वार्षिक प्रतिवेदन
ANNUAL REPORT 2003-2004

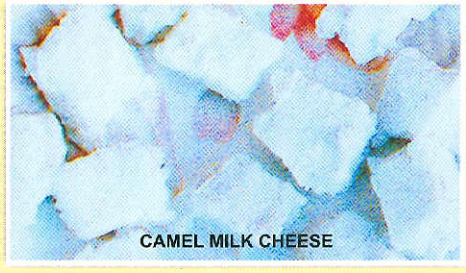
NRCC


CAMEL MILK
KARABH KESAR KULFI


CAMEL MILK
CHEESE PAKORA

FLAVOURED MILK

FLAVOURED LASSIE


CAMEL MILK CHEESE

राष्ट्रीय उष्ट्र अनुसंधान केन्द्र
जोरबीड़, बीकानेर – 334 001 (राज.)

NATIONAL RESEARCH CENTRE ON CAMEL
JORBEER, BIKANER - 334 001 (RAJASTHAN)

July- 2005

Published by
Dr. M.S. Sahani, Director
NRC on Camel, Bikaner-334 001

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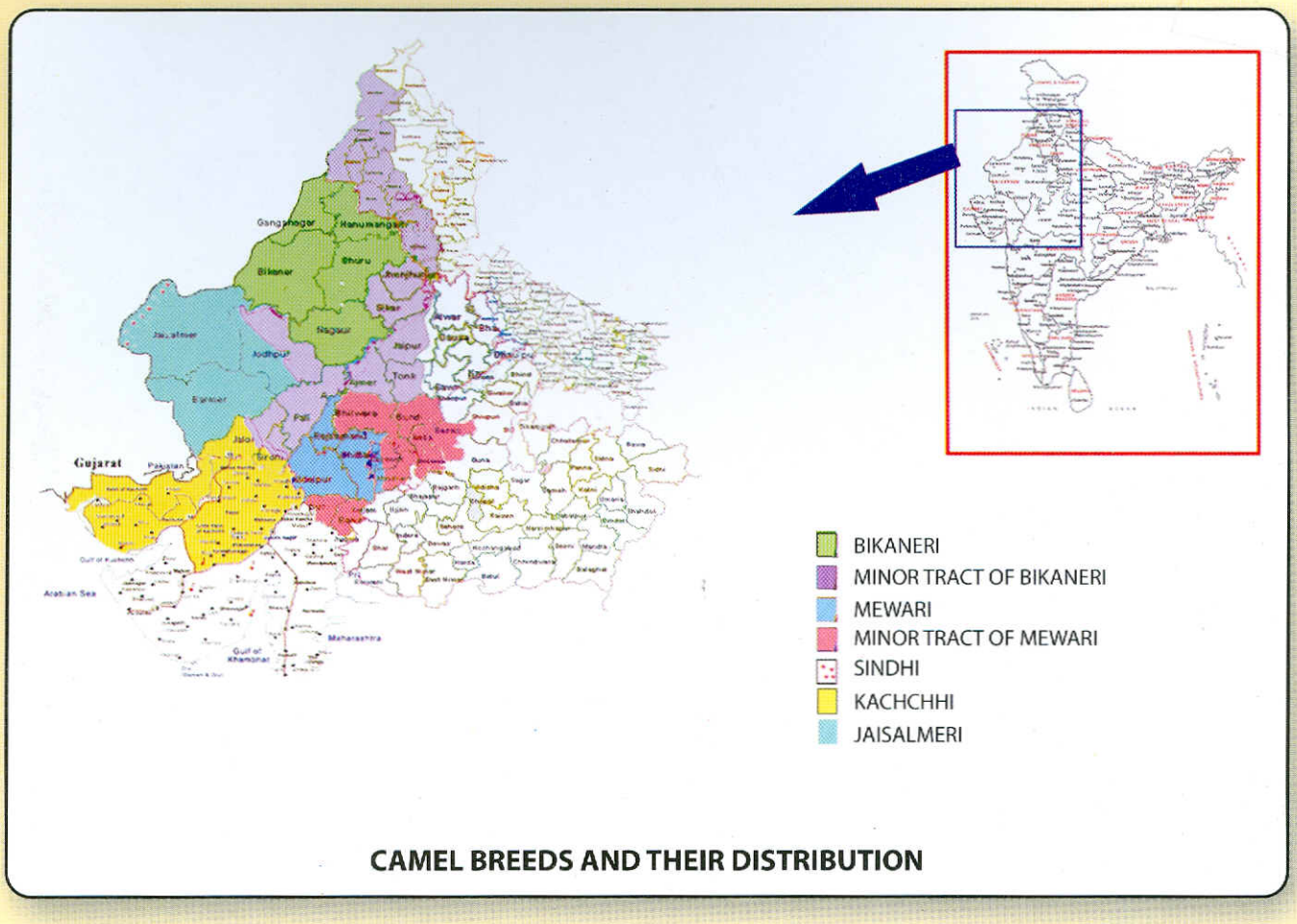

CAMEL BREEDS AND THEIR DISTRIBUTION

Printed by
R.G. Associates
Bikaner-334 001
Ph.: 0151-2527323

Hindi Abstract
Sh. Nemi Chand

Computer Assistance
Sh. Dinesh Munjal
Sh. Rajesh Kumar Sharma

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ICAR

वार्षिक प्रतिवेदन
ANNUAL REPORT
2003-2004

निदेशक : डॉ. एम.एस. साहनी
Director : Dr. M.S. Sahani

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CONTENTS

PREFACE

Although recent statistics indicate swift decline in camel population not only in India but in other Asian countries also. The major reasons for drop are continuous loss of pasture lands with simultaneous increase in irrigated area cropping both under canal and tube wells, restriction of grazing by fencing of land under tube wells near villages and rapid mechanization but camel still play the crucial role for making use of desert. The unique adoptive system of camel under hot arid system and less water requirement make this animal most ideal for the 30 per cent small/marginal farmers and land-less laborers of the area. For future sustainability of camel in addition to its main contribution in draught, possibilities are explored to increase utility of camel milk. Considering its beneficial role of high shelf life, cost effective production, longer lactation, priority was given to camel milk products and its therapeutic importance. I feel immense happiness in presenting the Annual Report 2003-04 which highlights the important research achievements under the ongoing research projects, training, extension activities and refinement of technologies developed with regard of camel milk products and electrification of traditional two wheel camel cart. As per the recommendation of Research Advisory Comittee & Vision 2020 major emphasis was given for applied and collaborative research, immediate and confirmatory diagnosis of important disease and its prophylaxis etc.

Training activities of centre were further strengthened for the B.Sc and PG students from various colleges in the field of Biotechnology and Microbiology. It seems that research on therapeutic importance of camel milk against diabetes and tuberculosis has started showing positive impact among the patients as evidenced by the demand. Human resource development formed priority component for all categories of staff. Inter institutional collaboration was extended with Zaloma Institute, Agra. Infrastructure achievement includes speed progress in construction of Office cum Library building and other works which were completed are Small Animal House cum Laboratory, children park, new road , fodder godown and dipping tank in farm area.

The revenue generation as on the monitorable target has been further improved during the year through promoting training programmes and increased facilities for tourists turnover. I appreciate the dedicated and team spirit of the scientists, technical, administrative and supporting staff in achieving the goals.

At this occasion I also acknowledge the support and guidance received from Dr. Mangla Rai, Director General, ICAR & Secretary DARE, Govt of India, Dr. V. K. Taneja, Deputy Director General (Animal Sciences), Dr. O. P. Dhanda, Assistant Director General (Animal Nutrition & Physiology), Scientists of Animal Science Division and officers from various other divisions of ICAR headquarter in effective implementation of activities.

(M.S. Sahani)
Director

1. सारांश

राष्ट्रीय उष्ट्र अनुसंधान केन्द्र : एक संक्षिप्त परिचय

राष्ट्रीय उष्ट्र अनुसंधान केन्द्र की स्थापना 5 जुलाई, 1984 को हुई। उष्ट्र अनुसंधान केन्द्र के रूप में स्थापित होने से पहले उष्ट्र प्रजनन फार्म के नाम से परिचित यह केन्द्र पशुपालन विभाग (राजस्थान सरकार) एवम् पशु–चिकित्सा एवं पशु विज्ञान महाविद्यालय (राजस्थान कृषि विश्वविद्यालय) बीकानेर के देखरेख में रहा। देश के उत्तर–पश्चिमी शुष्क और अर्ध–शुष्क भू–भागों के विकास में इस प्रजाति के महत्व को देखते हुए भा.कृ.अ.प. द्वारा बीकानेर के जोड़बीड़ क्षेत्र में इस केन्द्र की स्थापना की गयी। समय के साथ केन्द्र ने अनुसंधान के क्षेत्र में विश्व–स्तर पर अपनी पहचान बनाई है। आज केन्द्र में आधुनिक प्रयोगशालाएँ तथा अनुसंधान की सभी आधारभूत सुविधाएं उपलब्ध हैं। इस अवधि के दौरान केन्द्र ने ऊँटों से सम्बन्धित विभिन्न पहलुओं पर ठोस वैज्ञानिक आँकड़े व तकनीकी विकसित की हैं।

इस वर्ष के दौरान केन्द्र पर ऊँटों की कुल संख्या 225 थीं। विभिन्न आयु वर्ग के इन सभी ऊँटों में मुख्यतः बीकानेरी, जैसलमेरी व कच्छी नस्ल के थे।

संगठनात्मक स्वरूप

केन्द्र में उष्ट्र फार्म इकाई, अनुसंधान प्रयोगशालाएं, चर भूमि, आवासीय खण्ड और अतिथि गृह सहित 689 हेक्टेयर भूमि है। वर्ष 2003–04 के दौरान विभिन्न वर्गों के अन्तर्गत स्वीकृत पदों की संख्या 76 थी। जिनमें निदेशक 1, वैज्ञानिक 25, तकनीकी 21, प्रशासकीय 10 तथा 19 सहायक कर्मचारीगण सहित 65 कर्मचारी कार्यरत रहे।

बजट

वितीय वर्ष 2003–04 के योजना मद में 209.80 व गैर योजना मद में 137.47 लाख रूपये की धनराशि स्वीकृत की गई।

अवसंरचनात्मक विकास के अन्तर्गत ही केन्द्र के पुस्तकालय को और अधिक आधुनिक व सम्पन्न बनाया गया। जिसमें इस वर्ष 962 हिन्दी पुस्तकें तथा 83 पुस्तकें विज्ञान आदि विषय से सम्बन्धित की खरीद की गई। वर्ष के दौरान कुल 1045 पुस्तकों की खरीद की गई। वर्तमान में केन्द्र के पुस्तकालय में कुल 2853 पुस्तकें उपलब्ध है।

4. अनुसंधान गतिविधियाँ

4.1 शुष्क एवम् अर्द्धशुष्क परिस्थितियों में ऊँटों की कार्यक्षमता में सुधार

पारम्परिक व उन्नत किस्म के ऊँट चालित कृषि उपकरणों पर अध्ययन–

इस परियोजना में 4 पूर्णतया प्रशिक्षित वयस्क ऊँटों पर खरीफ फसल के समय शोध कार्य किया गया। शोध में प्रयुक्त ऊँटों को 6 डिस्क हेरो व दुफाली हल को खींचने के दौरान प्रकट लक्षणों का तुलनात्मक मूल्याकंन करने पर पाया कि 6 डिस्क हेरो को एक ऊँट एक घंटे तक लगातार खींच सकता है तथा इसकों खींचने में उसे अधिक बल लगाना पड़ता है, जबकि दुफाली हल को एक ऊँट 4 घंटे लगातार खींच सकता है व 3–4 घंटे के आराम के पश्चात् फिर उसी गति से कार्य कर सकता है। दुफाली हल, खींचने में 6 डिस्क हेरो की अपेक्षा हल्का होता है।

ऊँटनी के दुग्ध प्रोटीन का मूल्यांकन एवं उपयोगिता

ऊँटनी के दुग्ध को विभिन्न ताप पर जैसे– 40° से., 70° से., व 80° से. पर 5 मिनट गरम कर लैक्टोपरआक्सीडेस की कार्यप्रणाली मापी गई जिसमें 40° से. पर 2.23± .001 यूनिट प्रति मि.ली. रही जबकि 70° से. पर 1.00 और 80° से. पर .07 यूनिट प्रति मिली लीटर कम हुई।

उष्ट्र दुग्ध इन्सुलिन

ऊँटनी के दूध में कच्ची अवस्था, कम ताप पर अधिक समय, अधिक ताप पर कम समय तथा उबले हुए दूध में इन्सुलिन नामक हारमोन की मात्रा का अध्ययन यह दर्शाता है कि उबले हुए दूध में इसका ह्रास सबसे अधिक होता है। यद्यपि कम ताप पर अधिक समय रखने से इन्सुलिन की मात्रा का ह्रास अपेक्षाकृत कम होता है लेकिन अन्य व्यावहारिक कारणों से इन्सुलिन की मात्रा को बनाये रखने के लिए उच्च ताप कम समय विधि से दूध का पास्चुरीकरण उपयुक्त रहेगा।

उष्ट्र लैक्टोफेरीन

कैमल लैक्टोफेरीन को शोधित किया गया तथा दूधारू ऊँटनियों से कॉलेस्ट्रॉल देखा गया। एपो और संतृप्त लैक्टोफेरीन शोधन का कार्य जैव भौतिकी विभाग, एम्स, नई दिल्ली की मदद से किया गया। रोग जनक जीवाणु के सन्दर्भ में प्रति जीवाणुक गुण धर्म का अध्ययन जारी है।

4.2– भारतीय नस्ल के ऊँटों में आनुवंशिक गुणों का निर्धारण, मूल्यांकन एवम् संरक्षण

ऊँटों की भारवहन क्षमता में सुधार लाने हेतु किये गए शोध कार्य के अन्तर्गत बीकानेरी (7), जैसलमेरी (5) एवं कच्छी (2) नस्लों के ऊँटों का मुख्यता उनकी शारीरिक लम्बाई के आधार पर चयन करते हुए उनका शारीरिक माप लिया गया तथा पाया कि ऊँटों की भारवहन क्षमता पर शारीरिक लम्बाई एवं सम्बन्धित चिन्ह का सह–सम्बन्ध दो समूहों की शारीरिक लम्बाई, हृदय घेर तथा ऊँचाई में भिन्नता का पता लगाने हेतु न्यूनतम वर्ग विश्लेषण में अन्तर ज्ञात किया गया। प्रजनन कार्य योजना के अन्तर्गत प्रजनन योग्य मादाओं की वंशावली तैयार की गई तथा केन्द्र के ऊँटों के टोले हेतु प्रजनन सम्बन्धी कुछ सुझाव दिए गए।

ऊँटों के गुणात्मक एवं मात्रात्मक विश्लेषण पर शोध में पाया कि नस्ल का 9, 12 तथा 24 महीनों की आयु में सार्थक प्रभाव रहता है तथा लिंग का प्रभाव नहीं पड़ता है।

जनन क्षमता पर अनुसंधान के अन्तर्गत ऊँटों के समूहों में समागम एवं वत्स–जनन संबंधी वर्ष 2000 से 2004 तक के आँकड़े विश्लेषित किये गये। इस वर्ष वत्स–जनन 75.86 प्रतिशत रही जो कि बीकानेरी नस्ल (77.77 प्रतिशत) में कच्छी नस्ल (75.00 प्रतिशत) तथा जैसलमेरी (71.43 प्रतिशत) नस्ल की तुलना में अधिक आँकी गई।

प्रथम गर्भधारण औसतन आयु 1796.07±80.62 दिन आंकी गई। गर्भधारण करने की न्यूनतम आयु कच्छी नस्ल में 1685.38±152.80 दिन एवं तथा जैसलमेरी में 1930.71±115.51 दिन आँकी गयी।

अप्रैल 2002 – मार्च 2004 के दौरान 10 बीकानेरी, 8 जैसलमेरी एवं 3 कच्छी तथा एक अरब संकर नस्ल ऊँट की मृत्यु हुई। जिनमें 50 प्रतिशत पाचन तन्त्र व 40.90 प्रतिशत श्वसन तन्त्र सम्बन्धी विकारों के कारण हुई। परियोजना के अन्तर्गत दुग्ध उत्पाद, नस्ल सुधार, डाटाबेस निर्माण, बाल उत्पादन, भारतीय नस्ल के ऊँटों में बाल उत्पादन आदि पर कार्य किया गया।

माइक्रोसेटेलाईट चिन्हों से ऊँटों की नस्लों के आनुवंशिक निर्धारण के अन्तर्गत 13 चिन्ह बहुरूपिक पाये गये। जिनमें

बीकानेरी एवम् जैसलमेरी में एलील 2 से 7 पाये गये। प्रयोग से पता चलता है कि इस तकनीक में ऊँट की नस्लों की आनुवंशिक बहुरूपता / चरित्रण की अच्छी क्षमता है।

4.3 ऊँटों की जनन क्षमता में सुधार और जनन अक्षमता के कारणों पर अध्ययन

मादा ऊँटनियों में प्रजनन पश्चात् एक माह तक प्रतिदिन एकत्रित किये गये रूधिर प्लाज्मा नमूनों में प्रोजेस्टेरान हारमोन का मात्रात्मक अध्ययन यह दर्शाता है कि संगम पश्चात् ग्याभिन तथा गर्भधारण न करने वाले मादा ऊँटनियों में छठे दिन से प्रोजेस्टेरान हारमोन की मात्रा में वृद्धि दिखाई देने लगती है, जो दोनों वर्ग की ऊँटनियों में अगले 4 (अर्थात् दिन 10) तक एक समान प्रतीत होती है। ग्याहरवें दिन और उसके पश्चात् गर्भधारण न करने वाली ऊँटनियों में प्रोजेस्टेरोन की मात्रा में यकायक तेजी से कमी देखने को मिलती है, जबकि ग्याभिन ऊँटनियों में प्रोजेस्टेरान की मात्रा में वृद्धि होती जाती है ।

