Technical Bulletin

BODY CONDITION SCORING SYSTEM

A NONINVASIVE, VISUAL AND SUBJECTIVE TOOL FOR OPTOMIZING PRODUCTIVITY IN CAMEL

Sajjan Singh, Rakesh Kumar Poonia, Kashi Nath and N.V. Patil

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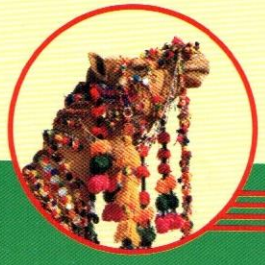

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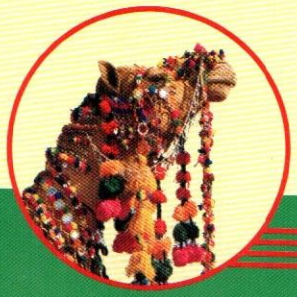
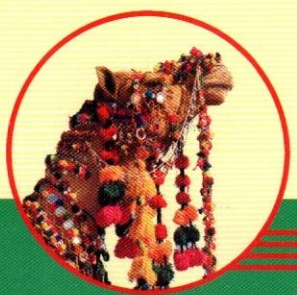


Contents

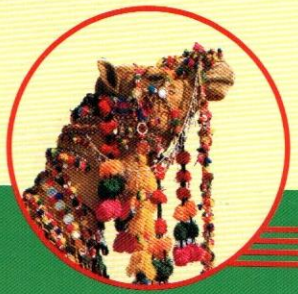


Preface

The arid and semi arid , the most fragile ecosystems, both together have 53.40% of total geographical area in the country (MoEF, 2001) have the climate parameters like extreme temperatures, high humidity during wet summers and winters, higher evapotranspiration and erratic rainfall. It causes much stress to the agricultural and livestock production systems prevalent in the areas. The most common effect of climate change has been increased desertification leading to less production and availability of feed and fodder. Dregne (2000) estimated that approximately 3% area of the dry lands are irrigated croplands, 9% are rain fed croplands, and 88% rangelands and about 30% of the irrigated croplands, 47% of the rain-fed croplands and 73% of the rangelands are degraded. In these areas animal husbandry being the major vocation of a large segment of population providing drought proofness compared to crop husbandry has also been affected because of the dependence of livestock on rangelands for nutrition and their exposure to extreme climatic factors which affects the productivity.

The dromedary camel, an important animal of dry region livestock production system is a livelihood support to pastoral communities through provision of milk and draft power for transportation of goods, withstands harsh conditions of climate and scarcity of water, feed and fodder. But have also suffered a lot in last 4 to 5 decades due to aberrations resulting from reduced availability of feed and fodder and the climate change. The most significant adverse impact of these changes in camel inhabiting areas remain loss in its numbers during last 50 years from 1.0 to 0.52 million (Livestock census, 2007) which can be ascribed to increased pressure of biotic and abiotic stress factors. We in India are deficit in green and dry fodder. It is increasing every year, while for concentrate gap is almost static. But this gap is critical and is going to determine the type of animal and husbandry practices to be followed. Camels with all capability and potential to survive and thrive coping with food and water scarcity in difficult areas of desert have established due to evolutionary process. Camels have developed physiological strategies of mobilizing body fat as per the anticipated needs of different physiological stages (growth, prepubertal, pubertal, pregnancy and lactation). Scarcity of feed, fodder and difficult climatic conditions reflected on the body weight and health of camel , a body condition Chart was developed for ready reference in field conditions to help the farmers by National Research Centre on Camel, Bikaner.

The authors believe this information contained in this bulletin will help the camel rearing farmers in increasing the productivity from camels cost effectively.



Authors

Chapter 1: Introduction

Camel researcher or producers must know whether or not their camels are in condition (thin, too fat, or just right) for the stage of production: breeding, late pregnancy and lactation (Milk production, fat, Solid not fat (SNF)). Weight at a given stage of production is the best indicator, but as there is a wide variation in mature size between individuals and breeds, it is extremely difficult to use weight to determine proper condition. Scoring is based on feeling the level of muscling and fat deposition over and around hump, the vertebrae in the loin region. In addition to the central spinal column, loin vertebrae have a vertical bone protrusion (spinous process) and a short horizontal protrusion on each side (transverse process). Both of these protrusions are felt and used to assess an individual body condition score. Body condition scoring (BCS) of camel allows camel producers to assess the level of fat reserves of camel during various production phases. The aim of BCS to obtained simple and reliable measure of the level of body reserves in camel. The body condition of female camel affects the incidences of estrus significantly. The female camel of low body condition scoring had significantly lower physiological response. It means that lower body condition score females try to save energy by decreasing their metabolic activity up to few extant. Lower body condition camel may have varied hematological and biochemical blood picture. Body conditions of He/she camel significantly affects the intensity of sexual behavior, estrus duration, conception and lambing rate visa-vis vigor vitality and fertility in he camel. In poor body conditioned animals there is greater possibility of reproductive failure and reduction in the production performance which in turn is adversely affecting the economic status of camel husbandry farmers. Under conditioned camels are subjected to health problems and over conditioned to reproductive problems. Optimal body condition score(BCS) will help in achieving the goal of optimal production on economical basis.

Chapter 2 : What is Body Condition Scoring

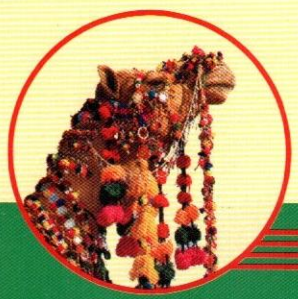
Body condition scores are excellent indicators of the nutritional status and is a useful management tool for distinguishing differences in nutritional needs. Body condition scores are numbers used to estimate energy reserves in the form of fat and muscle .Condition scoring is a system of describing or classifying animals by differences in relative body fatness. Although it is a non-invasive subjective scoring system but it provides a objectively reliable evaluation of body composition. Body Condition Scoring is a tool of judging exactly how thin or fat an animal is, rather than simply looking at it and guessing. It is important to carry out a hands-on practice for accuracy since, for example, in double humped camel a large amount of hair can give a very misleading idea of the body condition. Scoring is normally carried out according to a standard technique, which is well understood within a Raika community of camel keepers and evaluators . This provides a reasonably acceptable subjective measure so that equivalence can be made between individuals and herds during a particular period under reference. Body weight alone is inadequate because of apparent differences in mature body size among different breeds and individuals within a particular breed. The use of both body weight and condition scores can help producers make important feed management decisions. Different species have a range of different ways of condition scoring. BCS have been developed
for different species like horses, cows, sheep, goats, and chickens. In this bulletin the importance and detailed methodology of BCS in camel has been discussed.

