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Review Article

Potentials of Camelids and its Challenges to Genetic Improvement

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Abstract

Camel is an important livestock species that are uniquely adapted to hot arid environment. Adaptation to harsh weather is vital for future livestock as heat stress can extremely reduce their productivity, health and fertility. With increasing human population pressure and declining per capita production of food in Africa, there is an urgent need to develop previously marginal resources, such as the semi-arid and arid rangelands, and to optimize their utilization through appropriate livestock production systems of which camel production is certainly the most suitable one. Camel produce quality and nutritive product such as; milk, meat and fiber and most of the management system practice in camel production are under traditional system by traditional pastoralist, nomads and semi-intensively by agro-pastoralist in arid and semi-arid lands. The system is dominated by low production, capital, seasonal trans-migratory, shortage of feed and water. Despite the potential of camel in production of nutritive and quality product of dairy and beef, they need to under goes genetic improvement using modern method and tools. Small herd size and scattered population is a challenge facing the genetic improvement of camel by making it difficult to collect phenotypic data, this creates an obstacle in camel breeding programs.

Keywords: Camel; Genetic Resources; Milk; Beef and Diversity

Introduction

Camel production serves as the basis of livelihood of millions households across Africa, the Middle East, and Asia [1]. It is important livestock species uniquely adapted to hot arid environments. Among the large camelids, dromedary comprises of about 95% of camel population [2]. Ecologically, arid and semiarid environment accounts for 60% of the total land mass, 20 percent of total livestock, and 11 percent of human population [3]. Adaptation to a hotter climate is vital for future livestock as heat stress can extremely reduce their productivity, health, and fertility [4]. Camels have developed, through millennia, the ability to produce quality meat, milk, and fiber in some of the hottest and most hostile environments in the globe [5]. With increasing human population pressure and declining per capita production of food in Africa, there is an urgent need to develop previously marginal resources, such as the semi-arid and arid rangelands, and to optimize their utilization through appropriate livestock production systems of which camel production is certainly the most suitable one [6]. Camels are remarkable animals that have evolved with a ruminant like digestive system to enable them to survive on low quality and fibrous feeds, being browsers, are able to select high quality diets, that can efficiently digest and are capable of utilizing marginal areas, because they can survive under harsh environmental conditions and provide important sources of subsistence and income [7-9], Camels are true browsers and browse on plant species grown in those areas, which are suitable as camels' feed, whereby camel produce meat and milk after optimum utilization of the browses. To harness their potential of camel production, an improved understanding of

the genetics underlying their unique genetic resources is needed. The lagging effort that has come to be associated with camel breeding as a backward activity has to be removed [10].

Management system of camel

Traditional system of management were practiced by majority of pastoralist in the arid and semi-arid lands (ASALs). According to Wilson [10], single humped camel own by pastoralist are primarily depended on animal for transportation and supply of food. Camel are also considered as multipurpose animal in some areas with versatility in socio-economic activities, racing, as draught animal and trading [11,12]. Majority of the traditional system of camel production practiced by pastoralist do not in many ways contribute to the development of herds in areas of camel improvement [13]. The traditional system of camel production under pastoral system is mainly practiced by subsistence pastoralist and the system is dominated by low production, capital, seasonal trans-migratory, inadequate/shortage of feed and water [14]. Camel production systems may be nomadic, transhumant and sedentary depending on the region, geographical and natural setting [15]. Camels have contributed to the reduction of vegetation not only due to the increase in sheer numbers but also because they can browse and graze on a wide range of plants that are avoided by or are inaccessible to other livestock such as thorny bushes [16,17].

Economic Importance of Camel

The camel has been an important livestock for sustaining the livelihood of impoverish and subsistence pastoralist in the desert area due to its varietal uses. [18], the dependence of human beings on this animal is not just for, meat, milk and hide rather it is the vital source of transportation in desert. In desert area camel are the most suited and produce better than the small ruminant and cattle for animal husbandry [19]. The genetic resources of camel is not only adaptation to harsh environments, they are multipurpose animals used for milk and meat production, hair/felt, racing, transportation, and tourism [5]. Moreover, camels' milk and meat are highly nutritional and are comparable and sometimes deemed better than cattle beef and milk. For instance, camel meat contains less fat than lamb or beef and its protein quality, assessed by the index of essential amino acids in meat, is the highest among red meat, its milk contains between 3 and 10 times more vitamin C than cows' milk [20-22]. Camel produce meat and milk after optimum utilization of the browses [9]. The natural ability of the camel to produce milk, meat, fiber, hide and energy and its contribution to pastoralist livelihood can be improved from perspectives of productivity enhancement, value addition, market access, and institutional support [1].