ग्याभिन ऊँटनियों के गर्भावस्था के पश्चकाल व ब्याहत अवधि के इर्द–गिर्द समय पर प्रोजेस्टेरोन हारमोन का मात्रात्मक विश्लेषण यह दर्शाता हैं कि यह पश्चकाल में 3–13 नेनोग्राम प्रति मिली तक रहता है। ब्याहत अवधि के दौरान इसमें कमी आंकी गयी है तथा ब्याहते समय इसकी औसत कम होकर मात्रा 1.5–1.6 नेनोग्राम प्रति मि.ली. आंकी गयी है।

ऊँटों के वीर्य का परिरक्षण एवं कृत्रिम गर्भाधान विकास के अन्तर्गत वीर्य एकत्रण हेतु 12 से अधिक नर ऊँटों को चुना गया। वीर्य परीक्षण के दौरान यह देखने में आया कि ताजा उष्ट्र वीर्य, वीर्य विस्तारक के साथ मिश्रित नहीं होता जिससे कि वीर्य विस्तारक में वीर्य की परत ऊपर तैरती हैं। उष्ट्र वीर्य को तरल नाइट्रोजन गैस में उसके मूल्यांकन के उपरांत सफलतापूर्वक प्रशीतन किया गया।

मादा ऊँटनियों में अण्ड स्फूटन एवं गर्भ धारण दर का नर मादा संगम के समय मादा के अण्डाशय में स्थित ग्राफियन फॉलिकल के आकार संबंधी अध्ययन किया गया।

ब्याहत पश्चात् ऊँटनियों में जल्दी (40–45 दिन के उपरान्त) गर्भाधान किया जा सके, इस हेतु आठ ब्याही ऊँटनियों के अण्डाशयों की सोनोग्राफी जाँच में पाया गया कि पाँच में स्फूटन अवस्था के फॉलिकल मौजूद थे। उन पाँचों मादा ऊँटनियों को नर के साथ संगम क्रिया कराने पर दो ने गर्भधारण किया।

ब्रुसेलोसिस नामक संक्रमण के स्क्रीनिंग परीक्षण हेतु रोज बेन्गाल परीक्षण की सहायता से केन्द्र के ऊँटों के 213 रूधिर सीरम नमूनों की जाँच की गयी, जिसमें पाया गया कि कोई भी नमूना ब्रुसेलोसिस से संक्रमित नहीं था, जो केन्द्र के ऊँट टोले के इस संक्रमण से मुक्त होने को इंगित करता है। नर ऊँटों में यौवन को प्रभावित करने वाले जैव–रसायनिक एवं हार्मोनल कारकों का अध्ययन किया गया।

4.4 शुष्क और अर्द्ध–शुष्क पारिस्थितिकी में विभिन्न उष्ट्र प्रबन्धन विधियों का आर्थिक स्तर पर अध्ययन

सिंचित व असिंचित क्षेत्रों में ऊँटों की बीमारियों के सर्वेक्षण कार्य के दौरान 167 उष्ट्र–पालकों से जानकारी प्राप्त की गई। आँकड़ों के अनुसार सन् 1998–2001 की अपेक्षा खुजली रोग का प्रकोप 2002–03 में कम पाया गया। जबकि पिछले वर्ष की तुलना में तिबरसा नामक रोग का प्रकोप इस वर्ष बढ़ा हुआ पाया गया। तिबरसा की भाँति ही आहार तन्त्र को प्रभावित करने वाले रोगों में वृद्धि आँकी गयी। सिंचित क्षेत्रों की प्रमुख बीमारियां–तिबरसा व श्वास रोग अंकित किये गये जबकि असिंचित क्षेत्रों में आहार सम्बन्धी विकार प्रमुख थे। ऊँटों में बीमारियों से ग्रसित होने की प्रबलता वर्षा ऋतु के दौरान अधिक रहती है। अधिकांश ऊँट पालक, ऊँटों की बीमारियों के पारम्परिक ईलाज को अधिक महत्व देते है। खुजली रोग का पारम्परिक ईलाज

आयुर्वेदिक उपचार की तुलना में सस्ता पड़ता है। जबकि सर्रा रोग के आयुर्वेदिक उपचार पारम्परिक ढंग के ईलाज से सस्ता पड़ता है। इसका कारण सर्रा के ईलाज हेतु दवाईओं का गलत चयन करना व गलत पद्धति से ईलाज करना हैं।

4.5 उष्ट्र बीमारियों का पर्यवेक्षण, निगरानी एवं नियन्त्रण

पीसीआर की संवेदनशीलता पर तुलनात्मक अध्ययन व ट्रिपैनोसोमासिस के निदान हेतु सीरमीय परीक्षण के अन्तर्गत प्राइमर युगल (21 मरसेन्स व 22 मरसेन्स) प्रयुक्त करते हुए जब डीएनए का सकारात्मक नियन्त्रण हेतु विस्तारण किया गया तो 227 बीपी का एकल बैंड प्रकट हुआ।

कुल 79 रक्त नमूनों का विश्लेषण किया गया। इससे 34 नमूनों (43 प्रतिशत) में संक्रमण स्तर कुछ अधिक देखा गया। कुछ नमूनों में प्रतिरक्षी स्तर उच्च था परन्तु पीसीआर विस्तारण में कोई सकारात्मक चिन्ह प्रकट नहीं हुए। इसके अलावा 21 नमूनें पीसीआर विस्तारण में सकारात्मक पाये गए।

ऊँटों की मिंगनियों में परजीवी अण्डों का अध्ययन यह दर्शाता है कि नियोजित ऊँट फार्म या घरों में रखे जाने वालों में ऊँटों की मिंगनियों के क्रमशः 32.36 व 47.63 प्रतिशत नमूनों में परजीवी अण्डे पाए गये। नियोजित फार्म में निमेटोडाइरस नामक हेल्मिन्थ परजीवी जबकि घरों में रखे जाने वाले ऊँटों में हेमन्कस संक्रमण प्रमुख थे। जुलाई से अक्टूबर तथा मानसून पश्चात की अवधि में परजीवी संक्रमण पनपने हेतु अपेक्षाकृत उपयुक्त वातावरणीय परिस्थितियां रहती है।

भारतीय चिकित्सा पद्धति द्वारा ऊँटों में त्वचीय उपचार

ऊँटों में खुजली (पांव) रोग के उपचार हेतु ज्यादातर बाजार में उपलब्ध रासायनिक दवाईयों को काम में लेने वालों की समस्याओं को कम करने के लिए केन्द्र में तीन समिश्रित औषधियां तैयार की गई तथा जिनका तीन चरणों में प्रायोगिक ऊँटों पर विभिन्न समय अन्तराल पर बाह्य रूप से लेपन किया गया। केन्द्र पर किये गये प्रारम्भिक प्रयोगों के उत्साहवर्धक परिणाम प्राप्त हुए हैं। अब इन्हीं दवाओं का परीक्षण किसानों के ऊँटों पर स्थानीय पशु चिकित्सालयों के माध्यम से किया जा रहा है। तीन मिश्रिणों में से दो मिश्रणों (एफ1– एफ2) में खुजली मिटाने की उपयुक्त क्षमता आँकी गयी है। इसके अलावा द्वितीय मिश्रण (एफ2) में अन्य त्वचीय रोगों (दाद इत्यादि) के उपचार की भी अतिरिक्त उपयुक्तता पायी गई हैं। विभिन्न सूक्ष्म जीवाणुओं व चमड़ी रोग फैलाने वाले कीटाणुओं के विरूद्ध प्याज, लहसुन व नींबू के रसों के प्रयोगशालीय परीक्षण में प्रतिजैविक क्षमता के परिणाम उत्साहवर्धक रहे।

ऊँटों के थनैला रोग पर अध्ययन

थनैला रोग के अन्तर्गत केन्द्र की 6–12 वर्ष तक की आयु की 37 दुधारू ऊँटनियों से 148 दुग्ध नमूनें लिए गए। शोध के अन्तर्गत थनैला रोग से ग्रसित वे ऊँट जिनमें स्ट्रेटोकोकाई अथवा कोराइनीबैक्टीरियल संक्रमण उपस्थित था, को एमोक्सीसिलीन व क्लोक्सासिलीन संयुक्त औषधि देने पर शत–प्रतिशत लाभ आंका गया जबकि स्टेफिलोकोकस संक्रमण से ग्रसित ऊँटनियों में इस औषधि की प्रभाविता केवल 42.85 प्रतिशत आंकी गयी। इस प्रकार के संक्रमण में इन प्रति जैविक औषधियों के साथ लेवामिसॉल तथा विटामिन–ई व सेलेनियम जैसी औषधियों को देने से उपचार की प्रमाणिकता 42.85 प्रतिशत से बढ़कर 77.78 प्रतिशत हो गयी।

ऊँटनी के दूध द्वारा मधुमेह रोग (टाईप – 1) पर नियंत्रण

मधुमेह (टाईप – 1) के नियंत्रण में ऊँटनी के दूध की उपयोगिता पर शोध के अन्तर्गत चूहों को अलग–अलग समूहों में

बाँटते हुए अलग–अलग अवधि के आँकडे लिए गए। स्ट्रेप्टोजोटोसिन नामक रसायन का इन्जेक्शन देकर चूहों में कृत्रिम रूप से मधुमेह उत्पन्न कर ऊँट व गाय का कच्चा दूध पिलाया गया तथा पाया कि ऊँटनी का कच्चा दूध पिलाये जाने वाले चूहों में गाय का कच्चा दूध पिलाये जाने वाले चूहों की तुलना में रक्त शर्करा प्रबन्धन था। ऊँटनी के दूध को गर्म करके पिलाने पर उसका यह औषधीए गुण काफी कम हो गया।

केन्द्र में उपलब्ध 232 ऊँटों का टयूबरोकुलिन परीक्षण तथा ऊँटों में इसका हैमोटोलोजिकल प्राचल के साथ सह–सम्बन्ध के अन्तर्गत शोध कार्य किया गया। इसके अन्तर्गत यह कहा जा सकता है कि टयूबरोकुलिन परीक्षण ऊँटों में विश्वास योग्य है परन्तु अधिक देखभाल तथा संक्रमण को देखते हुए इसमें भ्रान्ति उत्पन्न करते हैं। इस सन्दर्भ में अभी गहन अनुसंधान किया जाना आवश्यक है।

राष्ट्रीय कृषि तकनीकी परियोजना के तहत अनुसंधान योजनाएं

ऊँटनी एवं बकरी के दूध एंव दुग्ध उत्पाद के स्वः जीवन में सुधार

उष्ट्र सुगन्धित दूध

उष्ट्र दूध को पीने में और अधिक रूचिकर बनाने एवं इसकी उपयोगिता तथा बिक्री बढ़ाने के प्रयोजन से ऊँटनी के दूध को सुगन्धित दूध के रूप में तैयार करते हुए इसे सफलतापूर्वक मानकीकृत किया गया। इसे बनाने हेतु विभिन्न सुगन्धों – केसर, पाइनेपल, वनीला, चाकलेट व पीला रंग, गुलाबी एवं पीला, गुलाबी व पिंक वर्णों का उपयोग करते हुए ऊँटनी के दूध को सुगन्धित किया गया। वनीला सुगन्ध व हरा वर्ण सबसे अधिक पसन्द किया गया।

विधि :– ऊँटनी के दूध को गरम कर छान लेते हैं। फिर उसे 60° से. तक गरम कर उसमें चीनी, सुगन्ध, रंग एवं स्टेबीलाईजर डालकर अच्छी तरह घोल लेते हैं। तत्पश्चात् इसे 73° से. पर 15 मिनट तक गरम कर पास्तुरीकृत कर लेते हैं एवं बोतलों में पैकिंग में बन्द कर 50° से. तापमान पर भण्डारित कर देते हैं।

फ्लेवर्ड दूध बनाने के दौरान परिवर्तन को मापने के लिए तैयार फ्लेवर्ड दूध के रासायनिक संघटक जैसे पानी, कुल ठोस वसा, वसारहित ठोस व पी.एच. का मूल्यांकन किया गया। उपर्युक्त विधि द्वारा ऊँटनी के दूध से वनीला, पाइनेपल, केसर व चाकलेट फ्लेवर्ड दूध का ज्ञानेन्द्रिय परीक्षण सात सदस्य पैनल द्वारा लगातार एक सप्ताह तक 9 अंकीय हेडोनीक स्केल द्वारा किया गया। इसके अनुसार स्वाद का औसत स्कोर क्रमशः 8.00, 7.76, 7.67 एवं 7.39 मापा गया।

ऊँटनी के दूध से चाय व कॉफी बनाने की विधि :–

ऊँटनी के दूध व पानी को 1:2 के अनुपात में मिलाकर उबालते हैं। फिर चाय की पत्ती व चीनी स्वादानुसार मिलाकर एक साथ उबाल देकर छान लेते हैं। लेकिन कॉफी के लिए दूध व पानी को 1:1 अनुपात में आवश्यकतानुसार चीनी मिलाकर उबाल लेते हैं। इसके बाद स्वादानुसार कॉफी पाउडर मिलाते हैं। उपरोक्त चाय व कॉफी का स्वाद व स्वीकार्यता का परीक्षण केन्द्र कर्मचारियों व केन्द्र में भ्रमण हेतु आने वाले पर्यटकों को करवाया गया जिसका परिणाम उत्साहवर्धक रहा।

ऊँटनी के दूध के ताप स्थिरता मानक के अध्ययन के अन्तर्गत दूध की सामान्य व विभिन्न पीएच मानकों पर उसकी स्थिरता का अध्ययन कर पाया गया कि 6.8 पर अधिक व पीएच 6 पर न्यूनतम स्थिरता मापी गयी।

ऊँटनी के दूध का परीक्षण एवं उष्ट्र दुग्ध से निर्मित विभिन्न उत्पाद बनाने के ग्रामीण महिला प्रशिक्षण शिविर के अन्तर्गत लोकहित पशुपालक संस्थान, सादड़ी के सहयोग से राष्ट्रीय उष्ट्र अनुसंधान केन्द्र की राष्ट्रीय कृषि तकनीकी परियोजना द्वारा

''ट्रेनिंग ऑन एनवॉयरमेंट ऑफ फार्म वूमन'' पर 10 दिवसीय प्रशिक्षण कार्यक्रम (24 मार्च से 2 अप्रैल, 2004) तक आयोजित किया गया जिसके अन्तर्गत ग्रामीण महिलाओं को ऊँटनी के दूध के विभिन्न संघटक, दुग्धकाल एवं दूध की विभिन्न बीमारियों में उपयोगिता (मधुमेह, टी.बी. व कब्ज सम्बंधी जानकारी के साथ), ऊँटनी के दूध से निर्मित उत्पाद (चीज, लस्सी, चाय, कॉफी, चीज पकौड़ा, सुगन्धित दूध आदि) के बनाने की विधि का क्षेत्र – प्रदर्शन (फील्ड देना), उक्त दुग्ध उत्पादों को महिलाओं द्वारा बनवाना एवं अभ्यास करवाना सिखाया गया।

जैसलमेरी ऊँटों का निर्धारण एवं संरक्षण –

राष्ट्रीय कृषि तकनीकी परियोजना के अन्तर्गत जैसलमेरी ऊँटों की उपलब्धता हेतु प्रजनन क्षेत्र में सर्वे का कार्य किया गया। इस हेतु जैसलमेर, बाड़मेर, जोधपुर व बीकानेर में नस्ल उपलब्धता का पता लगाने पर ज्ञात हुआ कि बीकानेर में जैसलमेरी ऊँट की उपलब्धता शून्य थी। परियोजना के अन्तर्गत नस्ल का निरूपक, नस्ल की तादाद का आंकलन, उत्पादन वृद्धि एवं उत्पादन आँकड़े, जनन, प्राचल, समाजार्थिक अभिमुखता, वीर्य हिमीकरण आदि पर कार्य करते हुए चयनित नर ऊँटों को रखा जा रहा हैं।

वातावरणीय दबाव एवं सेल्टर प्रबन्ध द्वारा सुधार –

विभिन्न प्रबन्धन की दशा में ऊँटों के मद व्यवहार पर अध्ययन के अन्तर्गत 10 नर ऊँटों (8–11वर्ष) को दो समूह में बाँटते हुए प्रथम समूह के ऊँटों को मादाओं के पास थोड़ी देर रखा गया। यह देखा गया कि नवम्बर माह के अंतिम सप्ताह तक दोनों समूहों में 'मद' लक्षणों की तीव्रता में कोई अन्तर नहीं पाया गया, तीसरे सप्ताह के पश्चात मद लक्षणों तथा चौथे सप्ताह के बाद कोर्टिसॉल व टेस्टोस्टीरोन हारमोन की सान्द्रता में अन्तर पाया गया। इसी प्रकार आहार ग्राह्यता व भार में अन्तर अंकित किया गया। अध्ययन से यह निष्कर्ष निकलता है कि सर्दी शुरू होने पर दो सप्ताह तक यदि नर ऊँटों को 20–30 मिनट प्रतिदिन सुबह व सायं को वयस्क मादा ऊँटों के पास रखें तो 'मद' लक्षण जल्दी शुरू हो जाते हैं।

स्थानीय चारागाह में उपलब्ध चारों को अनुपातिक मात्रा में मिलाकर उच्च गुणवता वाला खाद्य तैयार करना

इस अध्ययन को दो चरणों में किया गया। पहले चरण में 4 ऊँटों के बच्चों में सिर्फ चने की खार का पाचन परीक्षण किया गया तथा दूसरे चरण में 12 ऊँटों के बच्चों को 3 समूहों में विभाजित कर उन्हें बिना ईंटों वाला संतुलित आहार (सआ 1) जो कि चने की खार, मूँगफली चारा तथा सान्द्र मिश्रण (70 : 15 : 15) से बना था, ईंटों वाला संतुलित आहार (सआ2) (जिसकी भौतिक संरचना सआ–1 जैसी थी) चने की खार, मूँगफली चारा और मिश्रण (60 : 25 : 5 – सआ3) की ईंटे/ब्लॉक 98 दिनों तक दिया गया। इन सभी ग्रुप में सार्थक रूप से भिन्नता देखी गई। सआ 2 ग्रुप में पाचक कच्ची प्रोटीन/कि.ग्रा. मेटोबोलिक देह भार अन्तर्ग्रहण (7.70) उच्च था तथा पहले चरण वाले चने की खार वाले ग्रुप में (4.01) निम्न रहा। जबकि कुल पाचक तत्व अन्तर्ग्रहण ग्रा0/किलो मेटाबोलिक देह भार सआ–1 में सार्थक रूप से उच्च (62.4) थे तथा चने की खार वाले ग्रुप में निम्न (41.41) रहे। निष्कर्षतः यह कहा जा सकता है कि उष्ट्र बच्चों हेतु संतुलित आहार की ईंटें, पौष्टिक व शारीरिक वृद्धि (378–421 ग्रा./प्रतिदिन) में सहायक है तथा साथ ही यह स्थान कम (एक तिहाई) घेरने के साथ आसानी से रखी जा सकती है। संतुलित आहार की ईंटें/ब्लॉक की परिवहन लागत भी कम (1/2 से 1/3) आती है।