Chapter 3: Objectives of Body Condition Scoring

1. To develop body condition score chart for camel and its correlation with different physiological stages of life.
2. To develop a BCS system for camel that correlates with production parameters photo examples.
3. To understand biological relationship between Body fat on least and most basis, milk production and reproduction.
4. To adopt optimum management practices to derive maximum production and maintain optimum health

Chapter 4: Why BCS is a preferred technique

1. BCS is Non -invasive
2. Quick and inexpensive
3. Universally accepted
4. Good indicator of body reserve vis-a-vis body weight
5. BCS evaluates nutritional status, identify health problems, ideal body reserves and Breeding capabilities



Chapter 5: Body Condition Score for Grading Camels.

Body Condition Score is a systematic and subjective study. Systems have been developed based on different indices for different species ranging from 1-10. Camels can be scored on 1-5 scale. These are subjected to score by different individuals and compiled on average basis. Sometimes score rating comes to decimal on average basis. In each case a score 1- used to describe animals that are extremely emaciated and maximum score of 5 to describes animals that are very fatty and obese.

General description of 5-Point Scale scoring system for Camels

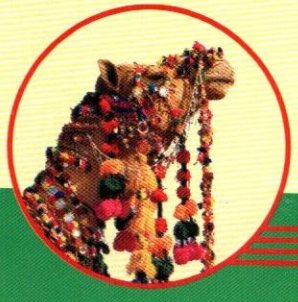
1. Emaciated : Camels in this body condition have no fatty deposition between skin and bone. These camels appear weak and unthrifty.

2. Thin: Camels in this body condition have only a slight adipose tissue tissue present between skin and bone. Bony protuberances are prominent. These animals appear thrifty with minimal fat deposits.

3. Average: camels in this body condition have average flesh and do not have excess fat reserves. This condition score includes animals with medium size hump.

4. Fat: This condition score includes camels that are moderately fat. Moderate fat deposits gives animal a smooth phenotypic look with all aesthetic appearance.

5. Obese: Includes camels that are extremely fat. Excess fat deposits can easily be seen in the hump, rump and tail-head regions. The fat deposition is to the extent that it hampers both reproduction and production..



Chapter 6: Different Body Condition Scores of Camels and their Characteristics

Table-1 Characteristics of camel of BCS 1.

Ischial tuberosity	Very prominent
Sacrotuberal ligament	Very concave
Ano-genital region	Very deep at the base of the tail
Spinous apophyses	All visible
Coxal tuberosity	Very prominent
Hollow of the flank	Clearly apparent
Transverse apophyses	All prominent
Rib	Clearly visible
Hump	No/Very small hump

Little or no fat in the hump sac, hump hairy and may be leaning to one side

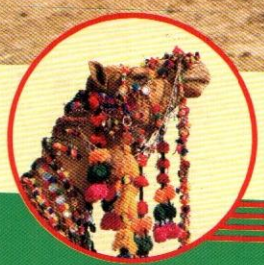
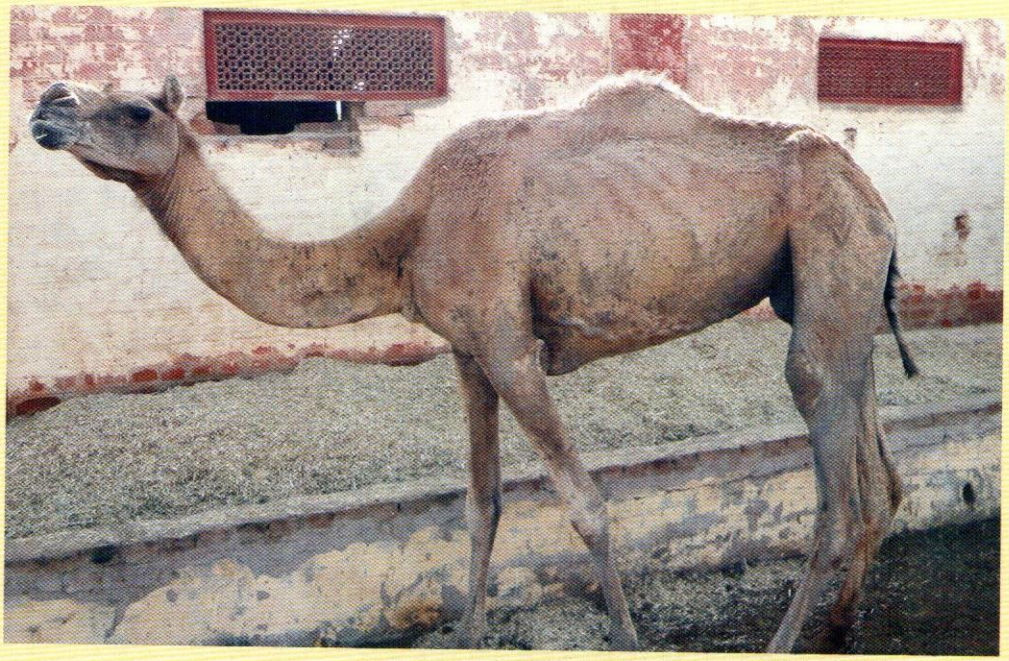
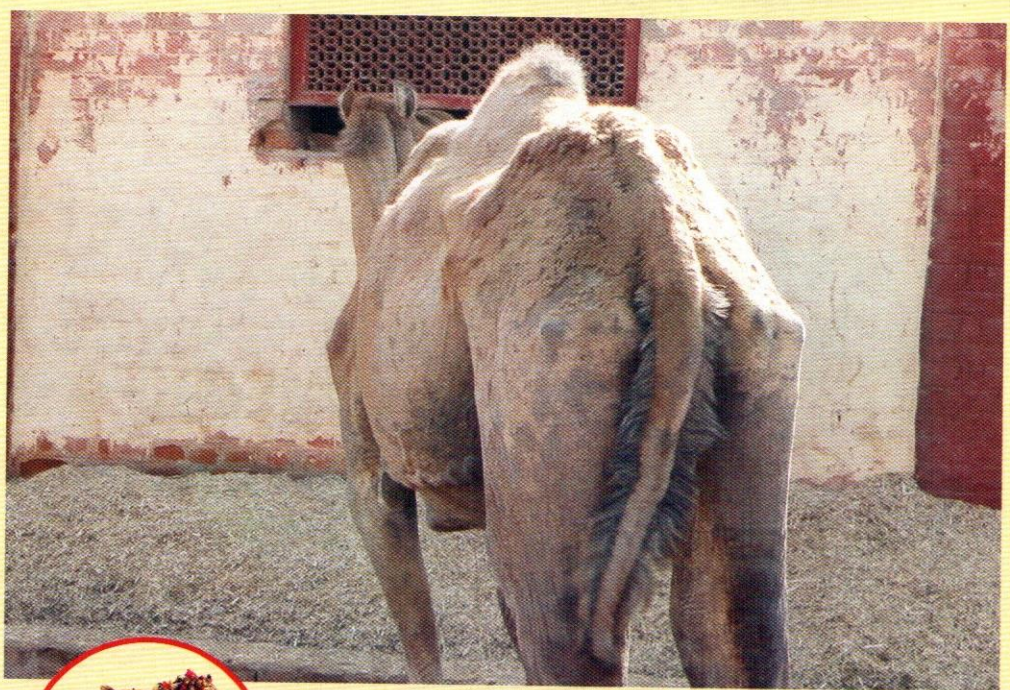