Milk production

Milk is often the most important camel product and is the staple food of nomads when move in search of pasture. They can live for up to a month in the desert on nothing but camel milk. [23], reported that the demand for camel milk have increased both locally (in arid regions) and internationally with products varying from milk and its derivatives. Thus, a number of camel intensive dairy farms have been established worldwide and are currently supplying local and international markets. Camel milk contains more nutrients than cows' milk and it also contains lower β-casein and β-lactoglobulin which results to its hypo-allergic property [22]. According to FAO (2003), the total milk production from camel in the world is increased from 4.8 to 5.1 million tons during the period of 1993- 2002 [24-26]. Camels can produce more milk from poor feed than any other dairy species, 5 liters a day is considered a decent yield.

Meat production

Camel meat is highly nutritional and it can be compared with or sometimes deemed better than cattle beef. Camel meat contains less fat than lamb or beef and its protein quality assessed by the index of essential amino acids in meat is the highest among red meat [20,21]. The annual camel meat produced in Pakistan is 50,000 tons valued at Rs. 250 million [27]. It is a well-known fact that wealthy Islamic people slaughter camel during notable festivals and eat the meat. Many now raise camels for their sacrificial slaughter during some of the notable Islamic festivals. In most countries the camel meat is usually the small amount of meat consumed compared to the meat of other animals like cattle, sheep, goat, pig, etc. [28].

Transportation

The ability of camel to endure and conserved water, makes it the most suitable means of transport in the desert area. According to [19], camels are engaged in transport of salt, fuel wood, and agricultural produce. The work of [11] in Northern Nigeria suggested that camels are used in transporting of household goods by pastoralists during migration and in the remotest areas of extreme North during hot dry season. The author further stressed that camels can respond to the burden of transportation than cattle and donkeys.

Hide and hair

The Bactrian Camels hide is said to be of high economic importance as it has good export value than that of the Dromedary. The Dromedary hide is not of good quality, it can only be used for other products such as whips, container for milk and water. Hair is an important resource from camel which is used for making ropes, bags, mats, carpets blankets etc. About 1 to 3 kg of hair is produced from a camel annually [27].

Potential of camel to genetic improvement

A several species of livestock have undergoes genetic improvement of production traits which reshaped the livestock industry such as; cattle, sheep and goat while camel is left behind in genetic improvement despite it is potential in contributing to the livelihood of the society with it is product such as; milk, meat and hide and skin. [5], to utilize camels' potential, they need to undergo genetic improvement while sustaining their genetic diversity. Biochemical and DNA markers which are used in genetic characterization, targeting camel for genetic improvement have been attempted in few countries and genetic improvement in camel are so limited [1]. Through multi-traits genetic improvement program, several production traits; milk, meat and hide and skin can be improved, health traits in terms of resistance to diseases and other commercial traits e.g., racing ability, beauty and ease/suitability in machine milking can also be improved [16,29].

[30], the presence of different camel populations in morphology, productive and adaptive characters may provide a basis for selection and improvement. However, among the few studies that have been carried out indicated that camels have a high genetic variability which is due to the lack of selection and the current and historical movements of camels between countries for trade and sometimes war [31-33]. This variability was reflected in the heritability of various traits, which is an indicative of the potential for ample genetic gain if systematic selection is to be implemented. For instance, [34], recorded heritability estimates for milk yield at 305 days and test day yields were 0.24 and 0.22, respectively and direct heritability estimates of 0.37, 0.50, 0.60, and 0.85 for body weights at birth, 3, 6, and 12 months of age, respectively, and 0.25, 0.37, 0.49, and 0.29 for average daily gain (ADG) 0 3, 3-6, 6-12, and 0-12 months, respectively while [35] also reported heritability estimates of body weight and growth rates were moderate to high, 0.24-0.40, respectively. Through selection the respective traits can be improved due to its heritability estimated from different studies.