शिवबाड़ी क्षेत्र में पानी की आपूर्ति हेतु प्रयुक्त किये जाने वाले ऊँटों तथा उनकों पालने वाले परिवारों की समाजार्थिक अभिमुखता का पता लगाया गया। अनुसंधान द्वारा ऊँटों के कार्य करने के घंटे, पानी की टंकियाँ तथा दूरी आहार अन्तर्ग्रहण 41 दिनों तक देखा गया। प्रथम चरण में भार ढोने वाले ऊँटों को मात्र ग्वार फलगटी/मूंगफली चारा दिया गया तथा द्वितीय चरण

के ऊँटों को ग्वार फलगटी, मूंगफली चारा तथा सान्द्र (70.3:15:14.7 क्रमशः) से सन्तुलित आहार की ईंटें दी गईं। जिसके अन्तर्गत द्वितीय चरण के ऊँटों में शुष्क पदार्थ अन्तर्ग्रहण 2.48 प्रतिशत था जो कि प्रथम चरण (1.93) प्रतिशत के ऊँटों की तुलना में उच्च था। द्वितीय चरण में प्रथम चरण की तुलना में कच्चा प्रोटीन की पाच्यता उच्च तथा सीएफ भिन्न था। चयापचय शारीरिक भार के आधार पर शुष्क पदार्थ, कुल पाचक तत्व तथा चयापचय ऊर्जा सन्तुलित आहार दिये जाने वाले ऊँटों (द्वितीय चरण) में सार्थक रूप से उच्च थीं।

निष्कर्षतः यह कहा जा सकता है कि सन्तुलित आहार के रूप में तैयार ईंटें आर्थिक, पौष्टिक अन्तर्ग्रहण की दृष्टि से उच्च है तथा ऊँट के स्वास्थ्य तथा उसकी आयु की दृष्टि से भी लाभकारी है।

सन्तुलित आहार की ईंटों की उष्ट्र पालकों में लोकप्रियता बढ़ाने के प्रयोजन से कुल 5 प्रदर्शनियां आयोजित की गई। प्रदर्शनियों के माध्यम से उन्हें सन्तुलित आहार की ईंटों से होने वाले लाभों की जानकारी दी गयीं। 249 उष्ट्र पालकों को ये ईंटें निःशुल्क वितरित की गईं। साथ ही स्थानीय समाचार–पत्रों द्वारा इन सन्तुलित आहार की ईंटों का विज्ञापन भी किया गया। इसके अलावा इन ईंटों की लागत में कमी लाते हुए भण्डार में रखवाया गया जिसके अन्तर्गत इनमें किसी प्रकार का परिवर्तन नहीं देखा गया।

राजस्थान के शुष्क क्षेत्र में आहार चारे के खनिज स्तर, जैव प्राप्यता तथा क्षेत्र विशिष्ट खनिज मिश्रण को तैयार कर उत्पादकता में सुधार पर अध्ययन

इसके अन्तर्गत राउअनुके, बीकानेर के ही कृषि वानिकी इकाई सहित फार्म क्षेत्र में पशुओं को दिए जाने वाले आहार चारे के नमूनें लिए गए। सेवन, बेकरिया, गेहूँ भूसा, मूँग भूसा, चने की खार इत्यादि में ताँबे की मात्रा कम पाई गई। अतः ऊँटों में अनुकूलतम उत्पादन एवं पालन–पोषण हेतु दिए जाने वाले चारा अवशेषों को संपूरक कर दिया जाना आवश्यक है।

राजस्थान के विभिन्न जिलों –बीकानेर, चूरू, जैसलमेर, नागौर व हनुमानगढ़ में आहार चारे में सूक्ष्म पोषक खनिज तत्वों– ताँबा, जस्ता, कोबाल्ट, मैंगनीज व लोहा की उपलब्धता संबंधी आँकड़ें लिए गए। बीकानेर जिले के आहार चारें में सूक्ष्म खनिज पोषक तत्वों– ताँबा,जिंक, कोबाल्ट, मैंगनीज व लोहा की औसत मात्रा क्रमश :12.99 मि.ग्रा./कि.ग्रा. शुष्क पदार्थ (डीएम–ड्राई मेटर), 30.81 मि.ग्रा./कि.ग्रा. डीएम, 0.30 मि.ग्रा./कि.ग्रा. डीएम, 40 मि.ग्रा./कि.ग्रा. डीएम, 63.56 मि.ग्रा./कि.ग्रा. डीएम, चूरू में क्रमश : 21.06 मि.ग्रा./कि.ग्रा. डीएम, 43.13 मि.ग्रा./कि.ग्रा. डीएम 0.08 मि.ग्रा./कि.ग्रा. डीएम, 59.03 मि.ग्रा./कि.ग्रा. डीएम 62.90 मि.ग्रा./कि.ग्रा. डीएम, नागौर जिलें में क्रमशः 13.37 मि.ग्रा./कि.ग्रा. डीएम, 26.77 मि.ग्रा./कि.ग्रा. डीएम, 0.48 मि.ग्रा./कि.ग्रा. डीएम, 86.55 मि.ग्रा./कि.ग्रा. डीएम, 63.67 मि.ग्रा./कि.ग्रा. डीएम, जैसलमेर में क्रमश : 45.67 मि.ग्रा./कि.ग्रा. डीएम, 20.64 मि.ग्रा./कि.ग्रा. डीएम, 0.09 मि.ग्रा./कि.ग्रा. डीएम 56.09 मि.ग्रा./कि.ग्रा. डीएम व 78.34 मि.ग्रा./कि.ग्रा. डीएम पाई गई। हनुमान गढ़ जिले में प्रयुक्त आहार के खनिज स्तर सम्बन्धी आँकड़े लिए गए। इसी प्रकार राजस्थान के विभिन्न शुष्क क्षेत्रों में प्रयुक्त किए जाने वाले आहार चारें में सूक्ष्म खनिज पोषक तत्वों का पता लगाया गया।

पशु उत्पादन के लिए पोषक तत्वों की उपयोगिता व चारा स्रोतों में सुधार

भेड़ व ऊँट की खाद का गुणवता व मात्रात्मक मूल्यांकन अरडू, बेरी व खेजड़ी के एक ही उम्र (2 वर्ष) के पौधों पर किया गया। एक ही उम्र (2 वर्ष) के पौधों में समान मात्रा (10.0 किग्रा प्रति पौधा) में खाद अप्रैल व जुलाई माह में डाली गई व पानी समान अवधि (15 दिन के अन्तराल) में दिया गया। अध्ययन के अन्तर्गत यह देखा गया कि भेड़ों की खाद में नाईट्रोजन, फास्फोरस व सूक्ष्म खनिज कॉपर, जस्ता, लोहा व कोबाल्ट की मात्रा ऊँटों की खाद की अपेक्षा अधिक पाई जाती हैं। जबकि कार्बनिक कार्बन में ज्यादा अन्तर नहीं है। खाद में इन तत्वों का संरक्षण खाद रखने की विधि पर बहुत निर्भर करता है ।

ऊँट के मूत्र के तत्वों का विश्लेषण करने पर यह पाया गया कि इसके मूत्र में जिंक, कोबाल्ट, लोहा, पोटैशियम व सोडियम भेड़ व गायों की खाद की तुलना में अधिक हैं।

एक वर्ष पश्चात् लिए गये आँकड़ों से देखा गया कि भेड़ की खाद वाले पौधों की ऊँचाई में मासिक वृद्धि 7.0 से.मी.से 13.5 से.मी.रही व दोनों ही खादों में पौधों की ऊँचाई में वृद्धि सबसे अधिक बेरी के पौधों में रही। अन्य पौधें (अरडू व खेजड़ी) में भी भेड़ों की खाद में ऊँटों की तुलना में वृद्धि अधिक पाई गई व पौधों का फैलाव भेड़ों की खाद में 7.5 से. मी. से 11.0 से.मी. पाया गया। जबकि ऊँटों की खाद में फैलाव 6.0 से 9.5 से.मी. रहा।

ऊँटों की खाद में उपलब्ध पोषक तत्वों व उपयोगिता के आधार पर देखा गया है कि भेड़ व गोबर की कम्पोस्ट खाद के समान ही ऊँटों की कम्पोस्ट खाद आसानी से उपयोग में लाई जा सकती है, परन्तु इसकी मात्रा लगभग दोगुना डालने की आवश्यकता है। मृदा के भौतिक एवं रासायनिक परीक्षण में नत्रजन, जिंक, कॉपर की मात्रा अल्प पाई गईं तथा पौटाश, कैल्शियम, मैंग्नीशियम प्रचुर मात्रा में पाये गये। सर्वेक्षण में यह पाया गया कि ऑर्गेनिक कॉर्बन की मात्रा कम तथा पी.एच. अत्यधिक होने के कारण यहां की मृदाओं में पोषक तत्त्वों की उपलब्धता न्यून हैं।

विकसित तकनीकी

ऊँट गाड़े में प्रकाश व्यवस्था

ऊँट, रेगिस्तान की ग्रामीण व्यवस्था व कस्बों में इसके पालकों व गरीब मजदूरों के लिए न सिर्फ यातायात व कम दूरी के लिए भार परिवहन का साधन है, बल्कि अकाल व अन्य समय में आमदनी का स्त्रोत है। हाल के कुछ वर्षों में ऊँट गाड़े की सड़क दुर्घटनाओं की संख्या में वृद्धि का मुख्य कारण ऊँट गाड़े में प्रकाश व्यवस्था का न होना है। समुचित प्रकाश व्यवस्था से इन दुर्घटनाओं को कम किया जा सकता हैं। राष्ट्रीय उष्ट्र अनुसंधान केन्द्र, बीकानेर द्वारा पारम्परिक 2 पहिया वाले ऊँट गाड़े में अन्य वाहनों की तरह प्रकाश व्यवस्था सुनिश्चित की गई। इस हेतु प्रयुक्त की जाने वाली आवश्यक सामग्री में 2 पुली 22 " व्यास, 1 पुली 5" व्यास, डायनुमों पुराना (जीप या कार का) बेल्ट, 2 सूखी बैटरी 12 वोल्ट, 15 एम्पीयर से 25 एम्पीयर तक व आवश्यकतानुसार आगे व पीछे लगाने की लाईट शामिल हैं। इस प्रकाश व्यवस्था में काम आने वाले सारे सामान पर कुल लागत राशि 2000/– से 2500/– रू. तक आती है। यह प्रकाश व्यवस्था, घरों में जहाँ बिजली की आपूर्ति नहीं है, वहाँ भी पढ़ाई व गृह कार्य के लिए उपयोगी है।

विस्तार, संचार एवं मानव संसाधन विकास योजना

किसान दिवस

29 दिसम्बर, 2003 को केन्द्र में किसान दिवस का आयोजन रखा गया जिसमें आस–पास स्थित गाँवों के उष्ट्र पालकों/किसानों को उष्ट्र प्रबन्धन, उष्ट्र जनन, उनकी प्रमुख बीमारियां तथा रोगनिरोध, शीघ्र रोग निदान, अच्छा आहार, संपूरक आहार बनाने की विधि, नस्ल निर्धारण संबंधी जानकारी प्रदान की गईं। किसानों को ग्रामीण कुटीर उद्योगों में आर्थिक संबल प्रदान कराने हेतु उष्ट्र उत्पादों – दूध के औषधीए गुण, बाल इत्यादि के बारे में भी महत्वपूर्ण जानकारी दी गईं। इस अवसर पर उष्ट्र पालकों को केन्द्र द्वारा तैयार विद्युत चालित पारम्परिक उष्ट्र गाड़ा दिखाया गया साथ ही उन्हें नवजात शिशु एवं माता की देखभाल, प्रसव, रोग निरोधी एवं उपचार गतिविधियां इत्यादि संबंधी फिल्म दिखाई गई।

प्रदर्शनियां

केन्द्र द्वारा इस वर्ष 5 प्रदर्शनियां आयोजित की गई। जिसमें उष्ट्र के पालन–पोषण, जनन, प्रबन्ध तथा केन्द्र द्वारा

विकसित नई तकनीकियां सम्बन्धी थीं। ये प्रदर्शनियां– किसान दिवस, उष्ट्र उत्सव– बीकानेर , राष्ट्रीय विज्ञान दिवस, बीकानेर, राज्य कृषि विज्ञान मेला, बीकानेर व एनएएससी, भाकृअप, नई दिल्ली में रखी गईं।

तकनीकी जानकारी

उष्ट्र पालकों को उष्ट्र के दूध से बने विभिन्न उत्पादों– दही, सुगन्धित दूध, सॉफ्ट चीज, कॉफी एवं चाय इत्यादि बनाने का प्रशिक्षण दिया गया। साथ ही उन्हें केन्द्र द्वारा तैयार विद्युत चालित पारम्परिक दो पहिया ऊँट गाड़े का प्रदर्शन कर बताया गया कि विद्युत चालित ऊँट गाड़े द्वारा रात्रि समय में होने वाली दुर्घटनाओं की संख्या को कम कर सकते हैं।

किसान गोष्ठी

केन्द्र में तथा बाहर, वर्ष के दौरान कुल 6 किसान गोष्ठियां आयोजित की गईं। आयोज्य गोष्ठियों में केन्द्र के वैज्ञानिक/तकनीकी अधिकारी, विषय विशेषज्ञ तथा किसानों ने भाग लिया। ये गोष्ठियां केन्द्र, राज्य कृषि विज्ञान मेला, केसरदेसर गाँव तथा 3 केन्द्र के गोद लिये गये गाँव गाढ़वाला में आयोजित की गईं।

उष्ट्र प्रतियोगिताओं में भागीदारी

केन्द्र द्वारा ऊँट उत्सव के दौरान ऊँटों की विभिन्न प्रतियोगिताओं में भाग लिया तथा पुरस्कार अर्जित किए।

केन्द्र की अनुसंधान संबंधी गतिविधियों की जानकारी

वर्ष के दौरान केन्द्र में आये विभिन्न प्रशिक्षणार्थियों, सैलानियों (देशी/विदेशी), वैज्ञानिकों, छात्रों, पशुपालकों, प्रशासकों, रक्षा अधिकारियों, गैर–सरकारी संस्थाओं, भारतीय एवं विदेशी शिक्षार्थियों, पत्रकारों, युवाओं, किसानों तथा कृषक महिलाओं इत्यादि को केन्द्र में चल रही अनुसंधान गतिविधियों, ऊँट पालन तथा नवीनतम तकनीकों की जानकारी दी गईं।

केन्द्र–भ्रमण

वर्ष के दौरान विभिन्न गणमान्य – श्रीमान् रविन्द्र कुमार, अतिरिक्त आयुक्त, आयकर विभाग, मुंबई, न्यायमूर्ति श्रीमान् एन.महात्रे, माननीय रॉबर्ट ब्लैक, भारत में अमेरिका के राजदूत, डॉ0 मंदाज, प्रिसिंपल अकाउटेन्ट जनरल राजस्थान, जयपुर भ्रमण हेतु केन्द्र में पधारें।

समन्वय

केन्द्र द्वारा वर्ष के दौरान विभिन्न गैर–सरकारी संस्थाओं – लोकहित पशुपालक संस्थान, सादड़ी (पाली), उरमूल डेयरी ट्रस्ट, बीकानेर, कृषि विज्ञान केन्द्र, बींछवाल (बीकानेर) तथा अन्य – केन्द्रीय भेड़ एवं ऊन अनुसंधान संस्थान, अविकानगर तथा राजस्थान कृषि विश्वविद्यालय, बीकानेर से समन्वय स्थापित किया गया। इसके अन्तर्गत उष्ट्र बालों, दूध, त्वचा के विभिन्न उपयोग को लोकप्रिय बनाने हेतु कार्य किया गया।

राजस्व उत्पादन कार्यक्रम

राजस्व बढ़ोतरी हेतु विभिन्न साधनों – पर्यटकों से प्रवेश शुल्क, फोटोग्राफी, उष्ट्र सवारी, उष्ट्र दूध तथा बालों की बिक्री आदि के द्वारा राजस्व एकत्रित किया गया।

हिन्दी पखवाड़ा, 2003

केन्द्र में 14 सितम्बर, 2003 हिन्दी दिवस के अवसर पर हिन्दी पखवाड़ा आयोजित किया गया। हिन्दी पखवाड़े के दौरान हिन्दी कार्यशाला, श्रुति लेखन प्रतियोगिता एवं हिन्दी निबन्ध प्रतियोगिता का आयोजन किया गया। हिन्दी पखवाड़े के समापन कार्यक्रम में मुख्य अतिथि श्री मधुकर गुप्ता, संभागीय आयुक्त, बीकानेर ने कहा कि आवश्यकता इस बात की हैं कि अन्य भाषा–भाषी राजभाषा का सम्मान करें व हिन्दी भाषी अन्य क्षेत्रीय भाषाओं का सम्मान करें । केन्द्र निदेशक डा0 मोहन सिंह साहनी ने वैज्ञानिक शोध ग्रामीणों को हिन्दी भाषा में उपलब्ध करवाने की बात कही। विशिष्ट अतिथि जनकवि हरीश भादाणी व कार्यक्रम अध्यक्ष श्री भवानी शंकर व्यास 'विनोद' ने इस अवसर पर अपने विचार रखे। हिन्दी पखवाड़े के समापन के अवसर पर प्रतियोगिताओं के विजेताओं को पुरस्कार व प्रशस्ति–पत्र प्रदान किये गये।

राजभाषा पत्रिका 'करभ' का लोकार्पण

राजभाषा स्वर्ण जयंती वर्ष के दौरान केन्द्र द्वारा आयोजित गतिविधियों में हिन्दी पत्रिका के प्रकाशन को शामिल करते हुए केन्द्र की ओर से हिन्दी में प्रथम पत्रिका 'करभ' स्मारिका के रूप में प्रकाशित की गई। पत्रिका की उपयोगिता व लोकप्रियता को देखते हुए इसे वर्ष (2003) से नियमित प्रकाशित करने का निर्णय लिया गया तथा इस अवसर पर मुख्य अतिथि श्री मधुकर गुप्ता, संभागीय आयुक्त, बीकानेर के कर कमलों द्वारा केन्द्र की राजभाषा गृह पत्रिका 'करभ' के प्रथम अंक का लोकार्पण किया गया।

2. EXECUTIVE SUMMARY

In order to know the efficiency and potential of camel drawn implements on sandy soils during rainy season (July-September, 2003). Trials were undertaken on 4 duly trained adult male camels using both improved kind of camel drawn implements (6 disc harrows) and traditional ploughs (2 tyne plough). Criteria used for evaluation were total pulling time before fatigue, area ploughed, pulling load, penetration depth and important biochemical profiles viz. Creatinine, Creatine Kinase, Lactate and Cortisol monitored pre and post- operation. The results indicated that efficiency of pulling harrow by camels in terms of total pulling time before fatigue is lower than traditional 2 tyne plough. Further it also reflected that a good camel can pull harrow for a maximum of 1 hour, while under similar conditions, a 2 tyne plough can be pulled continuously for 4 hours. The area ploughed by 2 implements measured around 2000 m^2 and 4000-4500 m^2, respectively.