Table-2 Characteristics of camel of BCS 2.

Ischial tuberosity	Well visble
Sacrotuberal ligament	Flat
Ano-genital region	Visible hollow
Spinous apophyses	Visible on the back
Coxal tuberosity	Visible
Hollow of the flank	Visible
Transverse apophyses	Visible all along the back
Rib	Visible in front
Hump	Small





Hump with moderate development rising 5% higher than chest depth, but may also be leaning to one side

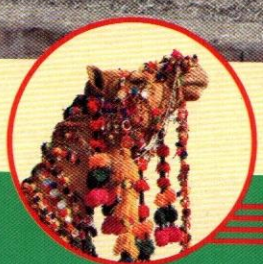
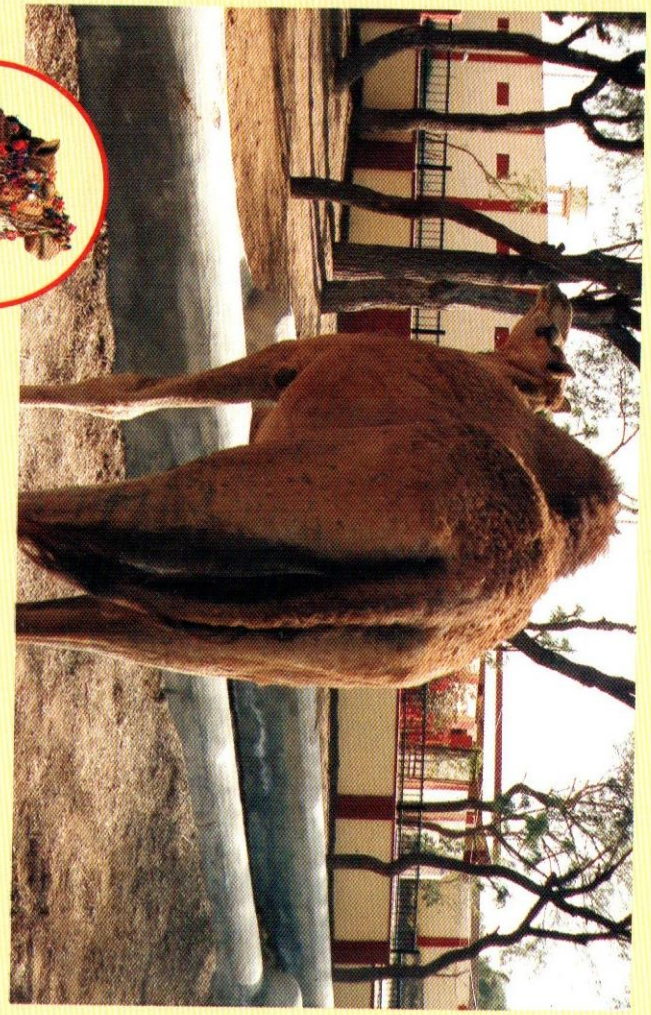
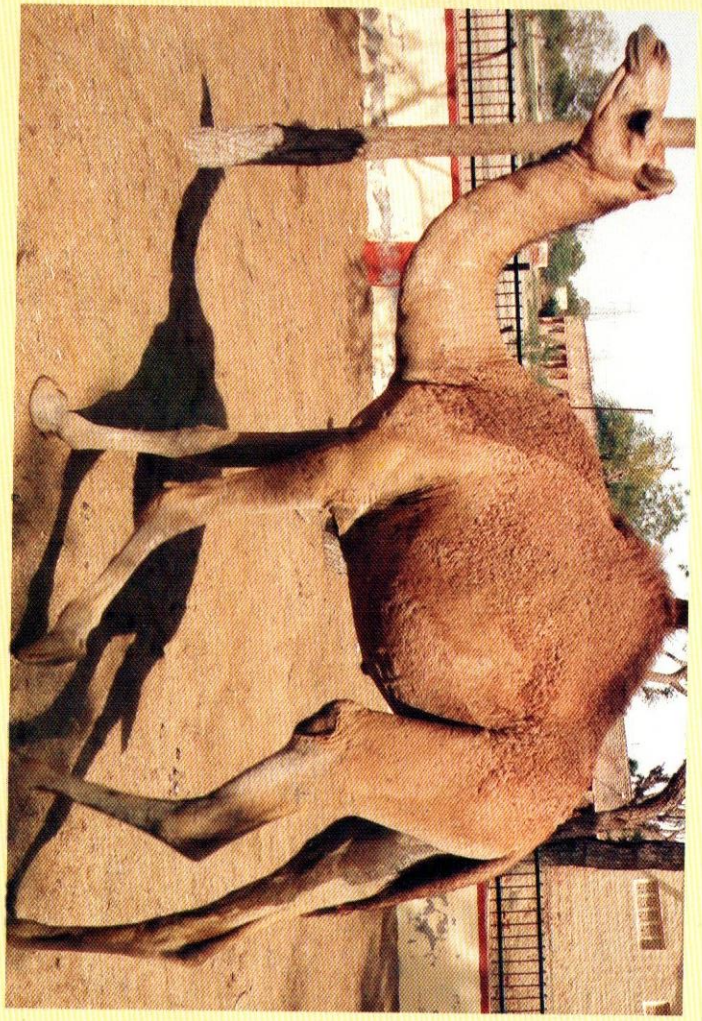