Genetic improvement in camel can be strive using various methods such as; quantitative and molecular genetics to tap the untapped genetic resources of camel.

Challenges of camel to genetic improvement

Comparatively less attention has been paid to camels compared to other livestock species, despite its unique potential and increased contribution to food security [36]. International Camel Consortium for Genetic Improvement and Conservation (ICCGIC) initiative there are relatively few published studies in the area of camel genetics and genomics albeit ongoing research efforts [37-39]. Most camels do not possess unique identification number which hampers pedigree recording, good farm management, and performance recording [40]. Most of the camel populations are still under traditional farming systems, although there is a gradual urbanization of some of the pastoral camel populations [36]. Difficulty in disseminating superior genetics due to the difficulty of performing Artificial Insemination (AI) is another challenge facing the genetic improvement in camels [5], due to primarily, to the difficulty in semen collection and handling (due to the gelatinous nature of seminal plasma), deep freezing of camel semen has proved to be highly a challenge. [41], different buffers and diluents as mediums for freezing camel semen have been tried by different research group. Genomics and phenotypes are still very important and the availability of accurate and well defined phenotypes to be used in genetic studies and evaluation programs is imperative [42].

Furthermore, most of the countries harboring the camel population are in different development stages pertaining to agriculture and infrastructure development. Thus, creation of intensive or camel dairy or beef industries requires immense infrastructure investments, support and coordination between all stakeholders all of which are challenging [5]. Small herd size and scattered population is another challenge facing the genetic improvement of camel by making it difficult to collect phenotypic data. Moreover, phenotypic recording is seldom practiced in camel populations except in intensive dairy farms, research, or racing which creates an obstacle for genetic improvement programs and would require a serious collaboration of owners and stakeholders to circumvent. If camel breeds are sometimes described at a national level, as for example in Saudi Arabia, Tunisia or Algeria [43-45], there is no standardization of the traits and parameters to be systematically recorded. Above all these are some of the challenges faced by camel genetic improvement which hindered its potential unlike other livestock species.

The way forward to strengthen camel genetic improvement

Camel has a wide range of potential that have been underutilized and lag behind, despite its contribution to the livelihood of many nomads, pastoralist and agro-pastoralist and this is due to the economic, political, technical and logistics and these challenges are not overwhelmed, much consideration would be given to exploits the potential of camel in terms of genetic improvement. To strengthen the potential of this exceptional animal to genetic improvement, some of the following should be considered.

- The need for government intervention at national and international level in order to provide systematic census of camel population, need to be undertaken for proper and accurate planning.

- The need for scientist to develop research interest in exploiting the potential of camel by conducting an experiment in different aspect of camel and its specialization, which would lead to the more sustainable livelihood of the nomads and pastoralist in the arid and semi-arid land.
- Creation of forum for camel pastoralist, agro-pastoralist and nomads for ease raising awareness and also there engagement to various activities that lead to the improvement of genetic resources of camel in areas of meat, milk, transportation and racing ability as it entails
- Breeding practices should be modernized and improved by using modern tools and technique such as quantitative and molecular aspect to show variation within and between camel breeds. Breeding management would be achieved with proper record keeping and pastoralist should be encourage to developed simplified means of recording
- Finally, the need for funding, supporting networking among researchers, teachers, extensionists, veterinarians, agronomists and other professionals, producers, administrators, market people and the whole range of stakeholders should enhance attention towards these camelid species and improve the chances of directing research more efficiently.

Conclusion

Camel have a wide range of potential that is underutilized due to some challenges it faced and camel stands out with qualities that can withstand all those challenges of the current global warming, desert encroachment and also give a firm resistance to many of the environmental conditions and still be productive with little management require from nomads and pastoralist unlike other livestock. Genetic improvement is promising in camel in order to exploit the potential it possess, but need collaboration of all the stakeholders involved with common interest to exploit the potential this exceptional species.

Conflict of Interest

Authors have no conflict of interest.

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