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The productive and reproductive performance of Barka cattle: A review

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Abstract

This review examines the productive and reproductive performance of Barka cattle, also known as Begait, found predominantly in the southwestern lowlands of Eritrea and the northern parts of Ethiopia. The breed, valued for its hardiness and adaptability to harsh climates, is known for high-quality beef, milk production, and draft power. Key parameters assessed include age at first mating, age at first calving, calving interval, services per conception, days open, lactation length, and daily milk yield. Studies indicate variability in performance outcomes across different management systems and regions. For instance, the age at first mating for Barka cattle ranges from 32 to 40 months, while the age at first calving spans from 41 to 50 months. Calving intervals for Barka cattle are reported between 16.6 and 18.4 months, with daily milk yields varying from 2.5 to 6.8 liters depending on feed, breed type, and management practices. This review highlights the need for standardized management and breeding interventions, and breed improvement strategies to optimize the productivity and reproductive efficiency of Barka cattle.

Keywords: Barka cattle, calving interval, milk yield, number of services per conception, productive performance, reproductive performance

Introduction

The Barka breed, alternatively called Begait, is predominantly found in the southwestern lowlands of Eritrea and the northern part of Ethiopia, specifically in the Humera area ^{[27]; [36]}. The specific origin of Barka/Begait cattle is not clearly known. Some believe they originate from Eritrea (Gash-Barka), others from Sudan (Kessela), and yet others suggest a dual origin in both Eritrea and Sudan. ^[12] reported that most farmers lacked knowledge regarding the origin of Barka cattle, with some believing they originated from the highlands of Eritrea and later spread to the northern part of Ethiopia, while others thought they came from Sudan. ^[40] also indicated that the origin of Barka cattle is believed to be the lowlands of Eritrea and Sudan. Additionally, ^[36] stated that their origin can be traced to the southwest region of Eritrea, specifically the Gash-Barka region.

In Eritrea, Barka cattle are traditionally herded in large numbers by pastoral and agro-pastoral communities in the vast open rangelands of the northern and southwestern lowland zones. The Eritrean herders move from place to place in search of water and pasture within these zones and sometimes as far as the Republic of Sudan and Ethiopia. However, before the eruption of the 1998 war with Ethiopia, due to continuous migration and crossbreeding for security reasons, the Barka breed became highly exposed to genetic adulteration and extinction. Consequently, it has become one of the four major breeds found in Ethiopia ^[24].

This breed is renowned for its high-quality beef, milk production, and draft power. Barka cattle have large, well-developed, yet pendulous udders ^[36]. Known for their hardiness and high milk production, they produce an average of 6 liters of milk per day from normal grazing forage, and approximately 9 to 10 liters during the initial stages of cross-breeding with improved dairy bulls. When kept in well-nourished dairy herds and crossbred with improved dairy cattle breeds, they can yield 10 to 16 liters of milk per day ^{[18]; [36]}. These cattle are well adapted to the hot and dry climate of the area where they are raised and serve multiple purposes in farming societies, including providing food, draft power, income, and other services.

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Performance of cows refers to how well cows function or operate in various aspects, often evaluated in the context of agricultural or livestock management. Productive and reproductive traits and performance are key determinants of the profitability of dairy production [19, 21, 23]. Reproductive performance is a major determinant of biological and economic efficiency in livestock production in the tropics [19]. High reproductive efficiency is essential for efficient milk production and significantly influences herd profitability [12], [32]. Improved reproductive performance is crucial not only for enhanced milk production but also for better genetic progress [1].

Information on productive and reproductive performance, along with interacting factors, is of paramount importance to livestock owners, extension agents, veterinarians, and researchers. Such information assists in developing strategies and prioritizing intervention options for performance improvement. However, there is a lack of information regarding the productive and reproductive performance of Barka dairy cows in subsistence smallholder dairy farms in the tropics and the factors affecting these parameters. Therefore, this review aims to assess the status of reproductive and productive performance of Barka dairy cows to obtain baseline information and to understand the breed's potential, which will aid in designing future management and breed improvement strategies.

Reproductive performance

Reproductive performance is a significant concern within the modern dairy industry worldwide, playing a crucial role in dairy cattle farming and serving as a major determinant of biological and economic efficiency in livestock production, particularly in tropical regions [34]. When evaluating the strengths and weaknesses of breeds within specific production environments, reproductive performance stands as an important criterion [5]. The impact of reproductive traits on profitability is three to nine times greater than that of other production traits [31]. Reproductive inefficiency leads to extended calving intervals, increased rates of involuntary culling, reduced milk production, delayed genetic progress, and various other issues, resulting in significant economic losses [30].