Table-3 Characteristics of camel of BCS 3.

Ischial tuberosity	Visible, low quantity of fat
Sacrotuberal ligament	Flat to convexe
Ano-genital region	Slight hollow
Spinous apophyses	Slightly apparent
Coxal tuberosity	Slightly visible
Hollow of the flank	Very slight
Transverse apophyses	Sligthly visible
Rib	Invisible or slighly visble in front of thorax
Hump	Medium size hump

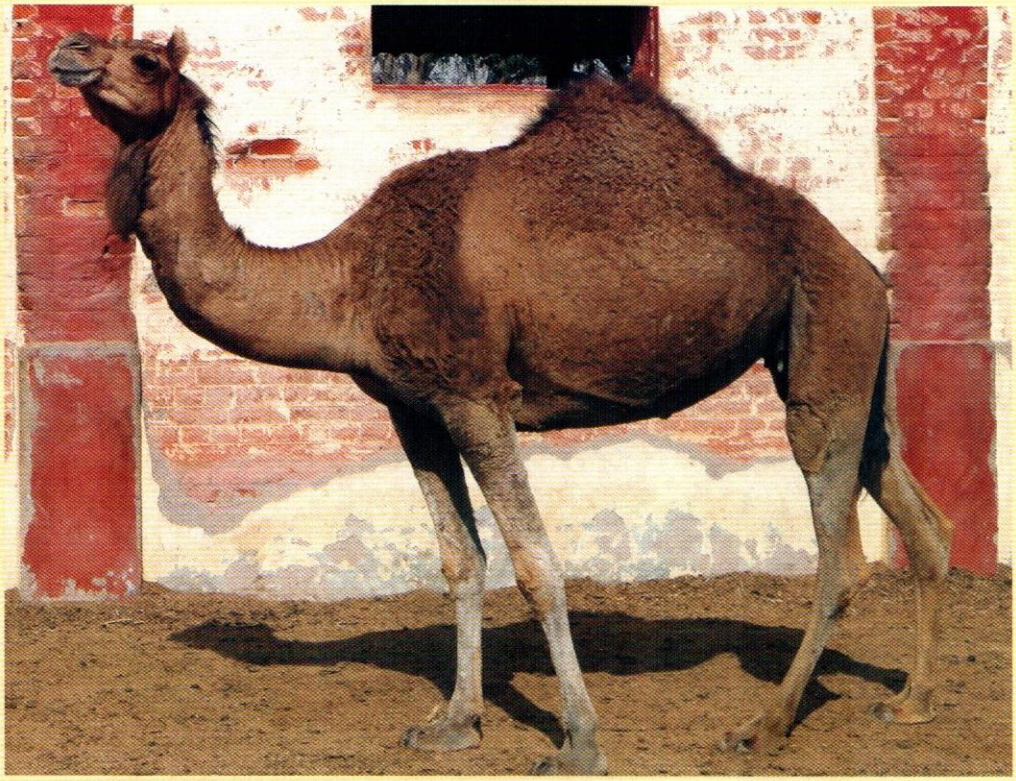


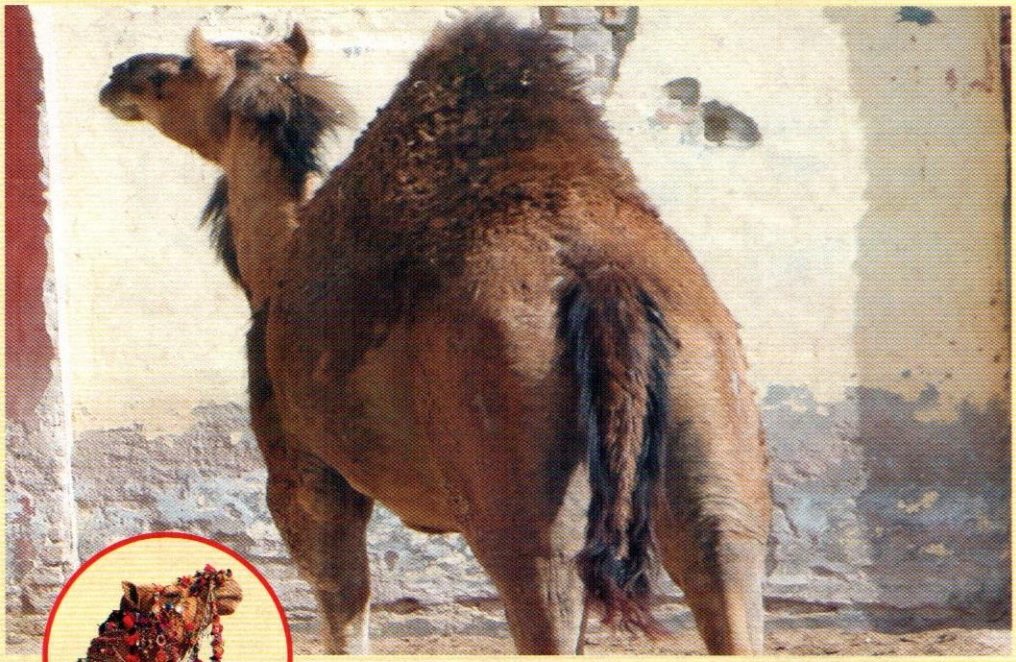


Hump with good development and rising to 10% higher than chest depth. Hump is still sculptured inwards on both sides and still fits over the chest and abdominal area.

