

Seasonality in feed availability and nutritional status of goats in heavy rainfall region of south Gujarat

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ABSTRACT

The seasonality pattern in availability of grazing and browsing along with nutritional status of grazing goats in heavy rainfall region of south Gujarat were studied for a year by monitoring 360 goats from 8 villages. The nutritional status of experimental goats was judged by body condition scoring (BCS), FAMACHA (FAffa MALan CHArt) and by analyzing packed cell volume (PCV). The availability of grazing and browsing resources was judged by participatory rural appraisal tools. The collected data was frequencised, tabulated and analyzed by various suitable techniques in IBM® SPSS® Statistics Version 20.0. The study revealed that a period from September to December was flush and May- August was lean period as far as availability of grazing or browsing resources. The grass is found in plenty in monsoon months; however, due to *kharif* crops most of the ways and roads are not accessible for goats. The BCS was highest (3.13 ± 0.04) in winter and lowest in monsoon (2.74 ± 0.03). The majority (57.5%) of goats was having low BCS in monsoon and good BCS in other seasons. The FAMACHA score was high in monsoon where as it was at par in winter and summer season. Frequency distribution of experimental goats based on FAMACHA score range shows that in monsoon, 40.8% and 15.8% goats were having either borderline or severe score. The PCV was significantly low (20.47 ± 0.43) in monsoon. Overall 31.67% of goats were having low PCV indicating that they were more or less anaemic during whole year. The BCS were negatively correlated with FAMACHA and positively correlated with PCV. It can be concluded that the feed availability and nutritional status of grazing goats in south Gujarat is poor during monsoon months.

Key words: BCS, Browsing, FAMACHA, Goats, Grazing, PCV, Seasonality

The goat farming under traditional production system is mostly practiced in heavy rainfall zone of south Gujarat by low input system with good profitability. Many traditional goat keepers (Ahirs) are keeping a flock of 25–40 Surti goats entirely on grazing and browsing with little supplementation (Sorathiya *et al.* 2013). The goat rearing by the traditional way is a profitable enterprise. It is main source of income for majority goat keepers of Ahir caste in this region. However, this system has many constraints which are affecting the profitability. Among them seasonality pattern in availability of grazing and browsing is the main constraints for goat keepers of this area (Sabapara *et al.* 2014). It requires feed supplementation to all goats when there is shortage of grazing resources. The Ahir goat keepers are generally not feeding their goats during feed shortage period of year due to lack of knowledge about feed supplementation. The feed supplementation calendar for whole year specific for this area will be great

useful to goat keepers. Therefore, to prepare such calendar it is necessary to have knowledge of flush and lean season of availability of feed resources. Further, the goat keepers in the study area are following uniform breeding season. Therefore, the nutritional requirement for goats of different physiological stages may vary from one season to another. So for maximizing the profit, the feed supplementation calendar should be designed by considering nutritional availability and nutritional status of animals. The nutritional status of goats can be judged by various methods like body conditioning and FAMACHA (FAffa MALan CHArt) scoring. Analysis of packed cell volume (PCV) as a gold standard tool to diagnose anaemia which is subsequent of nutritional, pathological and metabolic disorders in goats is also required in this context. Therefore, present study was conducted in south Gujarat region by monitoring 360 experimental goats in the period of whole year for BCS, FAMACHA scoring and PCV study.

MATERIALS AND METHODS

The study was conducted on goats from randomly selected 4 villages each from Valsad and Navsari district. The monitoring of BCS, FAMACHA and PCV was conducted by selecting 15 goats consisted of 10 adults, 3