The better-managed and well-fed heifers grew faster, served earlier and resulted in more milk and calves produced during the lifetime of the animal [12]. The reproductive performance of the breeding female is probably the single most important factor that is a prerequisite for sustainable dairy production system and influencing the productivity [2]. The key indicators considered in evaluating reproductive performance include age at first calving, calving interval, days open, and the number of services before conception [3].

A summary of the reproductive performance of the Barka dairy cattle is presented in Table 1. The reproductive measures considered include the following five factors of i. age at first mating; ii. age at first calving; iii. calving interval; iv. number of services per conception and v. days open. These are considered and briefly discussed.

Age at first mating

Age at first mating (AFM) is the age at which heifers attain the body condition and sexual maturity necessary to accept service for the first time [16]. AFM marks the beginning of the heifer's reproductive and productive life, directly influencing her lifetime calf crop and milk production, and indirectly affecting the costs invested in her upbringing [38].

The age at first mating (AFM) for Barka cattle varies across studies and management systems [19]. Reported an AFM of 32.32 ± 1.9 months, while [14] recorded 36.48 ± 0.09 months. In investor-managed systems [26], found an AFM of 34.8 ± 0.7 months, compared to 38.4 ± 0.6 months in smallholder systems. [12] reported an average AFM of 35.52 months, and [13] observed 39.96 months. These variations in AFM are likely due to differences in feed supply and management practices across regions [11].

Age at first calving

Age at first calving (AFC) defined as the period between birth and first calving, is a crucial factor contributing to economic returns and is partially determined by farmer policies [35]. It is recommended that heifers calve between 23 and 25 months of age, an optimum range that enhances dairy business profitability [17]. The AFC for local breeds being 3 years and 2 years in cross breed cattle is desirable for dairy farming [22]. The AFC directly influences the reproductive and productive life of the female through its effect on her lifetime calf crop and milk production, the costs invested and the magnitude of genetic progress [17, 37]. Delayed sexual maturity in dairy cows leads to economic loss due to an additional, non-lactating, unproductive period of the cow over several months [29].

The age at first calving for Barka cattle shows variation. [19] reported an age of 41.66 ± 2 months, while [12] found it to be 48.7 months, and [13] recorded 50.8 months. In the investor-managed system [26], reported an age of 46.8 ± 0.7 months, compared to 50.4 ± 0.6 months in the smallholder system. Delays in puberty and fertility can be attributed to factors such as poor nutrition, insufficient reproductive management (including accurate heat detection and timely insemination), and varying agro-ecological conditions.

Calving interval

The calving interval (CI) is the period between two consecutive parturitions and ideally should be 12 to 13 months [37]. This interval is also determined by the days open (the period from calving to the next conception) and gestation length. Consequently, the calving interval aligns closely with the annual production cycle and significantly affects the amount of milk a cow can produce within a given period [29]. A CI of 365 days is generally considered optimal for profitable milk production. Longer calving intervals reduce the total number of calvings in a cow's lifetime and consequently decrease her total lifetime milk production. Milk production levels and lactation persistency are crucial factors influencing the appropriate calving interval [4].

The calving interval (CI) for Barka cattle, [19] reported a CI of 16.6 ± 2.24 months, while [14] found it to be 17.4 ± 0.12 months, and [12] recorded an average CI of 17.06 months. [13] observed a slightly longer CI of 18.4 months. These differences in CI may be attributed to both genetic factors and management practices, including the cow's age and breed, calving season, and forage availability [6].

Number of services per conception

According to [16], the number of services per conception (NSC) refers to the number of mating attempts, either natural or artificial, required for successful conception. The number of services per conception is a critical reproductive trait, essential for determining the profitability of dairy production [34]. An NSC value higher than 2 is considered suboptimal [29]. Variations in NSC can be attributed to differences in

management practices and the agro-ecological conditions of specific areas [22]. Effective and timely heat detection and insemination practices can lead to variations in the number of services per conception [39]. The NSC for Barka cattle was 1.62 ± 0.6 [19].

Days open

Days open (DO) refers to the interval from calving to conception. According to [11] and [35] cited by [8], a herd average of less than 85 open days indicates that cows are being bred early, while 85 to 115 days is considered optimal for a dairy herd. An interval of 116 to 130 days suggests a slight problem, 131 to 145 days indicates moderate issues, and more than 145 open days is considered a severe reproductive problem in the dairy herd.

Days open (DO) for Barka cattle were reported to be 90.5 ± 16.5 days [19]. In an investor management system, DO extended to 182 ± 38 days, while smallholder-managed cattle had a DO of 229 ± 36 days [26]. Contributing factors to extended DO include feed shortages, silent estrus, and inadequate heat detection [22].