Table-4 Characteristics of camel of BCS 4.

Ischial tuberosity	Visible, low quantity of fat
Sacrotuberal ligament	Flat to convexe
Ano-genital region	Slight hollow
Spinous apophyses	Slightly apparent
Coxal tuberosity	Slightly visible
Hollow of the flank	Very slight
Transverse apophyses	Sligthly visible
Rib	Invisible or slighly visble in front of thorax
Hump	Medium size hump

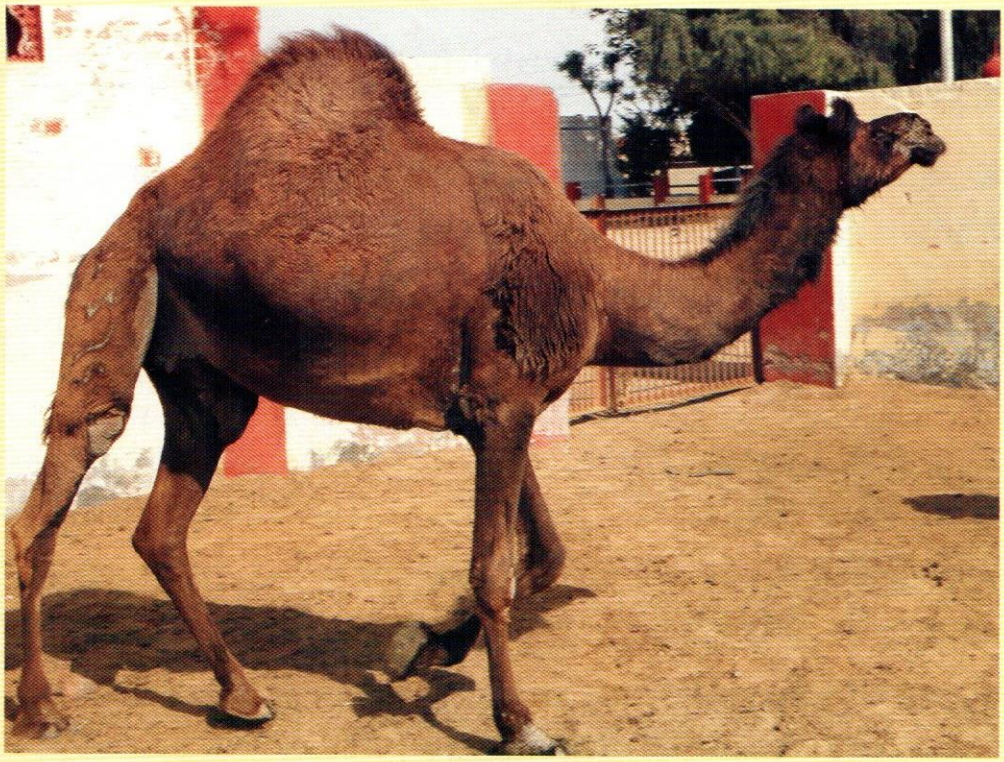


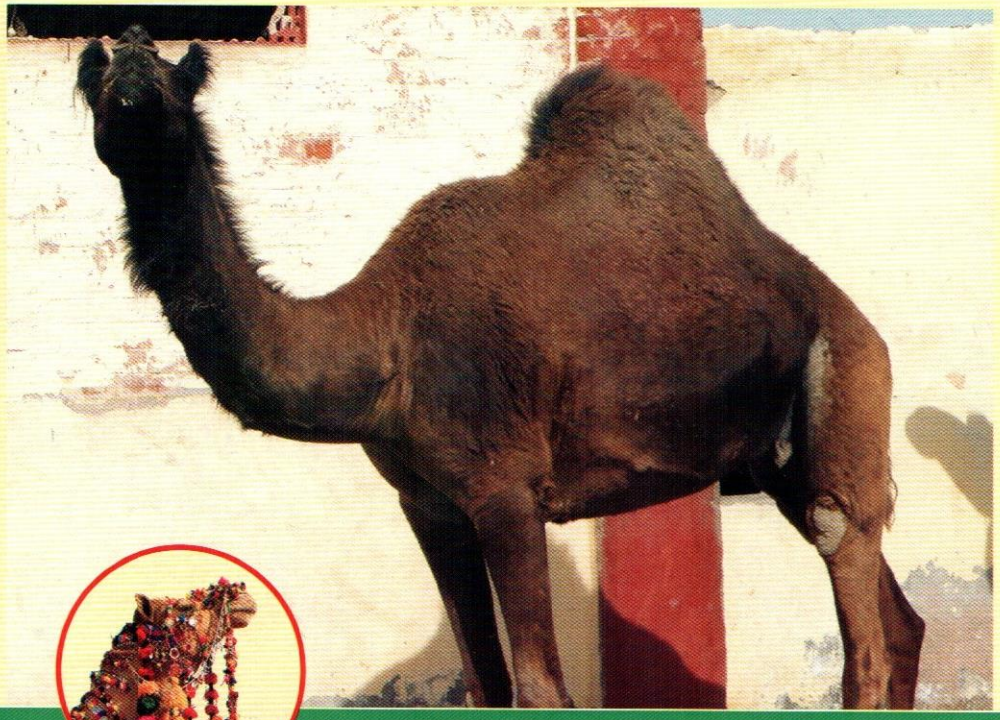


Hump fully developed and rising to 15% higher than chest depth .
Hump rounded outwards on both sides and runs from the shoulder to rump.

Table-5 Characteristics of camel of BCS 5.

Ischial tuberosity	Disapeared in fat
Sacrotuberal ligament	Convexe
Ano-genital region	The base of tai lis covered by fat
Spinous apophyses	Invisible
Coxal tuberosity	Invisible
Hollow of the flank	Invisible
Transverse apophyses	Invisible and rounded back
RIB	Visible Fat cover
HUMP	Very big hump covering all the back





Hump over-extended and rising more than 15% higher than chest or the hump is so full that it is rounded on the sides like a semi circle.