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yearlings and 2 kids from one village in one season. The same village was sampled during three seasons. A schedule was prepared covering two villages and 30 experimental animals in one month, thus, 120 samples per season and 360 samples in year. All experimental goats were monitored for FAMACHA (Kaplan *et al.* 2004) and BCS (Friedricks 1993). The FAMACHA score 1 and 2 were considered normal, 3 was at borderline and 4 and 5 were anaemic animals. Likewise, the BCS was also judged by 5 point method with increment of 0.25. The blood samples from selected experimental goats were collected and transported to laboratory on same day and preserved as per standard procedures. The PCV was measured by micro-haematocrit method. The information about availability in grazing and browsing resources in selected villages was collected with help of participatory rural appraisal tools by arranging group discussion in all 8 villages with goat owners as per method described by Gebeyehu *et al.* (2013). The grazing/ browsing availability was tabulated by giving upto five plus signs in which + means least availability and +++++ means abundant availability. The collected data was frequencised and tabulated as per standard statistical methods (Snedecor and Cochran 1994). The tabulated data were analyzed by various suitable techniques in IBM® SPSS® Statistics Version 20.0. The descriptive analysis in nominal data was analyzed by frequency distribution by cross tabulation. The chi square test was used to test significance in frequencies data. The means were analyzed by using one way ANOVA technique. The Duncan's method in post hoc test was used to compare various means. The correlations were analyzed by using Kendall's tau-b test in bivariate correlations.

RESULTS AND DISCUSSION

Basic information of the study area: There are three distinguishable agricultural seasons in study area viz. *kharif* (June to Sept), *rabi* (Oct to Jan) and Summer (Feb to May). The average rainfall of the study area is 1800–2200 mm with 55–60 rainy days. The weather data of study area during 2013 is depicted in Figs 1 and 2 which shows that winter is fairly cool; the temperature may fall about 10°C during winter. Summer is moderately hot. Temperature may raise upto 35 °C during summer. May – October is characterized by hot-humid season, as maximum relative humidity more than 80% was observed. The June–September were the months of monsoon. Rice and sugarcane are important crops in study area (Anon 2011).

Table 1. Bi-monthly availability of grazing and browsing resources in study area

Resources	Jan-Feb	Mar-April	May-June	July-Aug	Sept-Oct	Nov-Dec
Road side grazing	+			+++	+++	++
Road side browsing		++	++	+++	+++	++
Grazing in and around fields	+				+	++
Fallen grains, stubbles etc. after harvesting paddy crop in fields	+				+	++++
Canal bank grazing	+++	+++	+			++
Browsing on trees around farmers field		++	+		++	+
Grazing & browsing in protect forest	++	++	+	++	++	++

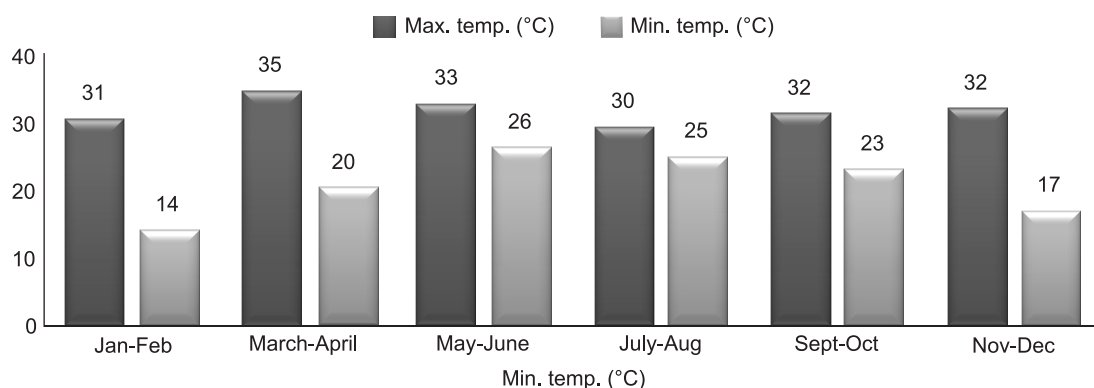


Fig. 1. Bi-monthly min. and max. temperature in study area (2013).

