

Review Article

Feeding potential of rangelands in Balochistan-Pakistan: A brief review

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Abstract

Balochistan has the largest rangeland area among other provinces of Pakistan. It is bestowed with large number of small ruminants, camel heads along with various ecological zones. These zones have different rangeland species that have varied feeding potential for livestock of the province. However, this feeding potential varies with season, growth and rainfall pattern in different zones and within zones. The scanty and scattered work has been done in different areas of Balochistan, however known feeding worth of these rangelands is still lacking at large scale. The key purpose of this manuscript is compile the scattered and scanty work on rangelands of Balochistan so that future research areas can be identified and policy for preventing degradation, sustainability and improvement in feeding value of rangelands can be planned.

Keywords: Balochistan; Feeding; Livestock; Nutrients; Rangelands

Introduction

The area of Pakistan is 88 million hectares. Of this total area, 65% is considered as rangelands. There are five major kinds of ecological range zones such as sub-tropical humid, tropical arid, sub-tropical sub humid, Mediterranean, sub-semiarid desert plain [1]. These rangelands are important source of feed for livestock population with variation in the precipitation about 125 – 1500 mm per annum. The rangeland areas of Pakistan are supporting about 30 million of the livestock herds that share about 400 million dollar with national income [2].

It is reported that rangelands having more ecological zones provides greater diversity of forage and hence results in higher livestock

gains even during dry seasons [3]. In Balochistan province, the rangeland species varies with rainfall. It is estimated that approximately 80% animals of the province particularly sheep and camel species depends on rangelands. However, its feeding value varied. In its south, desert scrubs mostly seen, in the central area there is dominancy of shrub grassland of *Haloxylon* and *Artemesia* (sagebrush) species whilst in the north perennial grassland of *Cymbopogon* and *Chrysopogon* is found. Due to heavy grazing load, the already reported many native annual species have almost vanished [4, 5]. Of total livestock heads in Pakistan, Balochistan possess 48, 41, 23, 7 and 1% of sheep, camels, goats, cattle and buffaloes,

respectively [6, 7]. Different ecological zones of Balochistan have different rangeland species. In this context, scanty and scattered work has been done in different areas of the province, however known feeding worth of these rangelands is lacking. Keeping in view these facts, the key purpose of this manuscript is to compile the scattered and scanty work on rangelands of Balochistan so that future research areas can be identified and policy for preventing degradation, sustainability and improvement in feeding value of rangelands can be effectively designed.

Rangelands in Balochistan

Rangelands are good source for grazing of livestock particularly sheep, goats and camels. It usually sustain maintenance requirement of these livestock depending upon the nutritional profile, rains, grazing pressure and likely other factors. Climate change and atmospheric nitrogen deposition are the other major reasons that have affected the rangeland types and their productivity [8]. In Balochistan, based on annual productivity, researchers have some worker divided rangelands of Balochistan into three major classes i.e., poor, medium and high potential areas based on annual productivity. They further elaborated that poor, medium and high productivity areas yield 50 kg, 60-190 kg and 200-250 kg dry matter per hectare, respectively. The north zones are composed as better sites of rangeland of this province, which are situated in of the north region i.e., Khuzdar, Pishin, Quetta, Kalat, Zhob, Loraai, Nasirabad, Kohlu and Sibi districts of province. The above described zones are equal to 18% of all area of the province and carry 76.5% of livestock provincial population. The south zone of the province is considered as the poor zone for rangeland i.e., Lasbela, Turabat, Gawadar, Chagi, Kharan, Panjgur and remaining part of Khuzdar district that cover 62% of total area and 23.5% of the total population of livestock.

It is reported that approximately 93% area of Balochistan can be characterized as rangelands [9]. The rangelands of Balochistan also categorized in the context of property regimes as common and open rangelands [10]. The tribes traditionally own common rangelands which are open and free access for all. The area under open rangelands have been increasing due to the fact that more special common rangelands have been deteriorated to such an extent that their owners preferred to left their ownership. The rangelands also categorized on the basis of dry matter (DM) yield. The rangeland areas producing 250-280 kg DM per hector is excellent to very good; 200- 240 kg DM per hector is very good to good; 170-190 kg DM per hector is fair to good; 60-160 kg DM per hector is poor to fair; 30-50 kg DM per hector is poor and below 30 kg DM per hector is categorized as non grazable [11].