Chapter 7: Effect of Body Condition Score on Stress Hormone and Stress Biomarkers

Stress endocrines (T3, T4 and Cortisol), the key regulators in the organ function systems particularly role in controlling Basal Metabolic Rate, growth as well as development and differentiation of many cells in the body were studied in the male and female animals with different Physiological stages and BCS. These hormones not only influence the body condition score during extreme weather condition but also affect the reproduction and production performance. Presented in the table below:

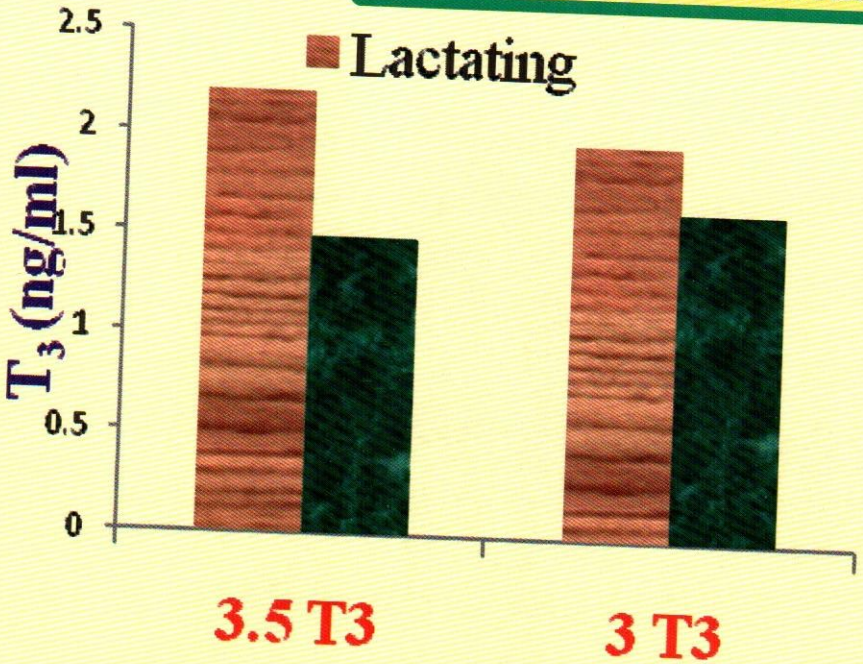
Parameters	Pregnant			Lactating		
BCS	BCS 3	BCS 3.5	Overall	BCS 3	BCS 3.5	Overall
T3(ng/ml)	1.6±0.22	1.5±0.31	1.6±0.19	2.0±0.16	2.2±0.13	2.1±0.10
T4(ng/ml)	133.3±14.13	173.3±20.0	153.3+12.24	157.9±10.4	140.0±8.52	148.9±6.7
Cortisol(ng/ml)	136.3±21.22	120.0±30.0	128.1±18.38	189.1±15.67	224.7±12.80	206.9±10.12

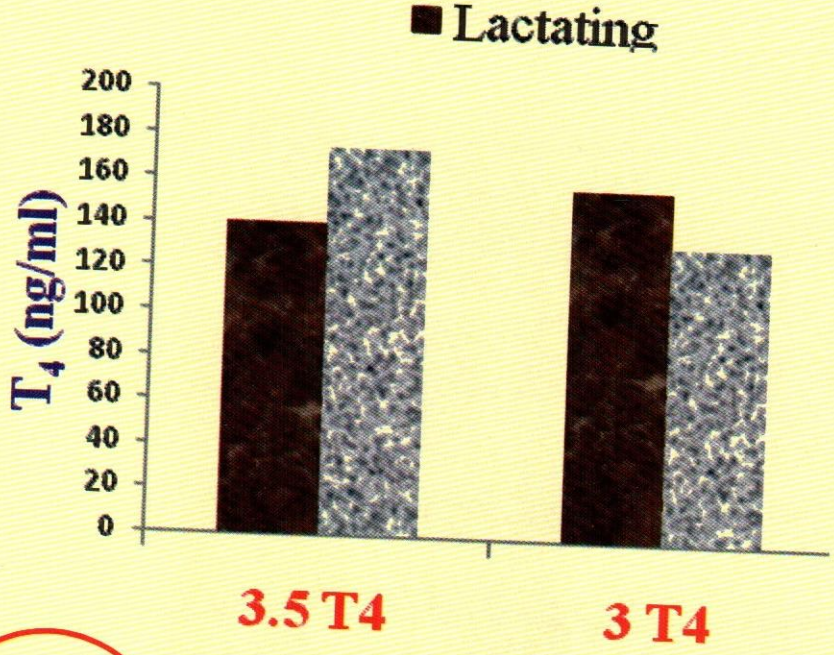
T3 and T4 increases the breakdown of fat(Lipolysis) and high level results in depletion of stores of body fat and fall in body weight and vice versa.

Biomarkers of oxidative stress: Malondialdehyde, catalase, reduced glutathione and plasma vitamin E were evaluated in pregnant, lactating and non pregnant non lactating Indian camels having BCS 3.5. Whole blood levels of Malondialdehyde (lipid peroxidation product) were significantly higher in pregnant camels (28.11±0.44 nanomol/ml) than the non-pregnant non -lactating (25.86 ±0.91 nanomol/ml). Levels of catalase (antioxidant enzyme) and reduced glutathione (antioxidant protein) were also lower in pregnant and lactating camels than the non pregnant non lactating camels. Study showed that levels of oxidative stress biomarkers are higher in pregnant and lactating camels than the control non lactating non pregnant camel.

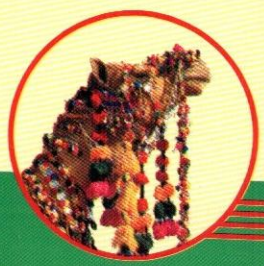
Biomarker of Oxidative Stress	Pregnant (N6)	Lactating(N5)	Non pregnant-non lactating
Malondialdehyde (nanomol/ml)	28.11±0.44*	26.08±1.40	25.86 ±0.91
Catalase (IU/ml)	3569 ±322*	3251 ±569*	5759±174
Reduced glutathione (mg/dl)	9.66 ±1.13*	10.44 ±1.58*	16.06±0.82
Plasma Vitamin E (mg/l)	2.31 ±0.42	2.75±0.29	3.00±0.13

***significant (P<.05) difference than the non pregnant non lactating camels.**





T3 and T4 increase the breakdown of fat (lipolysis), and high levels will result in a depletion of stores of body fat and a fall in body weight. Low levels of T3 and T4 will result in the opposite.