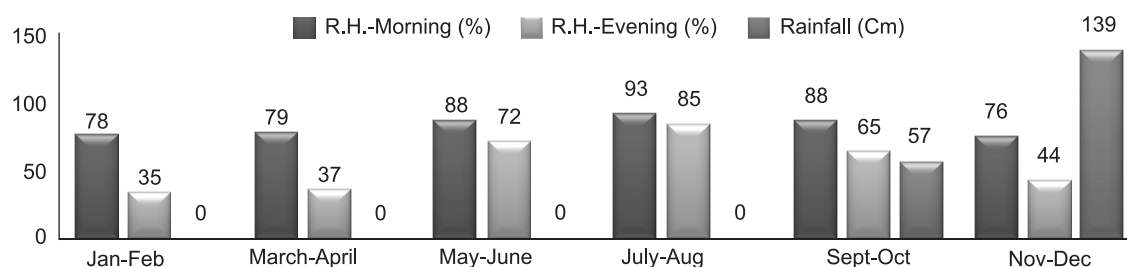


Fig. 2. Bi-monthly Relative humidity (R.H.) and rainfall in study area (2013).

Source: Weather station, Navsari Agricultural University

Hills in Valsad, Navsari and Dangs are extension of the Western Ghats. Both districts of south Gujarat are rich in livestock population. As per livestock census (2007) it is having 4.20, 1.92, 2.1 and 0.11 lakh heads of cattle, buffalo, goat and sheep, respectively.

Availability of grazing and browsing resources: The study area falls under heavy rainfall zone hence, the entire picture of availability of feed resources is quite different from the goat rearing areas mainly from north western region. The feed resources identified from all villages during survey is given in Table 1 which shows that road side grazing/ browsing, grazing in and around farmer's field, fallen grains, stubbles etc. were the main feed resources for goats. Further, table reveals that September to December was flush season and May-August was the lean period as far as grazing or browsing resources were concerned. The grass is found in plenty in monsoon months around cultivable waste land, farm boundaries and near farmer's fields; however, due to *kharif* crops most of the ways and roads are not accessible for goats. Soon after harvesting the *kharif* crops, the availability drastically increases.

Seasonality in body condition scoring (BCS): The mean BCS of sampled goats in all three seasons is presented in Table 2. Highest BCS (3.13 ± 0.04) was observed in winter and lowest was observed in monsoon (2.74 ± 0.03). Statistically it was different in all three seasons. The frequency distribution of sample goats based on BCS ranges

Table 2. Effect of seasons on mean BCS, FAMACHA and PCV% in grazing goats of south Gujarat

Seasons	Monsoon	Winter	Summer	Pooled
N	120	120	120	360
BCS	2.74 ± 0.03^a	3.13 ± 0.04^c	2.99 ± 0.03^b	2.95 ± 0.02
FAMACHA	2.64 ± 0.09^b	1.96 ± 0.07^a	1.93 ± 0.07^a	2.18 ± 0.05
PCV (%)	20.47 ± 0.43^a	22.56 ± 0.33^b	22.98 ± 0.27^b	22.00 ± 0.21

Means with different superscripts in a row are significantly ($P < 0.01$) different.

Table 3. Frequency distribution of grazing goats of south Gujarat based on BCS, FAMACHA and PCV ranges in various seasons

Seasons	n	BCS Range		FAMACHA range			PCV range	
		Low (<2.5)	Good (>2.5)	Normal (1 & 2)	Borderline (3)	Severe (4 & 5)	Low (<20)	Medium (>20)
Monsoon	120	69	51	52	49	19	60	60
	%	57.5	42.5	43.3	40.8	15.8	50	50
Winter	120	30	90	93	25	2	26	94
	%	25	75	77.5	20.8	1.7	21.7	78.3
Summer	120	48	72	93	25	2	28	92
	%	40	60	77.5	20.8	1.7	23.3	76.7
Total	360	147	213	238	99	23	114	246
	%	40.83	59.17	66.1	27.5	6.4	31.67	68.33
Chi-square test	Value	26.28		50.89			28.00	
	Sig.	0.0001		0.0001			0.0001	