Table 1: Reproductive performance of Barka dairy cattle

Parameters	Barka cattle value(s)	Source(s)
Age at first mating (month)	32.32 ± 1.93	[19]
	35.08 ± 0.99	[12]
	40 ± 0.4	[13]
	37.2 ± 0.6	[26]
	36.48 ± 0.09	[14]
Age at first calving (month)	41.66 ± 2.0	[19]
	48.04 ± 1.3	[12]
	50.8 ± 0.5	[13]
	49.2 ± 0.6	[26]
Calving interval (month)	16.6 ± 2.24	[18]
	17.10 ± 1.05	[12]
	18.4 ± 0.2	[13]
	17.4 ± 0.12	[14]
Number of services per conception	1.62 ± 0.6	[19]
Days open (days)	90.5 ± 16.5	[19]
	205.5 ± 37	[26]

Productive performance

The productivity of an individual cow encompasses the combined value of her milk production, offspring, and individual market worth upon leaving the herd. Numerous factors impact the productivity of each cow, which also relies on longevity and the proportion of time spent producing milk over her lifetime [9]. In developing countries, animals often exhibit lower milk yields and shorter lactation periods. The performance of livestock in small-scale dairy systems within these countries can be attributed to various factors, such as unfavorable climate conditions (high ambient temperature, humidity), low-quality feed, inadequate concentrate supplementation, limited genetic potential for milk production in multi-purpose animals (which often serve as a source of both milk and meat as well as provide draught power), and a high incidence of diseases [10]. The severity of these challenges is more pronounced in developing nations [20] due to a lack of technical resources, financial constraints for cattle genetic improvement, insufficient nutritional quality of feeds, and the persistence of major diseases [20]. Productive performance of cows is measured by daily and lactation milk yield and is dependent on the animal genetics [30], [39]. The productive measurements are presented in Table 2. These parameters basically include lactation length and daily milk yield which are important for dairy cows.

Lactation Length

Lactation length (LL) is the period of milk secretion. In most dairy farms, a lactation length of 305 days is commonly accepted as standard. However, such a standard lactation length LL might not be applicable for smallholder dairy cows, where the lactation length LL is often extended considerably [28]. As noted by [33], lactation length LL has a genetic basis and is a major limiting factor for milk production in the tropics. Genetic group and parity have a significant effect on LL lactation length [6], [22]. The profitability of short or extended lactation lengths LL depends on the additional days cows are not pregnant beyond the optimal time post-calving, which can be costly [25].

The mean lactation length (LL) for Barka cattle was reported as 250 ± 26.8 days [19]. [12] recorded an LL of 6.38 months, while [14] found it to be 5.64 ± 0.16 months. [26] provided detailed data: under investor management, LL was 5.3 ± 0.5 months for older cows and 5.7 ± 0.6 months for randomly selected cows, while under smallholder management, LL was 6.3 ± 1.0 months for older cows and 6.6 ± 0.9 months for randomly selected cows. At Humera Agricultural Research Center (HuARC), LL for Barka cows was seven months, and [13] reported a LL of 5.39 months for the breed.

Daily milk yield

The mean daily milk yield (DMY) for Barka cattle has been reported to vary widely. [12] recorded a DMY of 2.52 liters, while [14] reported 3.48 ± 0.27 liters. [15] found an on-station DMY of 4.31 liters cited by [7], and [26] noted an average DMY of 6.8 liters per cow at HuARC. [13] reported a DMY of 2.49 liters with a peak yield of 3.21 liters, and [36] observed an average yield ranging between 6 and 8 liters. The lactation milk yield (LMY) was reported as 459 liters [13]. Variations in LMY are attributed to both genetic and non-genetic factors, including genetic group, herd size, calving season, and parity [6], [13].

Table 2: Productive performance of Barka dairy cattle

Parameters	Barka cattle value(s)	Source(s)
Lactation lengths (month)	250 ± 26.80	[19]
	6.40 ± 0.27	[12]
	5.39 ± 0.1	[13]
	6.25 ± 0.95	[26]
	5.64 ± 0.16	[14]
Daily milk yield (liters)	2.52 ± 0.31	[12]
	2.49 ± 0.1	[13]
	2.7 ± 0.35	[26]
	3.48 ± 0.27	[14]

Conclusion

1. The reproductive and productive performance of Barka cattle shows variability across different studies. These results highlight the need for improved management and breeding practices to optimize productivity and reduce reproductive inefficiencies in Barka cattle.
2. Targeted research and breeding programs aimed at reducing calving intervals, improving lactation yields, and enhancing overall reproductive performance could significantly improve the economic and productive outcomes for farmers relying on Barka cattle.
3. Furthermore, developing breed-specific improvement strategies adapted to local ecological and management conditions is essential for the sustainable advancement of Barka cattle productivity in which they are raised.

Declaration

The authors declare no conflict and agree that the manuscript be submitted for publication.

Conflict of Interest

Not available

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