Chapter 8: Effect of Body Condition Score on Physiological, Haematological and Biochemical Parameters of Pregnant and Lactating Camel

Physiological Parameters						
Parameters	**Pregnant**			**Lactating**		
Physiological response	BCS3	BCS 3.5	overall	BCS3	BCS 3.5	overall
Temp.(0C)	37.7±0.11	37.5±0.15	37.6±0.10	37.7±0.08	37.7±0.07	37.7±0.05
Pulse rate(Pulse/minute)	60.8+0.67	59.9+0.88	60.3+0.55	58.8+0.50	59.0+0.40	58.9+0.32
Respiration rate(Breath/minute)	16.1±0.35	15.6±0.46	15.8±0.29	15.3±0.26	16.6±0.21	16.0±0.17
Blood Biochemical and Haematological Parameters						
Total Protein(g/dl)	8.1±0.32	704±0.46	7.8±0.28	7.5±0.24	7.7±0.20	7.6±0.15
Cholesterol(mg/dl)	34.9±3.18	38.9±4.5	36.9±2.76	44.9±2.35	47.8±1.92	46.4±1.52
Albumin(g/dl)	4.0±0.21	4.1±0.30	4.1±0.18	4.5±0.17	4.4±0.16	4.4±0.12
Glucose(mg/dl)	94.6±4.24	99.2±6.0	96.9±3.67	79.7±3.8	78.9±2.73	79.3±2.34
Creatine(mg/dl)	1.6±0.05	1.4±0.08	1.5±0.05	1.4±0.05	1.4±0.03	1.4±0.03
Haemoglobin(g/dl)	11.8±0.13	12.3±0.18	12.0±0.11	12.6±0.09	13.0±0.08	12.8±0.83
PCV(%)	36.4±1.74	38.7±2.47	37.5±1.51	40.3±1.29	43.5±1.05	41.9±0.83
Blood Counts						
TEC($x10^6$/µl)	8.0±0.07	8.1±0.09	8.1±0.06	8.3±0.05	8.4±0.04	8.3±0.03
TLC($x10^3$/µl /µl)	136.3±8.94	120.0±12.65	128.1±7.74	118.0±6.60	121.1±5.3	120.5±4.2
DLC(%)						
Neutrophils	34.0±0.83	33.3±1.18	33.7±0.72	32.5±0.61	32.2±0.50	32.3±0.40
Lymphocytes	59.6±1.88	63.3±2.66	61.5±1.63	59.6±1.39	57.7±1.14	58.6±0.90
Monocytes	2.4±0.26	2.7±0.37	2.5±0.23	2.4±0.19	2.5±0.16	2.5±0.12
Eosinophil	3.5±0.3	4.2±0.42	3.8±0.26*	3.1±0.22	3.1±0.18	3.1±0.14*
Basophil	0.7±0.15	1.0±0.21	0.8±0.13	0.5±0.11	0.3±0.09	0.4±0.007

Chapter 9: Effect of Body Condition Score on Mineral Profile of Pregnant and Lactating Camel

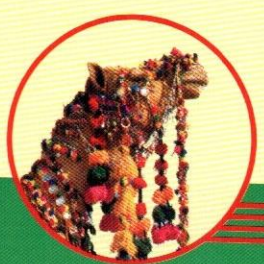
The study was carried out to generate first hand information about normal plasma concentration of sodium, potassium, phosphorus, ionized calcium, total calcium, magnesium and chlorides in Indian she camels in early lactating, late lactating and pregnant stages . Mean values of plasma concentrations of sodium, potassium, phosphorus, ionized calcium, total calcium, magnesium and chlorides in pregnant camels were 158.58 $mEq.L^{-1}$, 4.31 $mEq.L^{-1}$, 4.75 mg/dl, 5.15 mg/dl, 10.04 mg/dl, 2.09 mg/dl and 119.18 $mEq.L^{-1}$, respectively. While mean values of plasma levels of sodium, potassium, phosphorus, ionized calcium, total calcium, magnesium and chlorides in lactating camels in early lactation were 160.74 $mEq.L^{-1}$, 4.45 $mEq.L^{-1}$, 3.91 mg/dl ,5.25 mg/dl, 10.24 mg/dl, 1.90 mg/dl and 119.18 $mEq.L^{-1}$, respectively. Range of plasma levels of ionized calcium and total calcium was narrow but there was significant difference among early lactating, late lactation and pregnant she camels; higher level of plasma calcium was found in early lactation than the pregnant and late lactation stages. However, no significant difference was observed in values of magnesium, phosphorus, sodium and potassium among three physiological stages. Plasma chloride levels in camels in late lactation stage was significantly low than the camels in early lactation and pregnant camels.

Mineral profiling of lactating and pregnant animals with different BCS:

Parameter	Early Lactation Mean±SE (Range) N=10	Late Lactation Mean±SE (Range) N=8	Dry and Pregnant Mean±SE (Range) N=10	P Values
Sodium (mEq.L$^-$)	160.74 ±0.68 (156.80-163.70)	159.58 ±0.36 (158.50-161.40)	158.40 ±0.96 (155.50-162.40)	0.09
Potassium (mEq.L$^-$)	4.45 ±0.06 (4.17-4.80)	4.22 ±0.09 (3.94-4.50)	4.31 ±0.07 (4.10-4.64)	0.09
Magnesium (mg/dl)	1.90 ±0.07 (1.43-2.20)	2.12 ±0.14 (1.71-2.77)	2.09 ±0.21 (1.49-3.82)	0.52
Ionized Calcium (mg/dl)	5.25 ±0.02 (5.12-5.36)	5.15 ±0.02 (5.08-5.20)	5.15 ±0.03 (5.04-5.28)	0.01
Total Calcium (mg/dl)	10.24 ±0.04 (10.00-10.48)	10.04 ±0.05 (9.88-10.16)	10.04 ±0.05 (9.84-10.28)	0.01
Phosphorus (mg/dl)	3.91 ±0.32 (2.16-5.12)	4.72 ±0.14 (4.02-5.14)	4.75 ±0.43 (3.0-7.3)	0.14
Chlorides (mEq.L$^-$)	118.38 ±0.37	115.29 ±0.20	119.18 ±0.82	0.00

