involving stakeholders from all steps in the value chain and. With such ways, low-cost and local alternative feeding can be generated to reduce grazing pressure and increase the goat production performance, generating both food and financial security of the region [51].

Variables	Modalities	Frequencies & citations (%)
Reasons for goat keeping	Milk and/or meat home consumption	58.5
	Cash income	57.5
	Tradition	45.3
	Passion	15.1
	Nursing lambs	4.7
Production objective	Kids	90.6
	Milk	9.4

Table 1.
Purpose and production objective of goat farming.

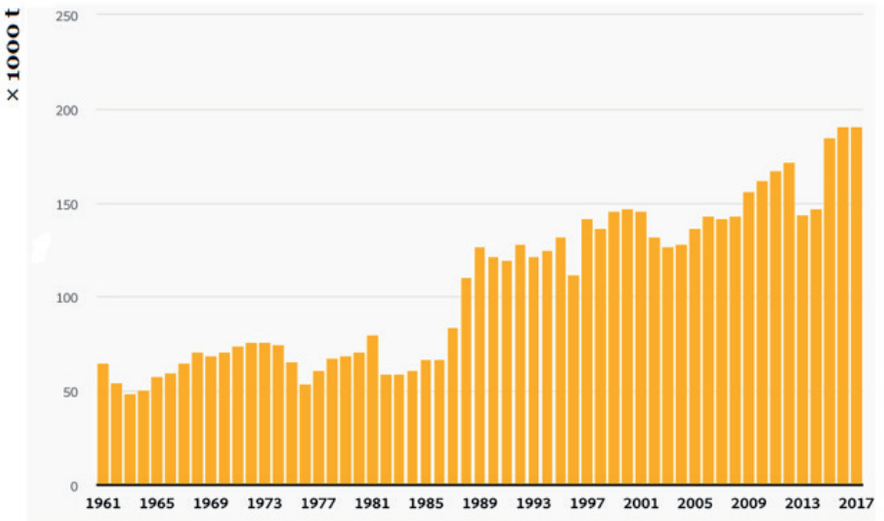


Figure 4.
Sheep and goat meat production in Morocco.

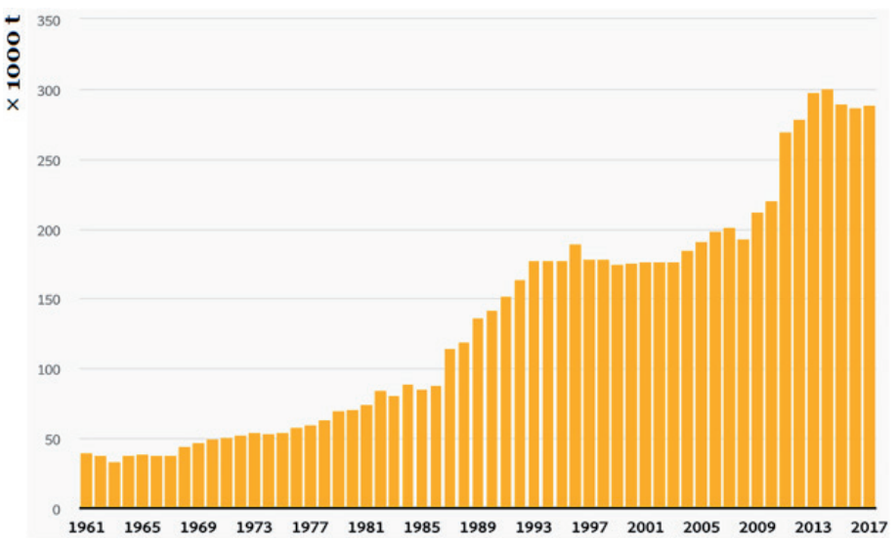


Figure 5.
Sheep and goat meat production in Algeria.

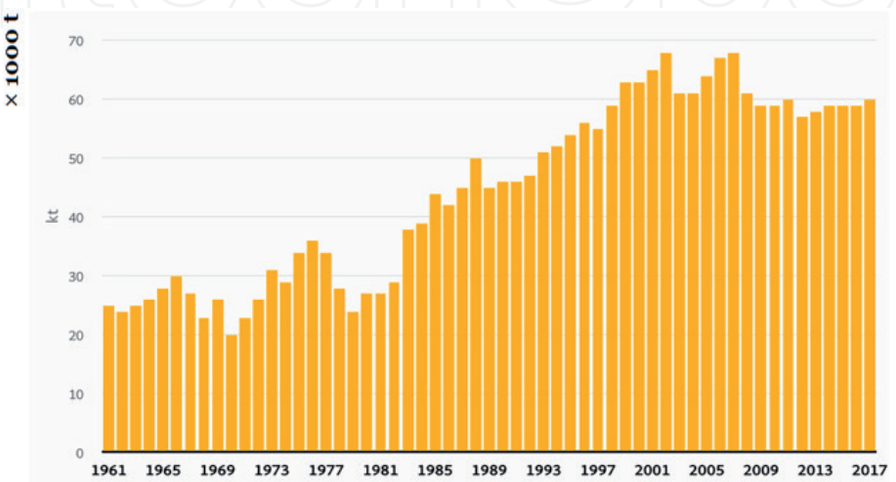


Figure 6.
Sheep and goat meat production in Tunisia.

The assessment of goat performance products is mainly associated with sheep productions. In 2017, indigenous sheep and goat meat productions reached 191, 289 and 60.0 kt respectively, in Morocco, Algeria and Tunisia [54]. Historically, indigenous sheep and goat meat productions reached an all-time high of 191 kt in 2016, 301 kt in 2014 and 68.0 kt in 2002, respectively in Morocco, Algeria and Tunisa. However, these productions reached an all-time low of 49.0 and 34.0 kt in 1963, and 20.0 kt in 1970, respectively in Morocco, Algeria and Tunisa (**Figures 4–6**).

In the Maghreb area, a large number of small agents competing for buying animals from breeders mainly on traditional markets ("souks") characterize the conventional marketing channels and often with low margins (85% of the price paid by the consumer goes to the farmer [44]. This allows the absence of variety of channels and a direct contact between the breeder and the consumer [55].

8. Conclusions

This global overview of goats in the Maghreb region has revealed that their attitudes are nowadays very opened according to each circumstance. For few of them, particularly the intensified systems, to be more sustainable and beneficial on the world market for milk or meat can be an intention. But in most situations, the potential of the goats is related to the perspectives of the neighborhood where they are elevated. In spite of their real resilience, it is likely that situations of rupture in these regions would lead to the decrease of goat population. The agro-ecological and eco-systemic challenges are both opportunities and menaces and their futures will be linked to the prospective capacity of the local actors to join forces and to organize together the transition towards new value chains.

Conflict of interest

None of the authors (M. Chniter, A. Dhaoui and J. Ben-Nasr) have a financial or personal relationship with other parts that could inappropriately influence or bias the chapter entitled "Economics and Profitability of Goat breeding in the Maghreb region".

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