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Growth Assessment in Camel (*Camelus dromedarius*): A Meta-Analysis Study

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ABSTRACT

In domestic animals, the body weight is the ultimate result of growth which forms the basis of meat production. Sex, nutrition, breed and health are the main factors which influence the growth rate in animals. Heredity which is the major factor affecting the prenatal growth either directly through the genotype of the fetus or indirectly through the genotype of the dam. The prenatal growth patterns and development of the camel fetus is just like the fetus of cattle, however, the meat output from the breeding she-camels is limited often due to longer gestation periods, longer milk feeding periods, lower calving rates under traditional management system. A lot of variation regarding camelid daily growth rate exists that varies widely between breeds, within breeds and regions. There is a significant effect of pre-weaning and post-weaning growth rates on the final body weights in camelids. Management system, the available milk quantity, husbandry practices and vegetative conditions are the main factors that affect the pre and post weaning growth rates of camel calves. However, it is partially dependent on the availability of browsing species throughout the whole year. In this specific study, an effort has been drawn to look into the literature data for camel growth assessment.

1. Introduction

Exploding population has challenged the available food resources; exploration of new resource eras is need of hour to combat the situation. The camel has extreme importance in this regard as it supplements the food chain by providing valuable products like meat and milk. Camel is the key source of subsistence and income for the pastoral

community in many areas of the world. The dromedary camel is a best source of meat and milk especially for the areas where production performance of other domestic animals is adversely affected by the harsh climatic conditions^[1].

The unique physiological characteristics of camel enable him to tolerate extreme temperatures, radiations, feed and water scarcity and rough topography^[2]. Camel has no

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competition with any domestic specie regarding feed and performance due to its specific attributes; they can browse that feed material which is beyond the approach of other livestock species [3]. Even can browse prickly plants, salty and thorny bushes because of having special mouth structure. In the absence of quality forages, camel can utilize poor quality forages with much more efficiency as it can retain fiber in its fore stomach for as long as 70 hours. In contrast with other ruminants, when it is fed with low protein forage it has the capacity and efficiency of reutilizing the urea for microbial protein synthesis [4]. Due to these attributes; camel is considered as the animal with unfathomed potential to meet the future dietary and medical needs of human beings [5].

Mainly there are two types of camels, 1- Single humped (*Camelus dromedarius*) or Arabian and 2-Double humped (*Camelus bactrianus*) or Bactrian. There are 35 million camels in the world while Pakistan ranks 8th with 1.1 million camels [6,7]. One humped camel is 95% of total camel population while Sudan and Somalia contribute 50% of the world's dromedary population. About 70% dromedary population of Asia is present in India and Pakistan. More than 40% of Pakistani camel population is available in Balochistan, 30% in Sindh, 22% in Punjab and 7% in Khyber Pakhtun Khwa province [8].

In arid areas camels constitute the most important source of meat [9]. Mostly they are raised under traditional management systems as pastoralists are moving always in search of food and water over large areas for their camels [10]. Camel is an indigenous genetic resource; it needs to be managed and preserved properly. It plays an indispensable role in the pastoral ecology [11]. Different studies highlight its unique characteristics especially under stress environment [4,5,9,10]. To meet the rapidly growing demands of exceeding population, the strategic idea is to minimize the dependence on external food supply. There is need to recognize the place of camel in farm animals and to get increased output from indigenous natural resources that have not been exploited yet [12-14].

Objective of Study

This paper will illuminate the importance of camel and focus growth at different stages like birth weight, daily weight gain (growth rate) and live weights in dromedary camels.

Methodology of Study

The main methodology of approach was a desk review of literature on camel growth, regarding birth weight, growth rate and live weight.