Enzyme study of camel milk showed that lactoperoxidase is most heat stable enzyme in milk and its destruction was used as an index of flash pasteurization. The peroxidase system has been found to have good bactericidal efficiency for the cold pasteurization of fluids. Lactoperoxidase activity at 40^0C was recorded 2.23 units per ml of milk while it was reduced to 1.00 and 0.07 unit per ml at 70^0 and 80^0C, respectively. The average insulin activity in the raw milk without heat treatment was 30.7±1.63 mIU /lt measured by Radio immuno assay. The percent loss of insulin activity was observed to be significantly ($P<0.05$) higher in the milk boiled for 5 min. The pasteurization of camel milk by HTST method was found to be more beneficial to prevent denaturation of insulin as compared to other heat treatment groups.

Purification and preparation of apo and saturated lactoferrin from camel milk was carried out in collaboration with Dept. of Biophysics, AIIMS, New Delhi with locally modified method of gel filtration chromatography using cation exchanger, CM- Sehadex C-50.

Selection for improvement of draughtability 7, 5 and 2 males of Bikaneri, Jaisalmeri and Kachchhi breeds, respectively were selected mainly on the basis of body length. The selected group in Bikaneri breed had significantly higher body length, heart girth and height at wither but due to the smaller population size in Jaisalmeri and Kachchhi breeds, the overall selection differential reduced significantly, accounting for non-significant difference in the two groups in pooled data for heart girth and height at wither.

The body weight data at various stages 3, 6, 9, 12, 24, 36 and 48 months of age indicated significant breed effect at 9, 12 and 24 months of age. The effect of sex was found non-significant except at 6 months weight. It was observed that during growth phase, the Jaisalmeri calves were at times heavier than the Bikaneri calves whereas the adult Bikaneri camels weigh more than the Jaisalmeri camels.

This year the overall calving was 75.86%. Highest calving was recorded in Bikaneri breed

(77.77%) followed by Kachchhi (75.00%) and Jaisalmeri (71.43%). Last year the calving was 79.31%, which is slightly better than this year's calving. However, this year the conception rate was 57.14%, which is relatively lower than the performance of the previous year.

In total 10 Bikaneri, 8 Jaisalmeri, 3 Kachchhi and one Arab cross camel have died. The involvement of digestive system diseases/disorders was highest (50%) followed by respiratory system (40.90%) and other systems.

The effect of breed was observed to be highly significant ($P< 0.01$) with the total average daily milk production of 2.37±0.01 kg in Bikaneri and 2.22±0.02 kg in Kachchhi from one side quarters for the period May to December, 2003.

Under extension activities this year 8 breedable males (5 Bikaneri and 3 Jaisalmeri) were distributed through Rajasthan Government under breed improvement in the fields. Five adult camels were given to the army/BSF for their use.

The six databases viz. inventory of the Centre's camel herd, biometry, breeding tract of Jaisalmeri camel, reproduction, health and production maintained at the centre were updated.

The highest annual hair production was observed at 3 years age followed by 2, 4-6 yr and 1 year age group, whereas least production was obtained in case of above 6 years age group. Bikaneri males showed their superiority with annual hair yield (0.75±0.14 to 1.69±0.09 kg) followed by Jaisalmeri males (0.57 ± 0.10 to 1.23± 0.16 kg) and Kachchhi males (0.56 ± 0.22 to 0.90± 0.19 kg).

In Bikaneri breed microsatellite analysis has been carried out for 16 loci. The number of alleles ranged from 2 to 7. The Nei's expected heterozygosity ranged from 0.289 to 0.815 and the polymorphic information content ranged from 0.267 to 0.789. Thirteen microsatellite loci were found polymorphic in Jaisalmeri camel. The number of alleles ranged from 2 to 7. The expected heterozygosity ranged from 0.320 to 0.816 and the polymorphic information content ranged from 0.268 to 0.791. In Kachchhi breed, the number of alleles ranged from 2 to 6 and expected heterozygosity ranged from 0.34 to 0.88 and 0.33 to 0.79. The polymorphic information content ranged from 0.277 to 0.765. The genetic distances between the three Indian breeds was estimated using the information of five polymorphic loci in the three breeds and using PHYLIP 3.6 and MICROSAT 2 software. The consensus arrived from observed data indicated close phylogenetic relationship between Bikaneri & Kachchhi breeds as compared to Bikaneri & Jaisalmeri and Kachchhi & Jaisalmeri.

Anti-progesterone serum was raised by repeated intra-dermal inoculation of progesterone hemi-succinate BSA conjugate (Sigma) emulsified in Freund's complete adjuvant (sigma) at monthly interval continuously for 6 months. The serum was harvested from immunized rabbits from blood collected by ear vein cut. Serum was tested for antibodies by inoculation with tritiated progesterone (Amersham Bio-sciences Ltd., U.K.). The results indicated that sera harvested from four rabbits can be used for RIA in greater than 1:1000, 1:8000, 1:1000 and 1:4000 titer, respectively.

In pregnant female camels out of 37 mated, average progesterone levels recorded were around 0.5 ng/ml from day 0 to day 3, it increased to 0.7- 0.85 ng/ml on day 4-5 and above 1 ng/ml, 2 ng/ml, 3 ng/ml and 4 ng/ml on days 6,9,13 and 28, respectively. In non- pregnant, the rise was initially similar up to day 10, but then started declining from day 11 onward, which is indicative of a short luteal phase in non-pregnant females in this species as compared to other livestock species. Progesterone concentration recorded at weekly interval in later half of gestation averaged and ranged from 3-14 ng/ml. Progesterone concentration at peri-parturient period was recorded between 3-5 ng/ml and decline was accomplished after expulsion of fetus, when it averaged 1.6 ng/ ml.

Anti- estradiol serum received from Professor Niswender of Colorodo State University, USA was calibrated for antibody titer using tritiated estradiol (Amersham Bio-sciences Ltd., U.K.).

Semen collection was accomplished with about one dozen Jaisalmeri male camels. It was evaluated, cryopreserved and 1000 dose were sent to NBAGR, Karnal under NATP project on characterization and conservation of Jaisalmeri camels.

Ultrasound technique used for the periodic monitoring of ovary of the 42 female camels of the centre's herd to be bred in the breeding season after second week of December, 2003. The females when observed to possess ovulating size follicle (≥ 9 mm) were mated with the camel studs as decided by the breeding policy of the centre. Twenty (69 %) females were observed with ovulating follicle at first examination between 18th Dec and 3rd January. Twelve (28 %) females were observed with ovulating follicle at second or third examination before 10th March. No follicle was observed in one female camel. All except one female when examined between 15th Jan and 11th March were observed to possess atleast one ovulating follicle.

To improve reproductive efficiency 8 female camels parturited during the breeding season (upto 8th February, 2004) were examined by ultrasound for presence of ovulating follicle. Five out of eight female camels were observed to possess ovulating follicle. Two out of these conceived saving atleast 300 days of calving interval for each animal.

Rose Bengal Plate Test (RBPT) antigen procured from Indian Veterinary Research Institute, Izatnagar was used for screening of 213 camels of centre's herd for Brucellosis. All of the serum samples were found to be negative for RBPT antigen.

A positive effect was observed in the improvement of libido of experimental males that were exposed to females before the onset of rutting season. The blood samples analysed for testosterone had wide fluctuations probably due to larger intervals in the collection of samples. There was no poll gland secretion in the castrated camels whereas secretions were observed in entire males. The semen collections have also been attempted during this rutting season. The live sperm percentage was 87.0 ± 1.02 in the young camels with intact testes. The semen samples were found to be normal in appearance as observed from their physical characteristics.

The survey data collected from veterinary hospitals located in irrigated zone (Pugal, Khajuwala, Lunkaransar, Jamsar, Mahajan, Kolayat & Gajner) and non-irrigated zone (Napasar, Kalyansar, Nokha, Badnu, Desnokh, Kuchor & Jasrasar) revealed that skin infection, Trypanosomiasis and respiratory system involvement was higher in irrigated region as compared to non-irrigated region. Incidence of disease was high during rainy season.

Morbidity in cases of mange and surra were high in irrigated zone as compared to non-irrigated zone, whereas mortality was highest due to impaction (digestive problems) followed by Mange and Surra in both of these regions. Majority of farmers prefered traditional treatment of diseases of camel.

Kissan divas was organised at the centre on 29th Dec, 2003 with the primary objective to provide exposure to camel keepers/ farmers about advanced technologies of camel management, camel reproduction, common diseases incidence, their prophylaxis, quick diagnosis, improved feeding, technique of complete feed, breed characterization, importance of camel milk products, scope of therapeutic use of camel milk, utilization of camel hair in village cottage industry for higher economic gains. Camel keepers from different villages (Gadwala, Sagar, Ridmalsar, Keshardesar, Surdhana and Pemasar) have participated. The centre had organised 5 exhibitions during the year. Out of these, 3 were at the centre and 2 were out of campus. Six kissan gosthies were arranged on and off the campus involving scientists/ technical officers, subject matter specialists and farmers.

Trypanosoma evansi isolated from camel were maintained in albino rats, mice and rabbits upon intraperitoneal inoculation of 1 x 10^4 live parasites. Microscopy of wet blood film for direct detection of trypanosomosis was found to be the least sensitive method. Indirect methods of diagnosis based on demonstration of specific antibodies or parasitic antigen in the host blood or tissue have higher sensitivity and a greater variability and therefore, are more difficult to intercept in terms of disease status.

Total 2778 and 2030 faecal samples from organized farm and field, respectively were collected and examined (2002-04). Out of these, 899 (32.36%) and 967 (47.63%) samples from farm and field camels, respectively were found positive for different types of helminth infections. July to October months were found favourable for harbouring the latent helminth infection and monsoon month (August-September) showed maximum infection rate both at farm (32.98% to 37.71%) and field (66.93%).

Two (FI & FII) of the three herbal formulations developed at the centre were found to possess effective mangicidal action and F II seem to have additional coverage against some other skin diseases (Dermatitis, Pachydermia etc.). Both formulations relieved the animals from symptoms viz. intense itching, thickening and wrinkling of skin, excoriation etc. apart from conditioning, nourishing and toning of skin.

Isolation and characterization of bacteria namely staphs, β staphs, *E. coli*, Pseudomonas spp.

(Twenty four isolates) were carried out. *In vitro* sensitivity conducted against these isolates using garlic, lemon and onion juices gave preliminary encouraging results.

Overall cure rate for the treatments of staphylococcal mastitis was lower than other microbes. *In vitro* sensitivity testing showed staphylococci to be 100% sensitive against amoxycillin and cloxacillin. The overall efficacy of treatment was 69.23% for T_1 (Amoxycillin and Cloxacillin), 69.23% for T_2 (Amoxycillin and Cloxacillin + levamisole) and 84.61% for T_3 (Amoxycillin and Cloxacillin + levamisole + Vitamin E and selenium).

A significant decrease in mean blood glucose was observed in rats getting raw camel milk compared to pasteurized and other milk.

The process of flavoring of camel milk was successfully standardized with different combination of flavors (pineapple, vanilla, chocolate and kesar) and colours (yellow, rose and pink) to make camel milk more palatable to those who do not like to drink it as such, as well as to enhance its utilization and sale of milk. Sensory evaluation test carried out by using hedonic scale to assess the performance of all four different types of camel flavored milks revealed that highest points in respect to taste, odour and colour was scored by the vanilla flavor with green colour. The camel milk tea and coffee were prepared and served to Indian and foreign tourists during their visit of this center to carry out sensory evaluation test. The overall acceptability was recorded as very good and results were encouraging. At pH 6.0, the heat coagulation time (HCT) of camel milk in early and late lactation was observed lowest while it was observed highest at pH 6.8. The HCT of camel milk get stable after pH 7.2 to 7.6. It was observed that rate of development of acidity is comparatively slow in camel milk than cattle milk in all the four lactic strains. The growth of lactic culture 159 and 144 was recorded highest and lowest in first six hours in camel milk. The growth of lactic culture 144 and 167 was recorded highest and lowest in first six hours in cattle milk. A farm women training course "Improving the shelf life of milk and milk products of camel and goat" of 10 days under NATP was organized from 24th March to 2nd April, 2004, with the help of Lokhit Pashu Palak Sansthan at Sadri, Pali, Rajasthan. On farm training was imparted to twenty five farm women on technologies of preparation of camel milk products such as fermented milk (Lassie), besan cheese pakoara, flavoured milk, tea and coffee.

Survey of the breeding tract for availability of pure Jaisalmeri camels was carried out in the four strata of the Jaisalmer and Barmer district and two of the Jodhpur district. In all 36 enumerators were employed for the characterisation work, of which 16 were in Jaisalmer, 15 in Barmer district and 5 in the Jodhpur district. Breed descriptor prepared, breed population estimated, growth and production data, reproduction parameters and socioeconomic aspects were incorporated in the descriptor, cryopreservation of the semen was carried out and selected breedable males were maintained.

Pattern of rutting behaviour of camel in different management conditions was examined. Ten adult male camels (8-11 years old) were taken and divided into two groups of five each. Group I is given exposure in front of female camel for 20 to 30 minutes everyday. Rutting behavioural frequency was

almost of similar type in both the groups during 1st and 2nd week. From 3rd week onwards frequency significantly ($P<0.01$) increased in exposed group as compared to unexposed group. From 4th week onwards significant increase in levels of testosterone ($P<0.01$) and cortisol were observed in exposed group as compared to unexposed group.

It was revealed that gram straw alone is not sufficient for camel calves. No significant difference was observed among loose and complete feed block feeding to camels in respect of plane of nutrition, growth and feed efficiency. Feeding of complete feed blocks, CR1-FB, consisting of gram straw, groundnut forage and concentrate may be used for optimum nutrient utilization and growth of camel calves for getting additional advantage of less storage space, low transport cost and ease in feeding management.

Evaluation of complete feed blocks in draft camels under field conditions revealed that daily DMI (dry matter intake) and water intake was higher in draft camels in phase when camels were given complete feed blocks. The nutrient intake in terms of DCP, TDN and ME g/d or on metabolic body weight basis were higher in draft camels given complete feed blocks in phase II indicating the beneficial effect of feeding complete feed blocks to draft camels.

Five exhibitions were organised in Bikaner and nearby villages to explain the benefit of feeding complete blocks to camel cart owners and wide publicity was given through local newspapers. The complete feed blocks were freely distributed to 249 camel cart owners.

Trace mineral evaluation of feed and fodder used at the NRCC farm including samples collected from Agro forestry unit revealed that 31.6, 26.3, 73.7, 31.6, and 21.1 percent of the samples were deficient in copper, cobalt, zinc, manganese and iron, respectively. Average copper content in the feeds and fodders of Jaisalmer region was 45.15 mg/kg DM which is four and half times of minimum value required (10.0 mg/kg DM). Majority of feed and fodder samples of NRCC, Nagaur, Churu, Bikaner and Jaisalmer were deficient in Zn content. The feed and fodders of arid zone in general, is poor source of cobalt. Average manganese and iron content in feed and fodders of NRCC, Bikaner, Churu, Nagaur and Jaisalmer were above minimum requirement (40 mg/kg DM and 50 mg/kg DM).

Highest bioavailability of Copper, Zinc and Manganese were observed in groundnut (*Arachis hypogea*) green fodder, whereas, green guar (*Cyamopsis tetragonolobus*) showed higher bioavailability of Cobalt and Iron.

Extensive surveys were made to know the present status of different camel breeds in their respective breeding tracts for the scientific information on Mewari, Sindhi, Marwari and Mewati camels. A breed descriptor of Mewari breed was prepared and published.

In farm rangeland 2500 saplings were planted during the year. 15 quintals of guar seed and 35 quintals of guar phalgati were produced.

Comparative trial on camel manure with others was undertaken on Khejri, Ardu and Ber plants of same age (two year), for one year. Growth of all plants with respect to monthly average height (7.5 and 13.5 cm) was found more with sheep manure, while the height of beri was found maximum with both manure as compared to Khejri and Ardu. The analysis of urine and manure for micronutrients of camel, sheep and calf depicted that the camel manure contains a high amount of micronutrients viz. Zn, Cu, Co Fe, Mg and macrominerals Ca, Na, and K compared to other samples of urine. Analysis of soil samples of Nokha and Dungargarh tehsils of Bikaner district revealed that soil was deficient in available P_2O_5, K_2O and nitrogen content while Ca, Mg and Sulphate concentration were well above from critical level.