Table 4. Correlations between BCS, FAMACHA score, PCV and severity of parasitic infestations

Parameters	BCS	FAMACHA Score
Body condition score	1.000	
FAMACHA Score	-0.269**	
PCV	0.263**	-0.509**

** Indicates significance at $P < 0.01$.

is depicted in Table 3. It is showing that majority (57.5%) of goats were having low BCS in monsoon and good BCS in other seasons. However, it was satisfactory in all seasons. It indicates that the goats of Ahirs have satisfactory nutritional status throughout the year, however, winter was excellent and monsoon was worse season among them. Further, BCS was in concurrence with grazing/ browsing availability as shown in Table 1. It was highest in winter because of having good grazing option after harvesting of *kharif* crops. The seasonality pattern of BCS i.e. high in winter and low in monsoon is in agreement with Dorny *et al.* (2011). However, studies conducted in semi arid or low rainfall zones the BCS was recorded high in monsoon and low in summer (Gwaze *et al.* 2010). In spite of good grazing and browsing availability in monsoon, the heavy parasitic load in monsoon and less accession of available grazing area due to *kharif* crops might have affected the nutritional status, thus, BCS was low. Heavy rainfall and more rainy days are interfering with grazing and it also causes stress on goats.

Seasonality in FAMACHA: The effect of seasons on mean FAMACHA scores on goats is depicted in Table 2. It revealed that the FAMACHA score was high in monsoon where as it was at par in winter and summer. The higher score is indicative of severity of anaemia. The goats having FAMACHA score 2 or more throughout the year was suggestive of poor nutrition or parasitism or both. Frequency distribution of experimental goats based on FAMACHA score ranges is presented in Table 3. It shows that in

monsoon season 40.8% and 15.8% goats were having either borderline or severe score where as in winter and summer majority (77.5%) of goats were having normal FAMACHA score range. Similarly, Pinto *et al.* (2009) found high FAMACHA score in monsoon in goats.

Seasonality in Packed Cell Volume (PCV): The mean PCV in all seasons is presented in Table 2. The frequency distribution of experiment goats based on high (>20%) and low (<20%) PCV in three seasons with chi square test values is depicted in Table 3. The PCV was significantly low (20.47 ± 0.43) during monsoon and high during summer (22.98 ± 0.27) (Table 2). Frequency distribution of experiment goats based on high and low PCV in three seasons reflects half of goats were having less than 20% PCV during monsoon. Based on PCV study, it is clearly visible that the goats were more or less anaemic during whole year. The seasonality observed in PCV was in agreement with Gwaze *et al.* (2010). It was associated with nematode infestation in monsoon (Saddiqi *et al.* 2010).

Correlations between BCS, FAMACHA score and PCV: Kendall's correlation coefficients among BCS, FAMACHA scores and PCV is presented in Table 4. It shows that all of them were significantly correlated ($p < 0.01$). The BCS were negatively correlated with FAMACHA score and positively correlated with PCV. FAMACHA score was negatively correlated with PCV. The negative correlation between BCS and FAMACHA score in goats was also reported by Gwaze *et al.* (2010). Marshall *et al.* (2012) revealed that FAMACHA scores was negative correlation with PCV ($r = -0.35$, $p < 0.001$) and BCS ($r = -0.59$, $p < 0.001$). It revealed that in grazing goats of south Gujarat, anaemia can also be judged either by body condition or FAMACHA scoring.

On the basis of study, it is concluded that the feed availability and nutritional status of grazing goats in south Gujarat is low during monsoon months. Hence, stall feeding or feed supplementation to goats is required during monsoon season. Further, the goats were having good nutritional status during winter seasons; hence, no feed supplementation is necessary during that period just to reduce feed cost. The grazing availability and nutritional status of goats have definite seasonality, therefore, the breeding and kid fattening management should be planned accordingly. The nutritional status of goats can be judged by seeing anaemia which can also be judged either by body condition or FAMACHA scoring.

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