2. Birth Weight

Various factors like sex of calves, nutrition of dam,

breed of sire and dam and health influence the birth weight in camels [15,16]. Among all these, major factor is heredity which affects the prenatal growth either directly through the genotype of the fetus or indirectly through the dam. The prenatal growth patterns and development of the camel fetus is just like the fetus of cattle. The meat output from the breeding she-camels is limited often due to longer gestation periods (13 months) and the she-camel often bears single calf and rarely a twin. The ambulation time of new born camelid is very short and the calf walks within short periods (hours) after birth but remains very close to its mother until maturity as long as five years of age [15]. The range for birth weights in dromedary calves was reported between 27 and 39 kg and it is comparable than that of tropical cattle breeds. [16] reported the average birth weight of dromedary camel as 35 kg and it varies between breeds, regions and even in animals within the breed. The reported birth weights were to be, 26-28 kg in Somali and Tunisian camel calves [17-20] and 39 kg in Indian dromedary calves [21] and there is a minimum influence of sex on birth weight in dromedaries [19]. Weaning weights are very important factor in the growth rate of camels, after weaning the calves were fattened and achieved the highest weight gains at higher protein and energy regimes [25]. The birth weight and growth rate of Pakistani camel calves are summarized in Table 1.

Table 1. Birth weight and growth rate (kg) in Pakistani camel calves

Source	Camel calves	Birth Weight	Daily weight Gain
[22]	♂ calves	-	1.4
	♀ calves	-	0.95
[23]	♂ calves	-	1.5
	♀ calves	-	1.0
[24]	BLPRI Institute calves	-	0.75
	Private farmer's calves	-	0.82
[25]	♂ calves (IMS)	42	0.67
	♀ calves (IMS)	40	0.65
	♂ calves (IMS, fed with 18% CP)	42	0.95
	♀ calves (IMS, fed with 22% CP)	40	1.0
	♂ calves (SIMS)	42	0.42
	♀ calves (SIMS)	40	0.38
	♂ calves (EMS)	38	0.54
	♀ calves (EMS)	32	0.46

BLPRI: Barani Livestock Production Research Institute Kheri Murat; IMS: Intensive Management System; SIMS: Semi-intensive Management System; EMS: Extensive Management System



Figure 1. Marecha camel calves at CBRS

3. Growth Rate

^[18] reported 580 gm daily growth rate between birth to 90 days age. Reported growth rate was to be 733 gm/d from birth to 180 days in Indian dromedary camels ^[26]. These reported values are slightly lower than that of commonly reported rates of cattle but it is really known that camels are normally raised under extensive system of management where their dependence is on rangeland grazing rather than a feedlot. There is limited work on dromedary camel's nutrition that demonstrates a significant relationship between daily intake of concentrates and daily gain. ^[27] reported a daily growth rate of 260 gm/d in camels fed only on mangroves and 550 gm/d in camels fed on high dietary protein and energy diet. Reported daily weight gain was 400 gm/d and 720 gm/d in Bikaneri camels between 0-1-year age and 7-8-year age, respectively ^[28].

Dry and wet season have a definite impact on growth rates, in Kenya the calves under traditional management system gained 222 gm/d up to 6 months age in dry season and 655 gm/d in wet season ^[17]. The intrinsic ability of growth is mainly governed by genetics but supplemented with proper management and nutrition ^[15-17]. Average daily growth rates of camel calves were reported to range between 0.72-0.86 kg affected by high ambient temperature and restricted milk feeding that can slow this rate ^[29]. In Kenya, the weight gain in calves was 0.41 kg/d in males and 0.38 kg/d in females while weight gain after the sexual maturity was 0.12 kg/d in males and 0.06 kg/d in females. Moreover, after reaching the adult weights, no change in weight gain was observed ^[30]. ^[31] reported that average birth weight and live weight gain of dromedary calf was 35 kg and 0.5 kg/d, respectively.

^[32] reported that Sudanese camels raised and managed under semi-intensive and traditional systems did not differ

significantly regarding their birth weights. These calves were studied for 18 months of growth, and the mean daily weight gain (gm) under semi-intensive management system (535 ± 9.83) differed significantly from the traditional system (317 ± 5.46), respectively. In Pakistani camel the range for average daily weight gain has been reported by many workers as 0.5-1.5 kg. ^[22] and ^[23] reported average daily weight gain as 1.4 kg in male, 0.95 kg in female; 1.5 kg in male, 1 kg in female camel calves, respectively in Pakistan. ^[24] studied the growth pattern in camel calves. Fourteen camel calves were used in that study. Among them 5 calves belonged to Barani Livestock Production and Research Institute (BLPRI), Kherimurat District Attock, Pakistan and 9 from private farmers. Trial lasted for 6 months and observations were taken at age of 7 days. Calves started nibbling at the age of 4 weeks while all calves suckled their dam's milk *ad lib*. The study demonstrated daily growth rate of 0.75 and 0.82 kg in institute (BLPRI) calves and in private farmer's calves, respectively.