3. INTRODUCTION

The National Research Centre on Camel, Bikaner was established on 5th July 1984. Prior to that the Centre was known as Camel Breeding Farm under the aegis of college of Veterinary and Animal Science, Rajasthan Agricultural University, Bikaner. It is located in the Jorbeer area at a distance of about 10 km from Bikaner city. The geographical location is 28.3° North Latitude and 73.5° East Longitude at MSL of 234.84m. The topography of the area is arid undulating desert with vast range of sand dunes. The soil type is mostly loose and sandy. The climate is mostly dry and hot with average annual rainfall of around 250 mm. In summer temperature ranges from 30 to 45°C and between 4 to 28°C in winter season.

The present camel population of the world is 19.31 million. Africa having the highest camel population of 15.13 million followed by Asia it is 4.17 million. Overall population of camel in India is less than 1.0 million and it ranked fifth in the world after Somalia (6.2 m), Sudan (3.2 m), Mauritania (1.2 m) and Ethiopia (1.07 m).

The Centre has the mandate to conduct basic and applied research for the improvement of camel. Over the years, NRCC has developed excellent modern laboratory facilities and infrastructure and has generated substantial scientific data and developed technologies on various aspects for Indian camels. An elite herd of Bikaneri, Jaisalmeri and Kachchhi breeds of camel have been developed. The Centre has also generated useful information on various aspects of double humped camel found in Nobra Valley of Laddakh region for its further conservation.

The Centre is identified as one of the important tourist place of Bikaner and is included in the tourist map of Rajasthan. A small camel museum has been developed which has become an important source of attraction for researchers and tourists. Every year thousands of Foreign and Indian tourists visit the Centre. The museum remains open throughout the week from 2.30 PM to 5.30 PM for the visitors. The Centre participated in important events held during the Camel Festival organised by Rajasthan Tourism Development Corporation and Local Administration.

3.1 Mandate

- To undertake basic and applied research for improvement of camel.
- To provide leadership and co- ordinate camel research and training nationally and act as a National repository of information.
- To collaborate with national and international agencies for camel research and development.

3.2 Past achievements

Draught and Work Physiology

- Useful baseline data have been generated on draughtability, riding, ploughing capacity and fatigue index of Indian camel.

- Bikaneri camels are better than Jaisalmeri and Kachchhi for endurance for draught, whereas Jaisalmeri breed perform better for riding/race.
- Heart girth, height at wither, body weight and body length of camel are positively correlated with horse power and draught.
- The work rest cycle indicated 2 hours rest to be sufficient after 4-6 hours continuous work. The indices for formulating a fatigue index card has been identified

Camel Genetics and Breeding

- An elite herd of important indigenous Bikaneri, Jaisalmeri and Kachchhi breeds have been developed.
- Characterization of Bikaneri, Jaisalmeri and Kachchhi breed has been carried out on the basis of phenotypic appearance, biometry, body weights, milk & hair production.
- The restriction enzyme digestion of camel genomic DNA indicated probable existence of higher equimolar concentration of satellite DNA and probable internal periodicity spanning of about 100-200 bp.
- The PCR-RAPD showed enough genetic variation between and within dromedary breeds. Reproducible Polymorphic bands with varying frequencies among the three breeds of camel were obtained with five primers.
- Camel hair is an important commodity for the village cottage industry in camel rearing states. Various products, such as bags, shawls, blankets, ropes and floor coverings are prepared from it. The annual hair production trend was also observed to be significantly higher in Bikaneri (8060.57g) as compared to the Jaisalmeri (7580.46 g) and Kachchhi (6450.50 g) breed. Among all the age groups hair production was found to be heaviest at 2-3 yrs of age as compared to other age groups.
- The evaluation of milk production potential of Bikaneri camels indicated that the average milk production is about 3.5 liters per day. The milk production was higher in morning as compared to evening. The lactation in camel may continue up to 15th month if the calf is allowed to suckle.
- Microsatellite analysis was carried out in the three breeds of camel. So far 16 loci have been studied. The number of alleles ranged from 2 to 7. The Nei's expected heterozygosity ranged from 0.289 to 0.815 and the polymorphic information content ranged from 0.267 to 0.791. The genetic distances between the three Indian breeds have been estimated using PHYLIP 3.6 and MICROSTAT 2 software. The consensus arrived from observed data indicated close phylogenetic relationship between Bikaneri and Kachchhi breeds as compared to Bikaner and Jaisalmeri and Kachchhi and Jaisalmeri.

- Six databases viz. inventory of the camel herd, biometry database, breeding tract database of Jaisalmeri camel, reproduction database, health database, production database, have been developed and are being updated regularly.
- PCR-RFLP analysis at kappa-casein and MHC-DRB3 locus in livestock species carried out. Selection programme for improvement of draughtability has been started.

Camel Reproduction

- Camel semen has been successfully cryo-preserved though success rate is yet to be improved. Sonographic monitoring of pre-ovulatory follicle, induction of ovulation with exogenous hCG and AI with frozen thawed semen was attempted in limited number of females and successful conception at day 40 has been confirmed.
- Techniques of superovulation, embryo collection and transfer in camel have been attempted successfully and two camel calves have born after transplantation.
- Studies on poll glands indicated higher cellular activity and large quantity of androgens during breeding season than that of serum level. It is closely associated with male reproductive function.
- Reproductive efficiency of camel can be further improved by 10 to 15 per cent if given two mating at first 0 hr and second at 72 hr interval.

Camel Nutrition

- Analysis of different feed resources available in Bikaner region indicated higher crude protein values in tree leaves followed by bushes/shrubs, leguminous crops and grasses.
- Nutrient intake and utilization of growing calves, dry, pregnant, lactating camels and breeding studs have been worked out.
- During scarcity of grazing fodder in the field, feeding of guar phalgati along with green jall both @ 5 kg/camel/day sustained the body weight of the grazing camel calves.
- For optimum and economic utilisation of different feed resources feed blocks have been prepared and successfully consumed by the camels.

Camel Health Research

- Calf mortality has been reduced considerably to 5-7% at farm following improved management and health care practices, as compared to field where it is around 20 to 30%.

- Disease surveillance of camels indicated sarcoptic mange and trypanosomosis to be major parasitic infections. Mange incidence can be reduced significantly by adaptation of improved management practices.

- The preliminary studies on role of raw camel milk as nutritional supplement in human tuberculosis were undertaken. The patients were given standard therapy along with raw camel milk @1 lt/day as supplement. Empathetically increase in appetite and body weight, no pus formation, radiological improvement in terms of lung expansion was found in patients supplemented with camel milk. A significant increase in Hb%, reduction in ESR and TLC was noticed in these patients. The level of Zn was significantly higher in patients supplemented with camel milk.

- The research on camel milk as nutritional adjuvant has been found to be very beneficial against type I diabetes patients.

Camel Management

- Comparative study of camel carting vs bullock carting under hot arid region indicated that camel carting is more profitable for the small and marginal farmers due to higher cost benefit ratio, short pay back period and more load carrying capacity.

- Camel carting is a subsidiary source of income for unemployed rural youth/labours during lean and draught period for turning their economy viable in hot arid Thar Desert.

- The average cost of feeding/rearing is around Rs. 40 to 50/day under carting. The average daily income from camel carting ranges from Rs. 150 to 300/day which mainly depends upon location (village/ city), and transport frequency and number of items of transportation.

Extension activities

- Free breeding input through superior studs are provided to the she camels of camel keepers/farmers of near by villages who brought them during breeding season (January to March).

- Distribution of genetically improved studs to Panchayat sameeties/herd owners through state Animal Husbandry Department every year for breed improvement in respective home tracts of Indigenous breeds.

- Regular organization of Animal Health Camps, Kisan Gosthies and Kisan Divas at the Centre, adopted villages (Gadwala) and other places.

- Centre regularly participates in the local Camel Festival held annually and other National and State level Livestock fairs and exhibitions.

3.3 Infrastructure

The infrastructure facilities include a Livestock farming unit, Research Laboratories, Library, ARIS cell, Agricultural Farm office and Farm Range land, Residential complex, Guest House and Camel Museum.

Livestock farm: The farm maintains a herd of about 250 camels comprising of three indigenous breeds (Bikaneri, Jaisalmeri and Kachchhi). The unit is equipped with one camel Dispensary and a Disease Diagnostic Laboratory, 6 sheds, 3 camel boxes, one metabolic shed and a shed with provision for individual feeding. The farm also posses feed and fodder godown and two weighbridges-one mechanical and other electro-mechanical. Four new camel corrals, camel dispensary, agriculture farm office and post mortem room & pit have been added in block No. 1 and 2 of the farm range land area.

Laboratories: NRC on camel has modern laboratories at 2 different complexes. One having laboratories for camel Physiology cum Biochemistry, Camel Genetics, Camel Reproduction, Camel Health, ARIS cell with LAN and internet connectivity, Administrative Wing; and other complex has Camel Nutrition and Field Camel Reproduction labs. The research unit has one seminar hall with a capacity of about 110 seats. Recently Genetics and Camel Health Research laboratories have been renovated and modified. Small Animal House has been added.

Library: The library subscribes around 48 Indian and foreign journals. The magazines and newspapers are available to keep the readers up-to-date on national and international current affairs. The library has acquired a large number of books on science, literature and other subjects in Hindi language as well. Internet facility has also been provided to the users through LAN for accessing the online journals and scientific reports. The library has procured SOUL software package (INFLIBNET Centre, Ahmedabad) to undertake automation of housekeeping activities in the library. Reprographic services and reprints are available to the reader on demand.

ARIS Cell: Internet connectivity with e-mail facility to all sections has been provided through VSAT. Windows based 15 nodes Local Area Network (LAN) is successfully running at Centre under Window Back Office Server. The E-mail server named nrccamel has been created. The ARIS Cell is maintaining various databases. Centralised Laser, Inkjet Black & colour printing facilities have been provided to all sections.

Range land: The NRC on Camel has 824 ha land partitioned in 5 blocks with 3 tube wells. About 650 ha of area has been fenced and 35 ha of land has been brought under perennial silvipasture comprising of grasses, shrubs and trees. Main grasses are sewan (*Lasiurus sindicus)* and Blue panic (*Panicum antidotale)*. In order to improve feed resources Silvipasture development and large scale tree plantation has been undertaken in collaboration with State Forest Department in Block No. 1.

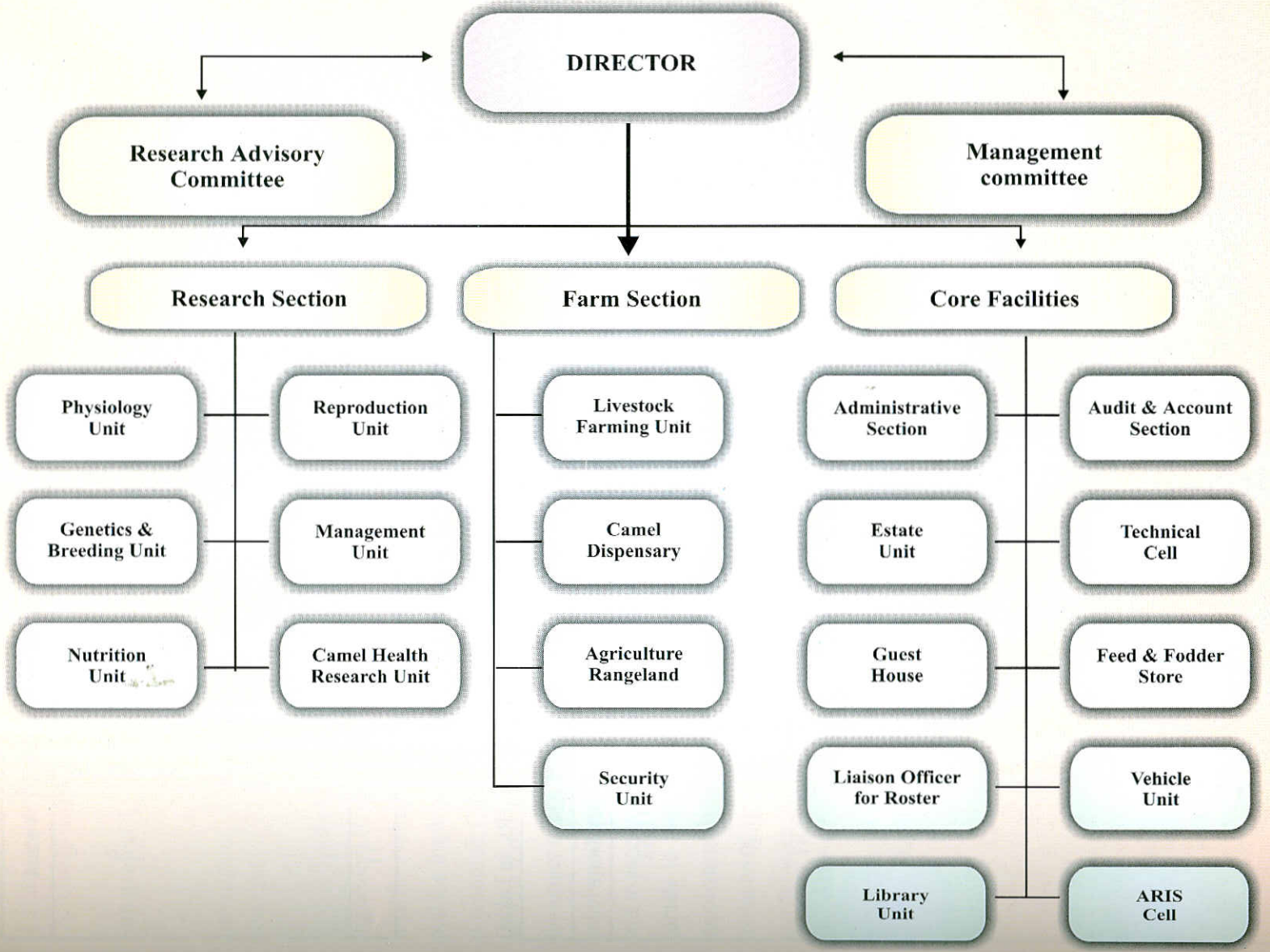
Residential complex: NRC on Camel has residential colony comprising 33 quarters including 2 type V, 5 type IV, 5 type III, 9 type II and 14 type I staff quarters.

Guest House: Centre has one small guesthouse with 6 rooms including two VIP suits and it can accommodate 12 guests.

The work of new administrative cum Library building is under progress.

3.4 ORGANOGRAM

NATIONAL RESEARCH CENTRE ON CAMEL, BIKANER



3.5. Staff Position (2003-04)

Cadre	Sanctioned	In position	Vacant
RMP	1	1	-
Scientist	25	16	9
Technical Category III	4	4	-
Category II	7	7	-
Category I	10	10	-
Administrative	10	9	1
Supporting	19	18	1
Total	76	65	11

3.6. Financial Statement and revenue receipt (2003-04)

(Rs. in Lakhs)

Head of Account	PLAN		NON-PLAN	
	Budget	Expenditure	Budget	Expenditure
Estt. Charge	-	-	111.53	111.53
Wages	13.19	13.19	-	-
O. T. A	-	-	0.20	0.20
T. A.	-	-	0.87	0.87
H. R. D.	1.73	1.73	-	-
Other Charge Including equipment	150.00	150.00	14.20	14.20
Works	44.88	44.88	-	-
Minor Works	-	-	4.95	4.95
A. R. M. O	-	-	2.86	2.86
On Residential	-	-	2.86	2.86
Total	209.80	209.80	137.47	137.47
Revenue Generation	3.84			

4. RESEARCH ACHIEVEMENTS

4.1 Improvement of working efficiency of camel under arid and semi-arid conditions

Sub project 1: To evaluate improved kind of camel drawn implements versus traditional implements

Investigator : Aminu Deen
Associate : M. S. Sahani

Trials were undertaken on 4 duly trained adult camels using both improved kind of camel drawn implement (6 disc harrow) (Fig. 4.1.1) and traditional plough (2 tyne plough) (Fig.4.1.2). The criteria used for evaluation were total pulling time before fatigue (Camel sits down on ground and do not further pull the implement), area ploughed, pulling load, penetration depth and certain biochemical profiles (Creatinine, Creatine Kinase, Lactate and Cortisol) monitored pre and post- operation. The study was in continuation of previous year's work, in which it was observed that harrow can not be pulled by camels for longer than 1 hour. The study was repeated due to certain reasons like drought conditions and non-supplementation of some energy substances during pervious year. The overall objective of the study was to ascertain if enrichment of diet and operations under rainy conditions can improve efficiency of camels to pull harrow or it is heavier and traditional ploughs can only be relevant. The dietary supplementation were accomplished with vegetable oil, jaggery and alum drenched before the initiation of operation. The trials were undertaken during July-September, 2003. The conditions of the ground were sometimes ideal with proper amount of moisture due to fresh rains and sometimes it was dry. Accordingly, the data have been splitted into two and presented in Tables 4.1.1(a) and 4.1.1(b).