Other researcher categorized rangeland of Balochistan in arid and semiarid zones depending based on the climate pattern [1]. They explained that production of rangeland in Balochistan province is significantly affected by absence of management practices regarding the grazing and fluctuation in the rain fall. These areas of rangelands are going to be decreasing very quickly in the relation as the production of biomass with favorable species of range. The deteriorating over grazing situation is getting visible everywhere. In this regard, many researcher have carried out studies to improve the yield and introduce new multi- beneficial verities. In a study, it was concluded that improvement in community rangelands is possible by involving all stakeholders and community through integrated approach in management of range livestock [12].

Rangeland species in Balochistan

Different grasslands contain diverse types of grasses, legumes, and other herbaceous species. Grasses provide the bulk feed. However, many forbs and some browse

plants contribute positively in improving the feeding of animals. Rangeland species varies depending on climate, soil types, topography and biotic factors [13]. Shrub fodders are sharing an important part in the production of livestock in arid and semiarid zones of Balochistan [14]. These areas have benefit for the nutrition quality, palatability and production than other rangeland species. While documenting rangeland species, it was reported [15] that in dominant range grasses in highlands of Balochistan, are *Cymbopogon jwarancusa* (Jones) Schult and *Chrysopogon aucheri* (Boiss) Stapf, which are perennial in nature. Potential use of *Atriplex canescens* (Pursh) Nutt. which is commonly called four wing saltbush is also reported [16]. It is a perennial halophytic exotic shrub and has origin from Western United States. This shrub has shown performance as promising fodder shrub in highland area of Balochistan having 250-300 mm annual rainfall. In a study, it was explained that that *Atriplex halimus* L., *A. nummularia* Lindl., *Medicago arborea* L., *Chamaecytisus proliferus* Link subsp. *palmensis* (Christ.), *G. Kunkel* *Colutea arborescens* L., *Gleditsia triacanthos* L., *Amorpha fruticosa* L., *Morus alba* L., and *Robinia pseudoacacia* L. were nutritionally superior to most of the native species and hence recommended them for artificial plantation in the area in order to balance existing natural rangeland species [17].

Nutrients composition of rangeland species in Balochistan

It is evident from literature that the quality of forage depends on many factors i.e., the variation in year of season, pattern of rain fall, plant age, nature of soil and nature of chemical [18]. In general, many species of rangeland plant contain higher ratio of ash and fiber with low percentage of protein with medium digestibility level. These plants have relatively small feeding values but they are not always same in their chemical

composition as most species contain high contents of anti-nutritional chemicals i.e., saponins, tannins, alkaloids which limits utilization of nutrients and reduction in the production.

The crude protein contents in plant/rangeland species are important and have high value for animal feeding. Literature shows that actively growing forage contains more contents of crude protein (CP) as compared to dormant stage [17]. It is also reported that higher level of protein is a sign that crop was harvested from the fertile land or during the early stage of life. Commonly the percentage of protein content is high in the shrubs during the season of winter and rain fall as compared to other grass, but it has small amount of crude protein during the season of summer as well as spring [19]. The decline in CP content of the forage coupled with decreasing digestibility with age makes forages less nutritious as they mature. However, the CP in grasses decline more rapidly than in legumes [20].

The fiber contents of plant sources/rangeland species stand as essential part for assuming their quality. In plants and rangeland species, it is found that advancing plant maturity is accompanied by an increase in dry matter, which is reflected in the increase of cell wall contents, and a decrease in cell contents. The decline in organic matter digestibility of forages with plant age may be due to the increase in plants structural carbohydrates and lignin as reflected in an increased percentage of cell wall contents. The fiber content/cell wall contents can be calculated through ADF and NDF [21]. The primary composition of ADF is lignin and cellulose, whereas the composition of NDF is lignin, hemicelluloses and cellulose.

In relation to ash contents of plant source/rangeland species, it is reported that all minerals of plant can be recovered through ash contents by burning at 6000 °C. The ash content provides sign for the presence of all

mineral contents but can also make false indication about the higher values of nonnutritive factors or about silica [22]. There is no energy content in ash material. Large number of the plant which are halophytic have higher amount of ash content, in specific; when conditions are drought the ash content could increase from 18-30% to the total dry matter [23].