Average daily weight gain was found to be 0.74 kg during 90 days in Saudi camel calves when they were fed 75% concentrate and 25% hay ^[33]. ^[34] studied the feedlot performance of dromedary camel fed different dietary regimes and reported average daily gain and dry matter intake as 0.81, 4.53; 0.59, 3.99 and 0.67, 4.42 kg with Kenana pellets, cotton seed cake and ground nut cake-based diets, respectively. ^[35] studied the effect of management systems on growth performance of Indian dromedary camel calves reared under organized farm conditions and reported average growth rate as significantly higher in intensive system of management (611 gm/d) than semi-intensive system of management (319 gm/d).

In recent studies, ^[36] compared the intensive management system (IMS) with semi-intensive management system (SIMS) regarding growth rate of Marecha camel calves and found higher growth rate about 674 g/d in male calves of 11-12 months age reared under IMS and 419 g/d in SIMS. In another study, in Marecha camel calves of 11-12 months age reported values were 397 g/d in SIMS and 539 g/d in extensive management system (EMS) ^[37]. ^[38] compared the growth performance and hair mineral status of Marecha calves of 11-12 months age in different management systems and found a significant increase in the average daily gain of male and female calves being higher in intensive management system than semi-intensive management system. ^[39] compared growth rate of weaned growing camel calves of almost 1-year age reared under open grazing/browsing and stall-fed system and found average daily weight gain (DWG) as 480 and 520 gm/d ($P < 0.05$), respectively under open grazing and stall-fed system while feed conversion index (quantity of fodder/kg of gain) was found to be 14.42 in stall-fed animals.

The values of daily weight gain (gm) and feed conversion index (gm/kg average daily intake) of male and female weaned dromedary calves around 1-year age were found to be 670, 97.1; 650, 101.5 and 540, 154.3; 440, 125.7 reared under intensive and extensive feeding systems, respectively ^[40].

4. Live Weight

Various estimates of liveweights in camels have been reported. Age, feeding conditions, sex and general health are the main factors that have obvious effect on the weight of the camel ^[15-17;23-26,36] and they attain maturity rather slowly than other animals by reaching a liveweight of 650 kg for about 7-8 years of age. In early life (first 2-4 years) there is no marked difference of sex on liveweight in camels and at older ages males get heavier than those of females while ^[41] reported that mature male calves were heavier than female calves by 38%. Mature male camels (448 kg) were heavier than those of she-camels (414 kg) in the study of ^[16]. Camel liveweights are also affected by breed and type. Light and heavy breeds weigh about 450-550 kg and 660 kg at maturity and in good condition ^[42,43]. ^[44] reported liveweights in camels of different countries as Somalian deserted camels with lightest liveweights (350-400 kg) and Indian camels with the highest liveweights (660 kg). The range of mature weights of Australian camels was to be 514-645 kg in males and 470-510 kg in females. Iranian camels were ranged from 340-430 kg in mature weights at age of 5 years ^[45]. Various reports are there with a lot of variation regarding camel weights within the same region. Turkish camels ranged between 439-489 kg ^[46]. Liveweights are significantly affected by body condition and nutritional history. In well finished (fattened in feedlot) deserted Saudi mature camels ranged between 359-512 kg with an average weight of 475 kg ^[47]. However, reports are present for higher body weights in camels. Castrated male camels (Somali×Turkana) show a range of 530-800 kg liveweights as reported by ^[48]. ^[49] reported that the average adult body weight was highest in the Bikaneri breed as 617.33±17.02 and 577.83±9.79 kg in males and females, respectively while the adult Bikaneri animals were found to be heaviest than Jaisalmeri animals which were lightest.

5. Conclusions

The camel is no more considered as “Ship of the desert” now; which rather has been changed to a food security animal in the climate change context with a role as sustainable livestock specie in the desert ecology. It is the chief source of meat and milk for the pastorals and people

of marginal areas who have not any mode of production regarding other livestock species and mainly rely on camel for their subsistence. Camels are very productive in terms of meat production and are well recognized nowadays due to its productive abilities and therapeutic worth. This paper highlights the growth patterns and production potential of camel generally; thus, will pave a way for further investigations in camel science proving it a sustained food animal.

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