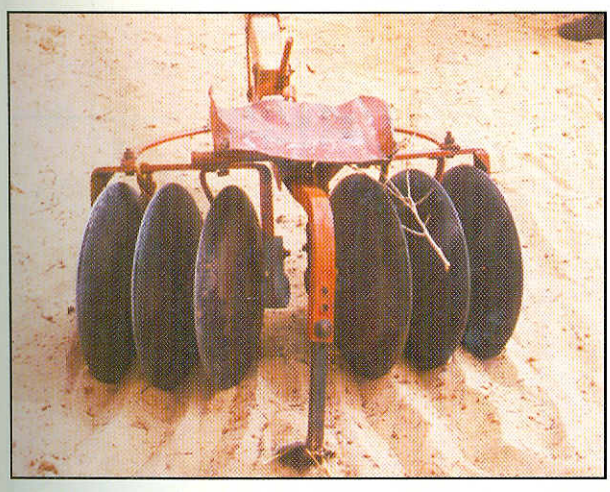


Fig. 4.1.1. - 6 disc harrow

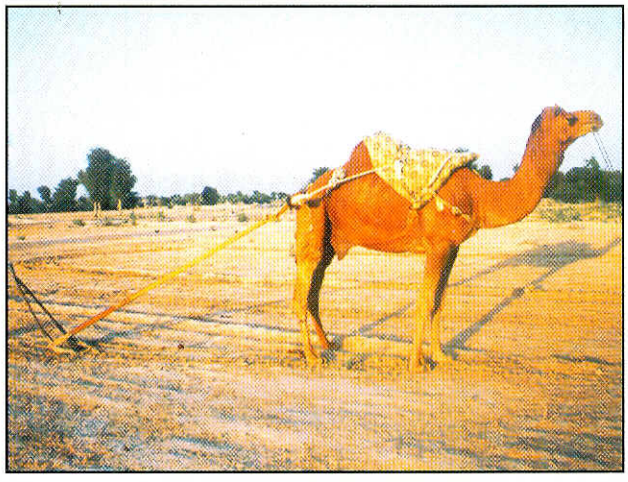


Fig. 4.1.2 Double Plough

Table 4.1.1(a) Average total pulling time, pulling load, Area covered and penetration depth with 2 type of implements during rains

Camel	Total Pulling time (min.)		Area covered (m^2)		Pulling Load (kg)	Penetration depth (inches)
	Harrow	2-Tyne	Harrow	2-Tyne plough		
	Mean (Range)	Mean (Range)	Mean (Range)	Mean (Range)		
J-54	54.2 (47-71)	164	2290.8 (1837-2747)	3800	Harrow 77-202 Kg	6-9
J-58	60.8 (49-82)	262	2036.7 (1341-2604)	3750		
K-90	60.1 (46-90)	229	2060 (1512-3200)	4436	2-Tyne plough	6-9
C-20	55.2 (46-56)	212.5 (202-223)	1878.3 (1370-2749)	4786 (4100-5472)	32-140 kg	

Table 4.1.1(b) Average total pulling time, pulling load, area covered and penetration depth with 2 type of implements during dry condition

Camel No.	Total Pulling time (min.)		Area covered (m^2)		Pulling Load (kg)	Penetration depth (inches)
	Harrow	2 Tyne plough	Harrow	2 Tyne plough		
	AV/ (Range)	AV/ (Range)	AV/ (Range)	AV/ (Range)		
J-54	31.2 (20-38)	76.25 (50-95)	1039.2 (300-1320)	2369 (1500-3089)	Harrow 77-202	6-9
J-58	39.6 (37-43)	99.75 (77-130)	1014.3 (896-1204)	2624.5 (2254-3000)		
K-90	29.4 (15-40)	100 (45-163)	987.7 (400-1730)	2325.3 (1120-3921)	2 Tyne plough 32-140	6-9
C-20	27.5 (18-43)	105.25 (45-135)	950.6 (700-1572.5)	2753.25 (1300-4618)		

These results indicated that efficiency of pulling harrow by camels in terms of total pulling time before fatigue is lower than traditional 2 tyne plough. These results also indicate that a good camel can pull harrow for a maximum of 1 hour, while under similar conditions, a 2 tyne plough can be pulled continuously for 4 hours. The area ploughed by 2 implements under rainy conditions measured around 2000m^2 and 4000-4500 m^2, respectively. Under dry field conditions it is difficult to operate these implements due to heavy load exerted in pulling. This is apparent from data presented in Table 4.1.1b, which indicate that harrow could be pulled on an average for 30-40 minutes covering around 1000 m^2 area, while a 2-tyne plough could be pulled for 90-105 minutes covering an area of around 2300-2700 m square. Dietary supplementation did not improve the efficiency of camel to pull harrow apparently it appear to be too heavy to pull upon. It can thus be concluded that promoting use of harrow with farmers appear to have poor perspectives. Traditional ploughs appear to be more relevant for use on farmers field, as pulling load is lower than harrow and it is less stressful for camel to pull upon. Table 4.1.2 shows biochemical profiles pre- and post- operation with harrow and 2 tyne ploughs.

Table 4.1.2 Plasma Creatinine, Creatine kinase, Lactate and Cortisol profile of camels, pre and post operation with 2 type of implements

Camel No.	Creatinine (mg/dl)				Creatine Kinase (Unit/ml)				Lactate (mg/dl)				Cortisol (µg/dL)			
	Harrow		2-tyne plough		Harrow		2-tyne plough		Harrow		2-tyne plough		Harrow		2-tyne plough	
	Pre-	post	Pre-	post	Pre-	Post	Pre-	Post	Pre-	post	Pre-	post	Pre-	post	Pre-	post
J-54	1.89	2.01	1.60	1.84	100.25	127.53	175.42	272.64	1.44	8.12	1.99	7.63	0.69	5.7	1.11	3.85
J-58	1.82	1.96	1.68	1.93	148.61	170.41	119.71	153.84	2.27	3.80	2.46	4.34	1.02	4.5	1.5	4.12
K-90	2.06	2.16	1.94	1.95	101.11	111.26	23.95	29.46	1.63	2.22	2.18	2.59	0.33	2.33	0.88	1.96
C-20	2.32	2.49	2.31	2.45	63.74	91.97	51.63	76.62	1.56	13.13	3.42	8.84	1.37	6.42	0.88	5.66

Biochemical changes associated with the operation of harrow and traditional plough did not differ significantly. There were no significant and consistent biochemical changes, which can be used as a tool or marker of fatigue in draft camels.

Sub project 2: Evaluation of camel milk proteins and their applications

Investigator : Raghvendar Singh
Associates : M.S. Sahani, Aminu Deen, S. K. Ghorui and S. K. Bhure

Camel milk lactoperoxidase

Lactoperoxidase is most heat stable enzyme in milk and its destruction was used as an index of flash pasteurization. The peroxidase system has been found to have good bactericidal efficiency for the cold pasteurization of fluids. Camel milk samples of late lactating Bikaneri camels were collected in sterilized cold container from the farm herd and processed for heat treatment at 40°, 70° and 80°C each for 5 minutes. The lactoperoxidase activity was measured by the increase in color at 485 nm wavelength per unit time. The activity at 40°C, that is around room temperature was recorded as 2.23±0.01 unit per ml of milk while it was reduced to 1.00 and 0.07 unit per ml at 70° and 80°C, respectively (Fig-4.1.3).

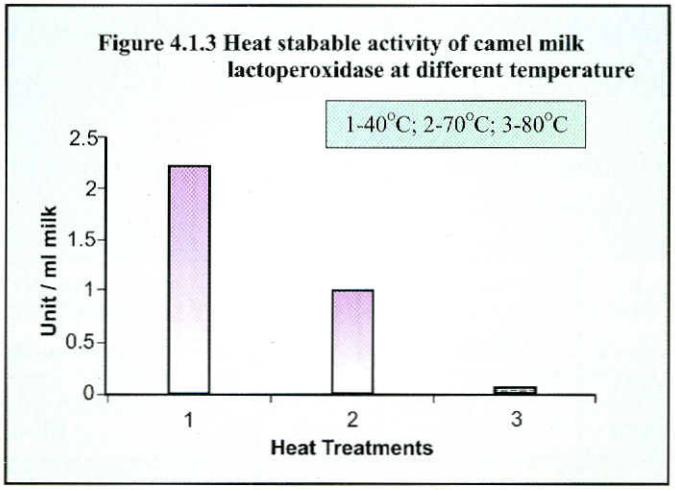
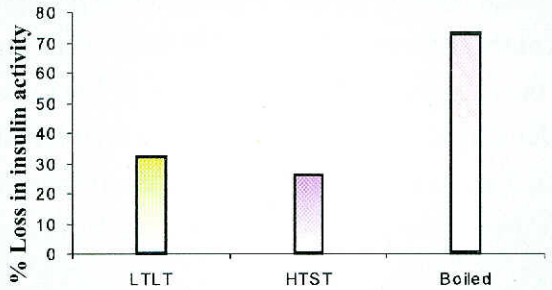


Figure 4.1.3 Heat stabable activity of camel milk lactoperoxidase at different temperature

Camel milk Insulin

Whole milk samples were collected in sterilized cold glass container from 7 late lactating she camels. Each milk sample was divided in 4 groups to give different heat treatments. The treatment were (A) raw camel milk without heat treatment, (B) long time low temperature (LTLT), (C) high temperature short time (HTST) and (D) boiling for five minutes. After giving respective heat treatments, all the samples were processed for determination of activity of milk insulin by radioimmunoassy as per the procedure mentioned in the insulin ^{125}I-labelled radioimmunoassay kit. The average insulin activity in the group A (raw milk without heat treatment) was measured 30.71±1.63 mIU /L. The percent loss of insulin activity was observed to be significantly ($P<0.05$) higher in the group D whereas in group B it was comparatively less followed by group C (Fig. 4.1.4). The pasteurization of camel milk by HTST will be more beneficial to prevent denaturation of insulin activity as compared to other groups of heat treatments.

Fig. 4.1.4 Heat induced effect on camel milk insulin activity



Camel lactoferrin

Camel lactoferrin was purified from pooled samples of camel milk and colostrum collected from lactating camel from camel herd of the center. Purification and preparation of apo and saturated lactoferrin was carried out with the help of Dept. of Biophysics, AIIMS, New Delhi according to locally modified method of gel filtration chromatography with use of cation exchanger CM- Sehadex C-50. The purified forms of lactoferrin were studied *in vivo* rat bioassay to evaluate its antidiabetic role. The antibacterial property against pathogenic bacteria is under process of study.

4.2. Genetic characterization, evaluation and conservation of Indigenous camel breeds

Subproject 1: Selection for the improvement of draughtability of camel breeds

Investigator: S.C.Mehta
Associates : M.S.Sahani, R.Singh and U.K.Bissa

Selection of studs

Body measurements of camel up to the age of six years were recorded in September, 2003. Since the body length and related traits have significant effect on draughtability 7, 5 and 2 males, respectively of Bikaneri, Jaisalmeri and Kachchhi breed were selected mainly on the basis of body length (Table 4.2.1). Of these, 4 males of Bikaneri, 3 males of Jaisalmeri and one male of Kachchhi breed were transferred to other sections for research. The population mean, mean of the selected individuals and the selection differential have been presented in Table 4.2.2.

Leastsquares analysis of variance was also carried out to see the significance of difference in the two groups for body length, heart girth and height at wither. The selected group had significantly ($P<0.01$) higher body length (172.67±3.07 cm) as compared to the population (159.91±1.62 cm). The two groups were non-significantly different ($P<0.05$) for heart girth and height at wither. Further analysis was carried out to see the reasons in the individual breed. The selected group in Bikaneri breed had significantly higher body length, heart girth and height at wither but due to the smaller population size in Jaisalmeri and Kachchhi, the over all selection differentials reduced significantly, accounting for non-significant difference in the two groups in pooled data for heart girth and height at wither.

Table 4.2.1 Breeding plan for the year 2003-2004

Breed	Available females	Studs to be used for breeding	Sire	Dam	Females bred
Bikaneri	20 + 8 (Research)	526 Chhaila	Purchased		2
		418 Degri ka beta	363	92	
		474 Sohanki ka beta	285	151	
		528 Chhabila	Purchased		11
		346 Surangadi ka beta	179	102	6
		530 Rangila	Purchased		
		480 Kajalki ka beta	47	78	
Jaisalmeri	10 + 5 (Research)	154 Mishia	Purchased		5
		158 Kaji	Purchased		6
		74 Mirgdan ka beta	373	262	
		92 Fuldi ka beta	268	289	
		54 Kojki ka beta	188	291	
Kachchhi	7	90 Anchi ka beta	213	305	9
		114 Patel	Purchased		
Crossbred	3 + 3 (Research)	20 Jhadki ka beta	415	242	

Table 4.2.2 Population mean and selection differential in adult camels

(Means in cm)

SGR	N	Body Length	Heart Girth	Height at wither
Selection		**	NS	NS
Population	54	159.9±1.6	211.0±3.4	200.7±1.3
Selected	15	172.7±3.1	223.8±6.5	204.7±2.5
Selection Differential		**12.76**	**12.82**	**3.99**
Bikaneri		**	**	*
Population	18	157.2±2.2	211.5±2.1	197.8±1.5
Selected	7	174.9±3.5	223.3±3.3	205.1±2.4

*(P<0.05) **(P<0.01)

Sub project 2: Studies on qualitative and quantitative genetic parameters in Indian Camel

Investigator: S.C. Mehta
Associates: M.S. Sahani, U.K. Bissa and B.L. Chirania

Body weight and growth

The least squares mean and analysis of variance of growth data for the period 1997-2003 is presented in Table 4.2.3. The average birth, 3, 6, 9, 12, 24, 36 and 48 months weight was 36.5±0.5, 89.9±3.19, 143.61±3.12, 176.19±3.25, 189.03±4.58, 260.26±5.57, 343.31±6.88 and 394.05±6.23 kg, respectively. The effect of breed was significant at 9, 12 and 24 months of age. The effect of sex was found non-significant except at 6 months weight. It is observed that during growth phase the Jaisalmeri calves were at times heavier than the Bikaneri calves whereas the adult Bikaneri camels weigh more than the Jaisalmeri camels.

Reproductive parameters

The information on mating and calving performance of the Center's herd from the year 2000 to 2004 is presented in Table 4.2.4. This year the overall calving was 75.86%. Highest calving percentage was recorded in Bikaneri (77.77%) followed by Kachchhi (75.00%) and Jaisalmeri (71.43%). Last year the calving was 79.31%, which is slightly higher than this year's calving. However, this year the

Table 4.2.3 Least squares analysis of body weight of camel calves (1997-2004)

Body Weight/ Effects	BWT	3MWT	6MWT	9MWT	12MWT	24MWT	36MWT	48MWT
Pooled	36.50±0.49	89.86±3.19	143.61±3.12	176.19±3.25	189.03±4.58	260.26±5.57	343.31±6.88	394.05±6.23
	(253)	(211)	(178)	(175)	(223)	(159)	(152)	(157)
Breed Effect	NS	NS	NS	**	**	**	NS	NS
Bikaneri	37.44±0.47	88.71±2.70	147.23±2.78	182.29±3.19	198.88±4.52	260.06±5.27	338.44±7.37	408.50±6.72
	(123)	(106)	(85)	(87)	(106)	(75)	(67)	(72)
Jaisalmeri	37.04±0.57	88.18±3.17	153.0±03.18	189.82±3.88	211.77±5.31	280.52±5.72	348.45±7.64	400.87±7.19
	(81)	(75)	(62)	(56)	(75)	(62)	(60)	(58)
Kachchhi	36.33±0.82	89.16±5.72	147.38±5.02	185.98±5.95	170.52±8.15	272.50±11.66	344.28±14.74	489.10±12.81
	(39)	(23)	(25)	(24)	(32)	(15)	(16)	(18)
Sex Effect	NS	NS	**	NS	NS	NS	NS	NS
Male	36.37±0.62	89.39±4.05	138.0±94.05	179.94±4.21	183.48±5.99	256.77±7.08	347.08±9.45	396.93±8.62
	(105)	(82)	(70)	(70)	(94)	(67)	(57)	(53)
Female	36.61±0.57	90.33±3.39	149.12±3.27	172.45±3.68	194.59±5.09	263.74±6.19	339.53±7.45	391.17±6.79
	(148)	(129)	(108)	(105)	(129)	(92)	(95)	(104)

conception rate was observed to be 57.14%, which is relatively lower than the performance of the previous year. This year 6 new- born calves died and there was one stillbirth. Ten calves were born out of females given to reproduction unit.

The data for age at first conception and calving along with gestation length were also analysed for the period 1986-2004 (Table 4.2.5). The average age at first conception was 1796.07±80.62 days. Lowest age at first conception was observed in Kachchhi (1685.38±152.80 days) followed by Bikaneri (1763.54±71.05 days) and Jaisalmeri (1930.711±115.51 days). A large SE in Jaisalmeri suggests the scope for improvement.

Table 4.2.4 Reproductive Performance of the Camel Herd

Year	Traits	Bikaneri	Jaisalmeri	Kachchhi	Crossbred	Pooled
2000	Mating	17	14	6	1	38
	Conception	12 (70.6 %)	12(85.7 %)	2(33.33 %)	1(100%)	27(71.1%)
	Calving	10 (83.3 %)	10(83.3%)	2(100%)	1(100%)	23(85.2%)
2001	Mating	35	25	17	-	77
	Conception	24(68.6%)	19(76.0%)	9 (53.0%)	-	52(67.5%)
	Calving	16(66.7%)	12(63.2%)	7 (77.8%)	-	35(67.3%)
2002	Mating	24	12	10	-	46
	Conception	18(75.0%)	6(50.0%)	5(50.0%)	-	29(63.0%)
	Calving	16(88.9%)	3(50.0%)	4(80.0%)	-	23(79.3%)
2003	Mating	26	16*	5	-	47*
	Conception	18(69.2%)	7(43.8%)	4(80.0%)	-	29(61.7%)
	Calving	14(77.8%)	5(71.4%)	3(75.0%)	-	22(75.9%)
2004	Mating	19	11	9	3	42
	Conception	12(63.2%)	6(54.6%)	4(44.4%)	2(66.7%)	24(57.1%)

New born calf mortality-6

Still birth - One Bikaneri female

Ten calves born out of females given to Reproduction unit.

*The females (9) of Jaisalmeri breed were transferred to reproduction unit after giving first service.

Mortality at NRCC herd

Breed wise mortality for the period April, 2002 to March, 2004 has been presented in Table 4.2.6. In all 10 Bikaneri, 8 Jaisalmeri, 3 Kachchhi and one Arab cross camel died. The involvement of digestive system was highest (50%) followed by respiratory system (40.90%) and other systems.

The system wise average age at death was also analyzed (Table 4.2.7). The average age at death in digestive and respiratory system was 1640 and 428 days, respectively. This suggests that care should be taken to protect the young animals from exposure to severe cold.