Various plant species differ in nutritional importance. Grasses, shrubs and trees are all playing important role in one or other way for the sustainability of livestock. The trees which serve as green fodder and shrubs are major sources of livestock feed. These both components maintain and support harsh environmental condition during the part of year for the animals. The share of shrub and trees is visible for fulfilling the need of animal. The tree fodder has large amount of minerals and CP which are major helper in the level of digestibility. The tree fodder are well known accepted by the livestock farmers due to their deep root system because they are producing continuously during the hot and dry season of the years. However, there are some anti nutritional component in few species which may cause problem for animal's health [24].

In a study on nutritional analysis of four wing saltbush, it was found that during mid-winter season, the crude protein content ranged from 12-15 % in leaves [4]. Some scientists [12] introduced drought and cold-tolerant fodder shrub (*Atriplex canescens*) plantation. They recorded 140 kg/ha, 174 kg/ha, and 190 kg/ha in spring 2005, fall 2005 and spring 2006, respectively dry matter forage-production (above ground) at community-protected site. The dry matter forage production in open range area was 40 kg/ha during spring 2006. The work on some fodder species at three phenological stages in Harboi rangeland of Balochistan was carried out to know their proximate composition and cell wall components [25]. They found more dry

matter (DM), nitrogen free extract (NFE), neutral detergent fiber, acid detergent fiber and hemicelluloses in grasses than shrubs. On the other hand, they found more ash, crude protein, ether extract (EE) and ADL contents in shrubs than grasses. Moreover, they concluded that chemical analysis varied with phenological stages and nutritional value decrease with advancement in phenological stage. They also deduced that carrying capacity of available grasses is less as compared to the nutritional requirement of small ruminants for maintenance and growth during all seasons. Likewise, in Harboi region of Kalat, Balochistan the concentration of nitrogen in *Chrysopogon aucheri* (Boiss) Stapf and *Cymbopogon jwarancusa* (Jones) Schult during different seasons was studied [15]. They recorded that nitrogen concentration in these rangeland plants varied from 12.4-13 mg g⁻¹ during spring, 15.4-17.26 mg g⁻¹ during early summer and 6.7 to 10.7 mg g⁻¹ during late summer, respectively. They were of the view that after good rains the very long protected grasslands is adequate for heavy grazing for short time. In the earlier stated study [25] it is reported that DM contents in *Pennisetum orientale*, *Stipa pennata*, *Cymbopogon jwarancusa* and *Tetrapogon villosus* were 63.41, 69.04%, 73.78 and 90.9%, respectively. Among shrubs, the DM in *Perovskia abrotanoides* and *Artemisia maritime* were 52.23% and 71.7%. The CP contents among grasses ranged from 6.83-9.95% in *Pennisetum orientale* and *Cymbopogon jwarancusa*. Whilst among shrubs it ranged from 8.23%-11.51% in *Hertia intermedia* and *Artemisia maritime*, respectively. ADF contents among grasses was maximum (42.33%) in *Pennisetum* and minimum (35.4%) in *Tetrapogon*. In a study conducted in Lasbela region, fifteen different rangeland species (*Salvadora persica* L, *Prosopis juliflora*, *Suaeda fruticosa*, *Conolulus glomeratus* Choisyin, *Calotropis*