Chapter 10: Mating Behavior of one Humped in Relation to Body Condition Score

Mating Behaviour of one humped camel in relation to body condition score was studied: A total of 12 breading bulls having body condition Score between 3.0 and 3.5 were nominated for breeding and mating of she Camel (n=72) having BCS between 2.5 to 4.0. The period of mating was from December to March, 2011. The number of females used per bull ranged from 3 to 9. The conception mating ranged from 1 to 4. The number of services per conception was a bit higher due to variation of weather during this period of observation. Males showed physical changes and also negative changes in body weight during this period exceptionally a few whose frequency of mating was restricted. This may be adaptability of males for mating purpose. The females having exceptionally high body condition score were found to be inconvenient for mating and bulls were reluctant to mount such females. The females having BCS between 2.5 and 3.5 were comfortable due to prominance of coxial and Ischial tuberocity prominance leading to locking of chest pad between these and rear side of hump. High Fat deposits of hump interfere with copulation since chest pad locking and fore limb grip in squating positions during the action resulted in difficult proximity between individuals. The critical observations (visuals) on behavior showed sniffing at genital region, urination, violent ejection of soft-palate from side of mouth, gapped apart hind limb with high frequency of vigorous vibrating tail wetted with urine splashing on body parts was common in almost all the males when females approach them. Highly aggressive rutting males even attack their controlled contemporary males. Before mating is initiated receptive females comes in recumbent position and bull camel squat dog like position. Completion of Copulation takes place from 5 to 12 minutes. Repeated mounting and demounting.



Chapter 11: Conclusions

- BCS 3 is optimal score(BCS) for production and reproduction.
- Non significant changes in the Physiological and blood hematology parameters indicates that camels are resilient to climatic changes.
- Interior Milieu of Cortisol stress hormone, T3, T4 increase the breakdown of fat (lipolysis), and high levels will result in a depletion of stores of body fat resulting in fall in body weight and BCS.
- Diseased condition of animals lead to drastic reduction in BCS.

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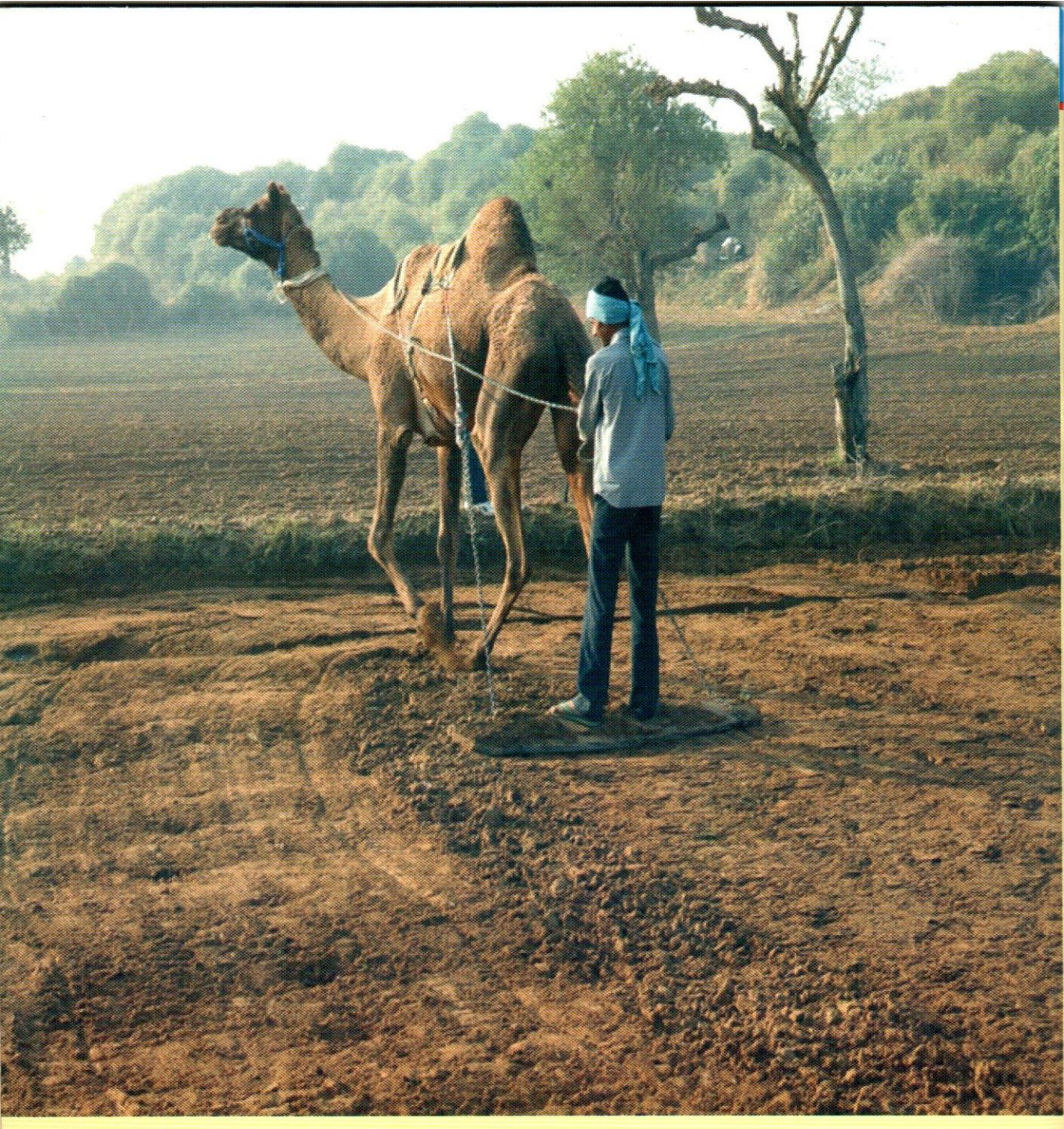

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