Milk production

Milk recording was done for 11 camels-7 of Bikaneri and 4 of Kachchhi for the period May to December, 2003 (Table 4.2.8). The quarters of one side were milked in the morning and evening of each day. The effect of breed was highly significant ($P< 0.01$) with the total average daily production of 2.37±0.01 kg in Bikaneri and 2.22±0.02 kg in Kachchhi from one side quarters.

Table 4.2.5 Least squares mean of reproductive traits in Indian camel breeds.

(in days)

Traits / Effects	Age at 1st Conception	Age at 1st calving	Gestation length
Breed effect		NS	
Pooled Breed	1796.1±80.6 (62)	2133.9±78.0 (51)	388.2±5.5 (170)
Bikaneri	1763.5±71.0 (37)	2142.3±86.1 (26)	391.4±4.0 (104)
Jaisalmeri	1930.7±115.5 (14)	2136.5±113.4 (15)	384.0±6.6 (39)
Kachchhi	1685.4±152.8 (8)	2191.6±196.3 (5)	383.6±8.8 (22)
Arab cross	1804.7±249.5 (3)	2065.4±196.3 (5)	393.6±18.4 (5)

NS: Non Significant

Table 4.2.6 Breed and system wise mortality

(April, 2002 to March, 2004)

System	Breed				Pooled (2003-04)	Pooled (2002-03)
	Bikaneri	Jaisalmeri	Kachchhi	Arab cross		
Digestive	5	4	1	1	11 (50 %)	6 (40 %)
Respiratory	3	4	2	-	9 (40.9 %)	5(33.3 %)
Cardiovascular	1	-	-	-	1 (4.6 %)	1 (6.7 %)
Genital	-	-	-	-	-	-
Urinary	-	-	-	-	-	1 (6.7%)
Nervous	1	-	-	-	1 (4.6%)	-
Others	-	-	-	-	-	2 (13.3%)
Total Mortality	10	8	3	1	22	15

Table 4.2.7 System-wise average age at death

S.No.	System	N	Age at death (days)
1	Digestive	11	1640
2	Respiratory	8	428
3	Cardio-vascular	1	719
4	Nervous	1	29

Table 4.2.8 Milk production from one side quarter per day in the Bikaneri and Kachchhi females

(in litres)

Breed	N	Morning	Evening	Total
Pooled	11	1.62±0.0	0.67±0.0	2.29±0.0
Bikaneri**	7	1.67±0.0	0.70±0.0	2.37±0.0
Kachchhi**	4	1.56±0.01	0.65±0.0	2.22±0.0

**(P<0.01)

Field improvement

The opening balance was 247 camels and the closing balance was 225 camels (Table 4.2.9). This year 8 breedable males, 5 of Bikaneri and 3 of Jaisalmeri were distributed through Rajasthan Government for improvement in the field. Five adult camels were given to the army BSF for their use.

Creation of Database

1. **Inventory of the Centre's camel herd**. This includes pedigree information on all available animals of Bikaneri, Jaisalmeri, Kachchhi and Arab cross camels maintained at the Centre's farm.

2. **Database on biometry**. This includes information on 17 traits (body measurements) of the camels maintained at the Centre.

3. **Breeding tract database on Jaisalmeri camel**. This includes information on district, tehsil, village, camel breeder and biometry on 17 traits of true to the breed animals of Jaisalmeri breed as found in the breeding tract.

4. **Reproduction database**. This includes information on reproductive performance of the Centre's herd from 1984 to 2004.

5. **Health database**. This includes information on mortality of camels at NRCC farm since 1984 to 2004.

6. **Production database**. This includes information on hair and milk production of camels

Table 4.2.9: Herd strength (2003-2004)

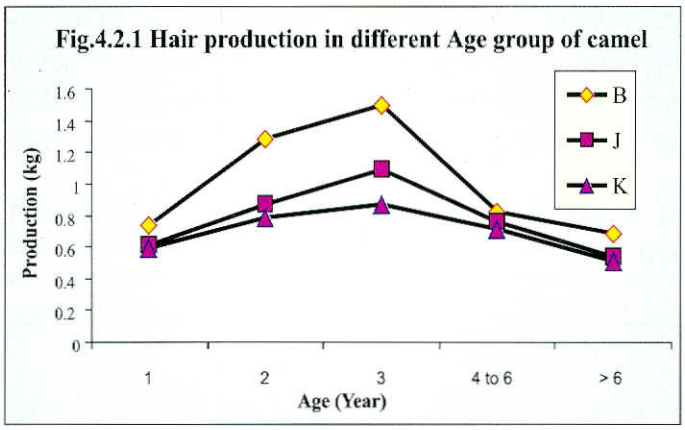
Breed	Opening		Calving		Pur	Died		Auction		Raj. Govt		Army	Closing	
Bikaneri	M	F	M	F	-	M	F	M	F	M	F	M	M	F
0-1 yr.	7	8	5	8	-	2	-	0	0	-	-	-	4	8
1-2yr.	7	8	-	-	-	1	3	3	-	-	-	-	6	8
2-3yr.	5	1	-	-	-	-	-	4	-	-	-	-	3	5
3-4yr.	5	6	-	-	-	-	1	-	-	4	-	1	1	1
>4yr.	15	45	-	-	-	-	1	2	2	1	1	-	11	47
Total	**39**	**68**	**5**	**8**	**-**	**4**	**6**	**9**	**1**	**5**	**-**	**1**	**25**	**69**
Jaisalmeri														
0-1 yr.	3	-	5	3	-	2	-	-	-	-	-	-	5	3
1-2yr.	7	4	-	-	-	2	2	-	-	-	-	-	1	-
2-3yr.	3	7	-	-	-	-	1	2	-	-	-	-	5	2
3-4yr.	3	6	-	-	-	-	-	-	-	2	-	1	1	6
>4yr.	33	25	-	-	-	-	1	2	2	1	-	1	29	28
Total	**49**	**42**	**5**	**3**	**-**	**4**	**4**	**4**	**2**	**3**	**-**	**2**	**41**	**39**
Kachchhi														
0-1 yr.	2	2	7	3	-	1	-	-	-	-	-	-	6	3
1-2yr.	3	2	-	-	-	1	-	1	-	-	-	-	2	2
2-3yr.	-	4	-	-	-	-	1	-	-	-	-	-	1	2
3-4yr.	2	1	-	-	-	-	-	1	-	-	-	1	-	3
>4yr.	6	18	-	-	-	-	-	-	-	-	-	1	5	19
Total	**13**	**27**	**7**	**3**	**-**	**2**	**1**	**2**	**-**	**-**	**-**	**2**	**14**	**29**
AxB														
0-1 yr.	-	-	-	1	-	-	1	-	-	-	-	-	-	-
1-2yr.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-3yr.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3-4yr.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
>4yr.	2	7	-	-	-	-	-	-	1	-	-	-	2	6
Total	**2**	**7**	**-**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**6**
Total	**103**	**144**	**17**	**15**	**-**	**10**	**12**	**15**	**4**	**8**	**-**	**5**	**82**	**143**

Sub project 3: Hair production

Investigator : C. Bhakat
Associates : S.C. Mehta and M.S. Sahani

Annual hair yield data from 196 Indian dromedary camels belonging to 3 breeds (Bikaneri, Jaisalmeri and Kachchhi) from 5 different age groups (1, 2, 3, 4-6 year and above 6 year) were meticulously recorded. The hair production in different age group of camel is presented in Fig 4.2.1. The comparison among different age groups indicated that the highest annual hair production was observed in 3 year age group followed by 2 year, 4-6 year and 1 year age group where as minimum value was obtained in case of above 6 year age group. The Bikaneri male produced maximum annual hair yield (0.75±0.14 to 1.69±0.09 kg) followed by Jaisalmeri male (0.57±0.10 to 1.23±0.16 kg) and Kachchhi male (0.56±0.22 to 0.90±0.19 kg). The female camels produced lesser annual hair yield than male in all breeds and all age groups. The mean annual hair production varied form 0.49±0.08 kg (Kachchhi, > 6 year age group) to 1.50±0.11 kg (Bikaneri, 3 year age group).

Fig.4.2.1 Hair production in different Age group of camel



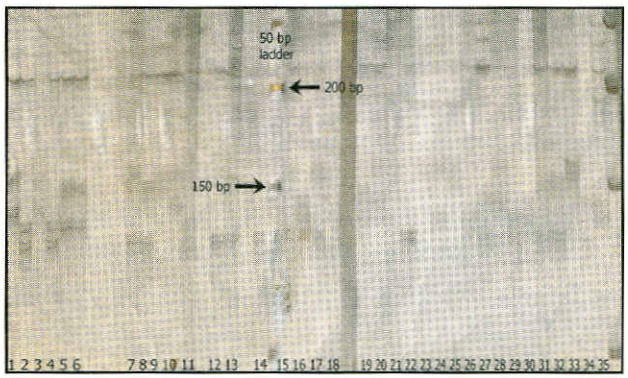
Project 4 : Molecular genetic studies in Indian camel.

Investigator : S.C. Mehta
Associates : M.S. Sahani

Microsatellite markers for genetic characterisation of Bikaneri, Jaisalmeri and Kachchhi camel

Blood samples from 50 unrelated individuals of Bikaneri, Jaisalmeri and Kachchhi breeds were collected from farm and field area. The annealing temperature and PCR amplification was optimised for eighteen primers. The results of sixteen microsatellite loci have been compiled. The PCR amplification products were resolved in 6% (denaturing) urea PAGE and stained with silver nitrate. In Bikaneri breed microsatellite analysis has been carried out for 16 loci. The number of alleles ranged from 2 to 7. The Nei's expected heterozygosity ranged from 0.289 to 0.815 and the polymorphic information content ranged from 0.267 to 0.789 (Table 4.2.10).

Thirteen microsatellite primer pairs were found polymorphic in Jaisalmeri camel. The number of alleles ranged from 2 to 7. The expected heterozygosity ranged from 0.320 to 0.816 and the polymorphic information content ranged from 0.268 to 0.791 (Table 4.2.11). Like Bikaneri and Jaisalmeri thirteen microsatellite primer pairs were polymorphic and remaining three were monomorphic in Kachchhi breed also. The number of alleles ranged from 2 to 6. The observed and expected heterozygosity ranged from 0.34 to 0.88 and 0.33 to 0.79. The polymorphic information content ranged from 0.277 to 0.765. The results indicated the potential use of microsatellite technique to study the genetic polymorphism in dromedary breeds which are very closely related to each other (Table 4.2.12).



Photograph showing alleles at microsatellite locus (YWLL-08) in Kachchhi camels

The genetic distances between the three Indian breeds were estimated using the information of five polymorphic loci in the three breeds and using PHYLIP 3.6 and MICROSAT 2 software. The consensus arrived from observed data indicated close phylogenetic relationship between Bikaneri & Kachchhi breeds as compared to Bikaneri & Jaisalmeri and Kachchhi & Jaisalmeri.

Table 4.2.10 Amplification of microsatellite loci in Bikaneri breed of camel using New World Camelidae primers

Locus	Alleles(n)	Size (bp)	Temp (°C)	H_O	H_e	PIC
VOLP - 03	5	145-168	64	0.43	0.741	0.675
VOLP - 08	3	143 146	50	0.35	0.289	0.267
VOLP - 10	5	250-265	55	0.68	0.715	0.624
VOLP - 67	6	151-195	53	0.32	0.813	0.786
YWLL - 08	7	132-162	55	0.94	0.815	0.789
YWLL - 09	2	160-162	53	0.45	0.339	0.281
YWLL - 38	3	180-186	55	0.63	0.545	0.440
YWLL - 44	2	104-107	55	0.31	0.368	0.300
YWLL - 58	3	173-177	51	1.00	0.619	0.547
YWLL - 59	2	115-117	53	0.58	0.406	0.323
LCA - 56	2	134-138	55	0.46	0.403	0.322
LCA - 63	5	196-220	58	0.54	0.641	0.583
LCA - 66	3	234-238	58	0.26	0.642	0.570
YWLL - 29	1	208	55	-	-	-
YWLL - 36	1	136	55	-	-	-
YWLL - 40	1	173	55	-	-	-

H_O, observed heterozygosity; H_e, expected heterozygosity, PIC- polymorphic information contents

Table 4.2.11 Amplification of microsatellite loci in Jaisalmeri breed of camel (*Camelus dromedarius*) using New World Camelidae primers

Locus	Alleles(n)	Size (bp)	Temp (°C)	H_O	H_e	PIC
VOLP-08	3	143 146	50	0.300	0.605	0.526
VOLP10	5	250-265	55	0.630	0.651	0.588
VOLP - 67	6	151-195	53	0.680	0.682	0.645
YWLL - 08	7	132-162	55	0.800	0.816	0.791
YWLL-09	2	160-162	53	0.388	0.32	0.268
YWLL-44	5	96-108	55	0.630	0.585	0.533
YWLL-58	3	173-176	51	1.00	0.597	0.516
YWLL-59	2	115-117	53	0.660	0.444	0.345
LCA - 56	2	134-138	55	0.400	0.385	0.311
LCA 63	5	196-220	58	0.380	0.633	0.587
LCA 66	3	234-238	58	0.480	0.635	0.558
VOLP - 03	3	148-168	64	0.466	0.573	0.522
YWLL 38	3	180-186	55	0.660	0.570	0.475

H_O, observed heterozygosity; H_e, expected heterozygosity, PIC- polymorphic information contents

Table 4.2.12 Amplification of microsatellite loci in Kachchhi breed of camel (*Camelus dromedarius*) using New World Camelidae primers

Locus	Alleles(n)	Size (bp)	Temp (°C)	H_O	H_e	PIC
VOLP-08	3	143 147	55	0.34	0.50	0.453
VOLP 10	5	250-264	55	0.74	0.74	0.702
VOLP - 67	4	157-185	53	0.88	0.66	0.625
YWLL - 08	6	132-158	55	0.86	0.796	0.765
YWLL-09	2	158-162	58	0.44	0.343	0.2843
YWLL-44	2	104-107	60	0.74	0.476	0.3626
YWLL-58	3	173-177	58	0.50	0.58	0.4934
YWLL-59	2	115-117	58	0.48	0.375	0.3046
LCA - 56	2	134-138	55	0.42	0.332	0.277
LCA 63	4	196-220	58	0.66	0.676	0.632
LCA 66	3	234-238	58	0.56	0.535	0.478
VOLP - 03	3	148-168	64	0.70	0.515	0.460
YWLL38	4	180-186	55	0.58	0.628	0.546

H_O, observed heterozygosity; H_e, expected heterozygosity, PIC- polymorphic information contents

4.3. Improvement of reproductive efficiency and to study the causes of reproductive failure in camels.

Sub project 1: Development of RIA facilities for reproductive hormones of camel

Investigator : Aminu Deen
Associates : Raghvender Singh, Sumant Vyas and M. S. Sahani

Development of RIA for progesterone in camel serum/ plasma.

Anti-progesterone serum was raised by repeated intra-dermal inoculation of progesterone hemi-succinate BSA conjugate (Sigma) emulsified in Freund's complete adjuvant (sigma) at monthly interval continuously for 6 months. The serum was harvested from immunized rabbits from blood collected by ear vein cut: Serum was tested for antibodies by inoculation with tritiated progesterone (Amersham Bio-sciences Ltd., U.K.) Antibody binding results have been shown in Table 4.3.1

Table 4.3.1: Antibody binding with labeled progesterone in sera harvested from 5 immunized rabbits

Antibody dilution / Rabbit No.	Antibody dilution/B/T ratio (%)			
	1:1000	1:2000	1:4000	1:8000
1.	53.3	40.7	25.0	13.4
2.	69.3	68.9	64.1	51.1
3.	54.4	45.3	26.0	19.8
4.	30.8	17.8	11.1	6.9
5.	56.0	53.1	41.9	25.8

These results indicated that sera harvested from rabbit No. 1, 2, 3 and 5 can be used for RIA in great than 1:1000, 1:8000, 1:1000 and 1:4000 litre, respectively. The antibody titer of rabbit No. 4 was little low to be useful for RIA.

Following this testing, standard curve was run using different calibrators viz. zero calibrator, 0.1 ng/ml, 0.5 ng/ml, 2.0 ng/ml, 10 ng/ml, 20 ng/ml and 40 ng/ml. The percent bindings with each calibrator are presented in Table 4.3.2.

Standard curve (Fig.4.3.1) plotted as % binding on vertical axis and concentration of calibrator on horizontal.

Table 4.3.2: Standard curve for progesterone

Tube	Average CPM	Net CPM	Binding %
Total count	14088		
Non specific Binding	172		
Zero Standard	4988	4816	100
0.1 ng/ml	4637	4565	94.7
0.5 ng/ml	4199	4027	83.6
2 ng/ml	3181	3009	62.4
10 ng/ml	1487	1315	27.3
20 ng/ml	976	804	16.6
40 ng/ml	635	463	9.6

Standardization of progesterone assay in the laboratory was then followed by quantitation of this hormone in camel plasma at different reproductive stages viz. day 0-30 after mating of 37 bred females and categorizing them into pregnant and non pregnant, later half of gestation at weekly interval and peri-parturient females at 6 hr interval from 3 days to +1 day of calving. These profiles are presented in Fig(s) 4.3.2-4.3.5.