Procera, *Prosopis Juliflora*, *Cressa Cretica* L, *Sehoenus Nigricans* L, *Datura Alba Solanaceae*, *Taverniera Spartea*, *Abutilon Muticuin*, *Heliotropium Curassavicum*, *Prosopis Cineraria*, *Ziziphus Mauritiana* and *Cynodon Dactylon*) grazed by small and large ruminants were chemically analysed [7]. He found variation in chemical composition and fiber contents. Among these rangeland species, CP contents as percent of dry matter was found maximum ($P<0.05$) in *Sehoenus Nigricans* L (28.38 ± 1.90) and *Datura Alba Solanaceae* (27.28 ± 5.20) and minimum ($P<0.05$) in *Prosopis Juliflora* (11.34 ± 2.19). The EE contents (%) were found maximum in *Prosopis Cineraria* (4.49 ± 1.24) whilst *Suaeda fruticosa* showed least ($P<0.05$, 0.97 ± 0.58) EE contents. The maximum ($P<0.05$) ash contents (33.20) recorded in *Sehoenus Nigricans* L while the least ($P<0.05$) ash contents recorded in *Cynoden Dactylon* (4.38 ± 2.55). The NDF contents were highest ($P<0.05$) NDF in *Datura Alba Solanaceae* (55.21 ± 3.22) whilst lowest ($P<0.05$) in *Salvadora persica* L (25.66 ± 3.39). The ADF contents were maximum ($P<0.05$) in *Datura Alba Solanaceae* (29.22 ± 2.90), whilst minimum in *Prosopis Juliflora* (14.50 ± 1.19). On similar fashion, samples of nine different livestock preferred rangeland species (*Koelpinia Linearis* Pallas, *Euphorbia Falcata*, *Tribulus Pentandrus*, *Launaea Glomerata*, *Cardaria draba*, *Rostraria cristate*, *Cenchrus Ciliaris*, *Isatis stocksii boiss*, *Melva Neglecta wallr*, *Atriplex Dimorposregium*, *Polypogon monspeliensis*, *Tamarix Articulata* Vahl, *Salsola Arbuscula* Pallas) were collected from two different area of Kharan region in Balochistan [26]. Among these rangeland species, he found that highest ($P<0.05$) DM contents were observed in *Rostraria cristate* (96.60 ± 1.10), whilst lowest ($P<0.05$) DM contents recorded in *Melva Neglecta wallr* (90.40 ± 1.78). The CP contents as percent of dry matter was found maximum ($P<0.05$) in

Salsola Arbuscula Pallas (30.60 ± 5.19) and minimum ($P<0.05$) in *Melva Neglecta wallr* (10.22 ± 3.18). The maximum ($P<0.05$) EE contents (%) were found in *Koelpinia Linearis* Pallas (3.87 ± 1.11) whilst *Melva Neglecta wallr* showed least ($P<0.05$, 1.50 ± 0.33) EE contents. The NDF and ADF contents were highest ($P<0.05$) in *Salsola Arbuscula* Pallas (59.33 ± 3.30 ; 42.19 ± 6.11) whilst lowest ($P<0.05$) in *Tribulus Pentandrus* (29.89 ± 7.88 ; 18.89 ± 6.76), respectively.

Rangelands degradation in Balochistan

The rangelands degradation occurs because of poor plans for grazing management and vegetation loss for the purpose of fuels in the form of wood. It happens due to lack of any visible administration for its ownership. Important indications for the degradation of rangeland are species shift, composition biodiversity, range losses with decrease in the production of biomass and low covering plant [27].

It has been observed that improper utilization/overgrazing by nomads, human-induced stresses, drought and erosion are various causes of rangelands degradation in Balochistan. The rangeland degradation in Balochistan are particular and only depending on present grazing accessibility, vegetation pastures for grazing, population of human with water stock availability and conflict of tribes [28]. The palatable species of shrubs and perennial grass are only found in the few protective regions of forest. It is reported that large number of rangeland species are going to be replaced with low or unpalatable species of shrubs such *Othonophasis intermedia* and *Peganum harmala* due to visible erosion of soil [12].

Conclusion and recommendations

Balochistan owns major chunk of rangelands in Pakistan which are major source of feeding huge number of sheep and camels. The existing nutritional profile of rangelands differ among zones, seasons and rainfall

pattern. In lieu of climate change and variation in rainfall and droughts, the studies on different aspects of rangeland management, palatability and consequent livestock feeding is need of the time. Studies on different aspects of rangelands in all ecological zones are scanty and limited. The initiation of mega research project addressing the carrying capacity of rangelands in all ecological zones, preferred rangeland species of small ruminant, large ruminants and wildlife, introducing livestock preferred exotic drought resistant varieties, rotational grazing and community awareness are different aspects to carry out studies, designing plans and executing policies in Balochistan.

Authors' contributions

Conceived and designed the review paper: IB Marghazani, Contributed in collection of reviews: M Yassen & M Afzal, Analysis of collected reviews: I Kakar, SA Khoso & IB Marghazani, Wrote the paper: IB Marghazani

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