Fig. 4.3.1: Standard curve of progesterone

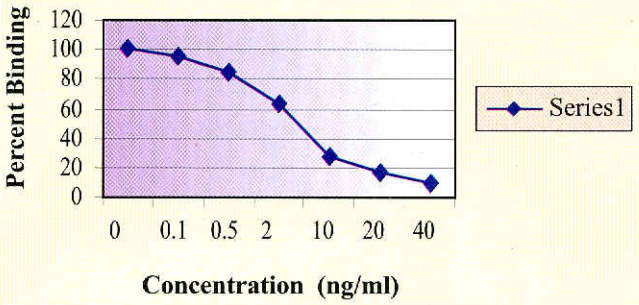


Fig.4.3.2: Progesterone profiles of pregnant female camels

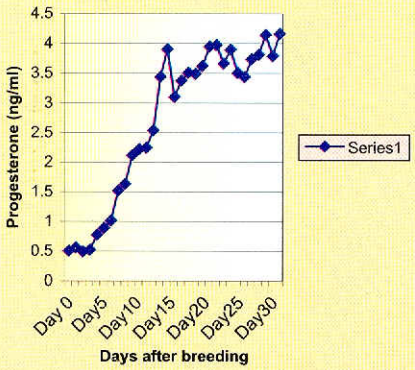
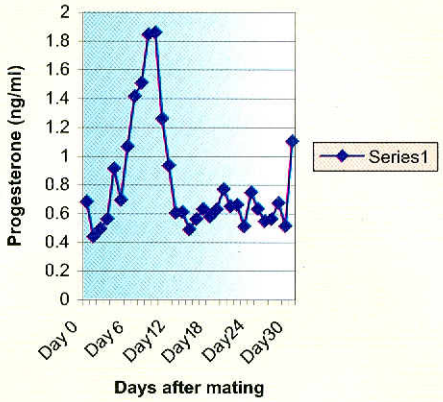


Fig.4.3.3: Progesterone profiles of non pregnant female camels



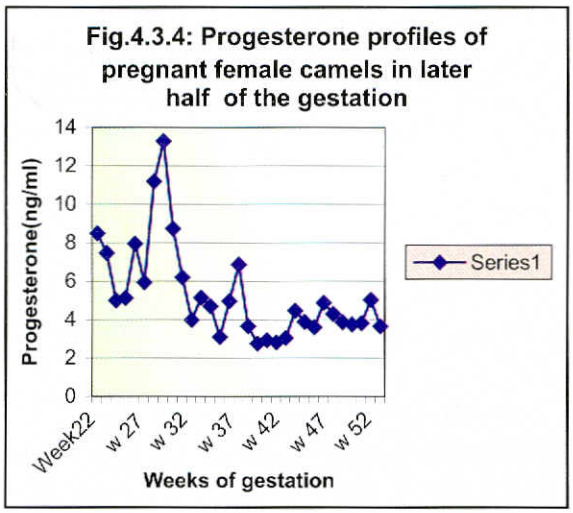


Fig.4.3.4: Progesterone profiles of pregnant female camels in later half of the gestation

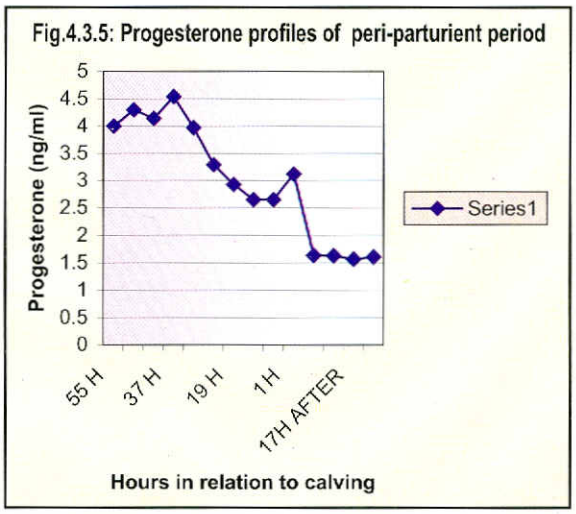


Fig.4.3.5: Progesterone profiles of peri-parturient period

In pregnant category of female camels out of 37 mated, average progesterone levels recorded were around 0.5 ng/ml from day 0 to day 3, it rose to 0.7- 0.85 ng/ml on day 4-5 and above 1 ng/ml, 2 ng/ml, 3 ng/ml and 4 ng/ml on days 6, 9, 13 and 28, respectively.

In non- pregnant category the rise was initially similar up to day 11, but then started declining from day 12 onward, which is indicative of a short luteal phase in non- pregnant females this species as compared to other domestic species of animals.

Progesterone concentration recorded at weekly interval in later half of gestation averaged and ranged from 3-14 ng/ml.

Progesterone concentration at peri-parturient period was recorded between 3-5 ng/ml and decline was accomplished after expulsion of fetus, when it averaged 1.6 ng/ ml.

Development of RIA for Estradiol

Anti- estradiol serum received from Professor Niswender of Colorodo State University, USA was calibrated for antibody titer using tritiated estradiol (Amersham Bio-sciences Ltd., U.K.). Results of Antibody titer curve are presented in Table 4.3.3 and Fig. 4.3.6.

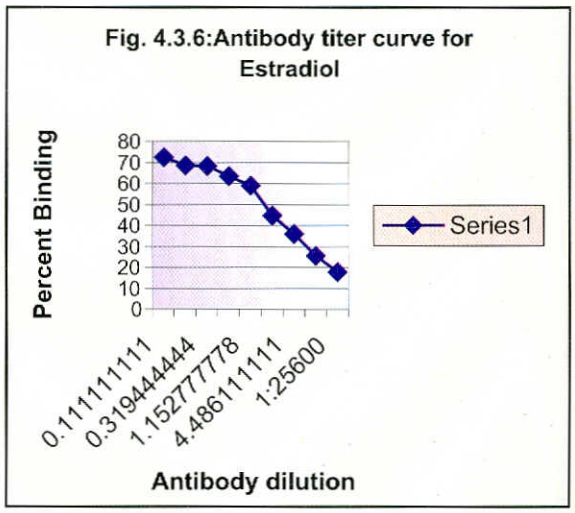


Fig. 4.3.6:Antibody titer curve for Estradiol

Table 4.3.3: Antibody titer curve for Estradiol

Antibody Titer	Average CPM/ total count	Binding percent
1.100	7054/9739	72.4
1:200	6708/9739	68.8
1:400	6661/9739	68.3
1:800	6190/9739	63.5
1:1600	5733/9739	59.0
1:3200	4372/9739	44.8
1:6400	3529/9739	36.2
1:12800	2510/9739	25.7
1:25600	1754/9739	18.0

The antibody dilution which allowed maximum binding of 50% tracer was determined and used to run standard curve with different calibrators. Calibrators used were zero calibrator 6.5 pg, 13.12 pg, 26.25 pg, 52.5 pg, 105 pg, 210 pg, 420 pg and 840 pg. The average CPM and Binding % with each calibrator is presented in Table 4.3.4 and Fig. 4.3.7

Fig. 4.3.7: Standard curve of Estradiol

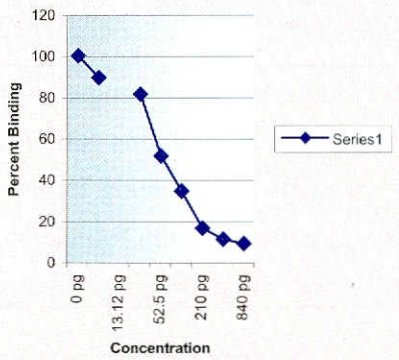


Table 4.3.4 Standard curve for Estradiol

Calibrators	Average CPM	Binding %
0 pg 3412	100	
6.5 pg	3055	89.5
13.12 pg		
26.25 pg	2784	81.5
52.5 pg	1757	51.4
105 pg	1180	34.5
210 pg	565	16.5
420 pg	384	11.25
840 pg	311	9.1

Sub project 2: Semen collection and cryo-preservation

Semen collection was accomplished with about one dozen Jaisalmeri male camels. It was evaluated, cryopreserved and sent to NBAGR, Karnal under NATP project on characterization and conservation of Jaisalmeri camels. About 1000 doses of semen were transferred.

Sub project 3: Application of sonography and other diagnostic techniques in fertility and infertility management.

Investigator : Sumant Vyas
Associates : Aminu Deen, S.K. Dixit, U.K. Bissa, N.Sharma and M. S. Sahani

Ultrasound monitoring for ovulating size follicle before mating

Female camels of the centre's herd to be bred in the breeding season were taken for the study. Ultrasound was used for the periodic monitoring of ovary of these females after second week of December, 2003. The females when observed to possess ovulating size follicle (>9mm) were mated with the camel studs as decided by the breeding policy of the center. The camels were examined at 20 and 30 days post mating to ascertain pregnancy.

Total female camels examined by ultrasound	42
Females having ovulating follicle at first exam. between 18th Dec and 3rd Jan	29 (69 %)
Females with no ovulating follicle at first exam. between 18th Dec and 3rd Jan	13 (31 %)
Females with ovulating follicle at second or third exam. Before 10th March	12 (28.6%)
Female with no ovulating follicle till 10th March	1

All except one female when examined between 15th Jan and 11th March were observed to possess at least one ovulating follicle. Ultrasound examination/ rectal examination should be preferred during first service or the services given in the month of December and early January. As per the management policy of our farm breeding of the females were stopped in first week of March, though females (unconceived) were possessing follicle.

Ultrasound monitoring of postparturient female camels

Eight female camels parturited during the breeding season (up to 8th February, 2004) were examined by ultrasound for presence of ovulating follicle. The ultrasound examination was performed at weekly interval from day 30 post partum. Females having ovulating follicle were mated with virile studs.

Five out of eight female camels were observed to possess ovulating follicle. Two out of these conceived saving at least 300 days of calving interval for each animal.

Table 4.3.5. Follicle development in post-parturient female camels

No. of female camels examined	Date of parturition	Presence of ovulating follicle (days after parturition / date)	Mating	Pregnant
K 93	2/1/04	35 (7/2)	Yes	Yes
K 115	26/12/03	68 (4/3)	Yes	No
K 111	15/1/04	Nil (D 58 10/3)	No	No
B 359	16/1/04	55 (10/3)	Yes	No
K 303	8/2/04	32 (11/3)	Yes	Yes
B 465	16/1/04	58 (11/3)	Yes	No
B 332	16/1/04	Nil (D 58 11/3/)	No	No
K 83	4/1/04	Nil (D 65 11/3)	No	No

Use of RBPT antigen to screen the NRCC herd for Brucellosis

Blood was collected from 213 camels of the farm herd, sera was separated and preserved at 4°C. Rose Bengal Plate Test (RBPT) antigen was procured from Indian Veterinary Research Institute, Izatnagar. The antigen and sera were brought to room temperature and kept for 30 min. One drop (0.03 ml) of antigen was placed along with side of (but not into) drop of serum on glass plate. The serum and antigen were mixed thoroughly with the help of a spreader. The plate was rotated for 4 min and readings were made and recorded.

All of the 213 serum samples were found to be negative by RBPT antigen. The test was also compared with the positive serum procured from Dept. of Veterinary Public Health, C.V.A.S., Bikaner.

Sub project 4: The biochemical and hormonal factors affecting puberty in male camels.

Investigator : A. K. Roy

Six male camels divided in two groups were fed chara ad lib and offered water daily in a separate enclosure. Physical exercise was provided to two animals daily on turn basis. These animals were taken out daily for a ride in the farm area. The body weights and skin thickness were recorded at monthly interval. However, there was not any definite pattern in the growth of skin thickness. The animals have been monitored for their reproductive behavior in the presence of female. There was a positive effect in the improvement of libido of experimental males that were exposed to females before the onset of

rutting season. The blood samples analysed for testosterone had wide fluctuations probably due to larger intervals in the samples. There was no poll gland secretion in the camels, which were castrated whereas slight secretions were visible in the animals with testes. The semen collections have also been attempted during this rutting season. The animals with intact testes donated semen into the artificial vagina. The live sperm percentage was 87.0 ± 1.02 in the young camels with intact testes. The semen samples were found to be normal in appearance as observed from their physical characteristics.

Camels	Adult	Young	Young (without testes)
Age (years)	14-16	6	5-6
Body wt (kg)	638	541	534
Skin thickness (mm)			
Shoulder	4.45	4.15	4.15
Abdomen	6.05	5.25	4.45
Hind quarter	4.60	4.55	4.40

4.4 To study the economics of different camel management practices under arid and semi- arid eco system

Investigator : C. Bhakat
Associates : N. Sharma, M. S. Sahani and B. L. Chirania

Epidemiology of camel diseases in irrigated and non-irrigated area.

Data have been collected from 167 camel keepers residing around veterinary hospitals belonging to irrigated zone (Pugal, Khajuwala, Lunkaransar, Jamsar, Mahajan, Kolayat and Gajner) and non-irrigated zone (Napasar, Kalyansar, Nokha, Badnu, Desnokh, Kuchor and Jasrasar). Table 4.4.1 reveals year wise incidence of diseases of camel in irrigated and non-irrigated region. The incidence of Mange was highest during 1998-2001 but during 2001-2003 incidence become reduced in both of these regions. The incidence of Trypanosomiasis was slightly high during recent past as compared to previous years. Similarly, incidence of Impaction, Diarrhoea and other GI disorders were increased during recent years as compared to earlier years. The disease pattern and system involvement of camel in irrigated and non-irrigated area revealed that in irrigated belt first and foremost disease problem is Mange, 2nd digestive problems, 3rd Surra, 4th Abscess/ wound /saddle gall, fifth respiratory problems, sixth other problems and seventh reproductive problems, whereas in non-irrigated zone digestive disorders ranked first, mange II, Surra III, Others IV, reproductive disorders V, Abscess /Wound /Saddle Gall VI, and Respiratory problem VII. Spearmans Rank test correlation was significant indicating that disease pattern of camel significantly ($P<0.01$) varies between these irrigated and non-irrigated zones. Skin infection, trypanosomiasis, respiratory system involvement was more in irrigated

belt as compared to non-irrigated region. Health hazards of camel are higher in irrigated belt than non-irrigated region. Incidence of disease problems of camel are high during rainy season and before or after rainy season.

The analysis of morbidity and mortality trend in camel in the two different zones revealed that morbidity due to mange and surra is high in irrigated belt as compared to non-irrigated zone. Mortality was highest due to impaction (digestive problems) followed by Mange and Surra in both the regions. Majority of farmers prefer traditional treatment of diseases of camel. The traditional treatment cost for Mange is low as compared to allopathic treatment whereas allopathic treatment cost of Surra is low as compared to traditional treatment cost. Since no definite pattern of traditional treatments are available for Surra. Farmers used to treat through with trial methods by using number of feeding materials in repeated doses.

Table 4.4.1 System/ disease wise percent incidence in irrigated and non-irrigated region

Diseases	Irrigated (%)		Non-irrigated (%)	
	1998 - 2001	2001 - 2003	1998 - 2001	2001 - 2003
Mange	49.11	40.78	45.87	38.86
Trypanosomiasis	6.10	9.03	5.88	8.79
Impaction	11.73	12.14	14.29	15.78
Diarrhoea	10.31	11.16	12.47	14.63
Other GI disorders	8.20	9.17	10.80	10.85
Pneumonia	2.11	2.00	0.76	0.89
Urinary Infection	2.12	2.23	1.13	1.00
Retention of placenta	0.05	0.08	0.29	0.36
Other reproductive problems	1.07	1.04	1.83	1.76
Wound / Abscess / Saddle Gall	6.10	8.00	2.00	2.14
Miscellaneous	3.10	4.37	4.68	5.00

Sub project 2: Service project on extension, communication and human resource development

Investigator : C Bhakat.
Associates : N. Sharma, B.L. Chirania and M.S Sahani.

Kissan Divas

Kissan divas was organised at the centre on 29th Dec, 2003 (Fig. 4.4.1 & 4.4.2) with the primary objective to provide exposure to camel keepers/ farmers about advanced technologies of camel management, camel reproduction, important diseases, their prophylaxis, quick diagnosis, improved feeding, technique of complete feed, breed characterization and importance of camel products viz:

Fig.4.4.1 A view of Kissan gosthi organised at NRCC on 29/12/03

Fig.4.4.2 A view of farmers participating in Kissan Diwas at NRCC on 29/12/03

milk, therapeutic use of camel milk, hair etc. for better utilization in village cottage industry for higher economic gains. Camel keepers along with farm women from different villages (Gadwala, Sagar, Ridmalsar, Keshardesar, Surdhana and Pemasar) participated. Camel keepers were shown the electrified traditional two wheel camel cart. At this occasion a video film high lighting care of newborn calves and mother, parturition, prophylactic and treatment activities etc. was shown. Prizes were distributed to camel keepers/farmers for various competitions.

Exhibitions

During the year centre participated in 5 exhibitions (Fig. 4.4.3) depicting advance techniques of camel rearing, reproduction, management and new technologies developed by the centre. Out of these 3 were organized at the centre and 2 were out of campus, viz: 1. During kisan divas at NRCC (29.12.03), 2. Camel Festival (03.01.04 to 11.01.04) Bikaner, 3. National Science Day, Bikaner (28.02.04), 4. State Krishi vigyan mela, Bikaner (24.02.04), 5. NASC, ICAR, Delhi (12.03.04).

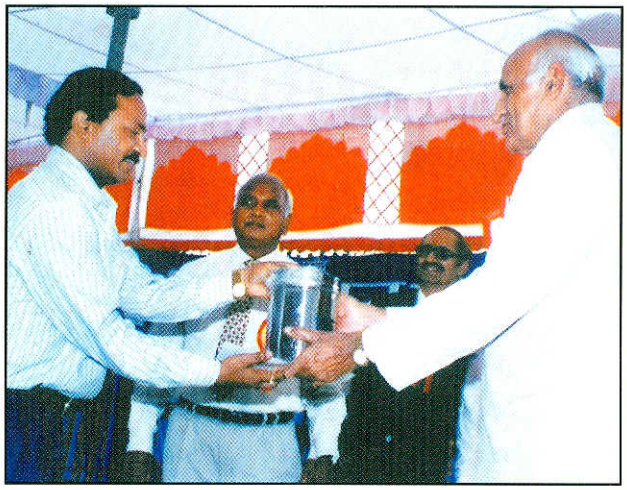


Fig.4.4.3 Dr. A.S. Faroda presenting best stall award during this state Kissan Vigyan Mela RAU, Bikaner

Transfer Technology

Camel keepers were given training regarding preparation of various camel milk products viz: Dahi, Flavored milk, Soft cheese, Coffee and Tea etc. Electrified traditional two wheel camel cart was demonstrated, how it can be beneficial in avoiding road accidents during night and also as a source of electricity in non-electrified dhanis and villages.

Kissan gosthies

Six kissan gosthies were arranged on and off the campus with scientists/ technical officers, subject matter specialists and farmers. On Campus at NRCC on 29.12.03 (Fig 4.4.2), off campus at State Krishi vigyan mela on 24.02.04, at Kesardesar village on 12.05.03 and three at our adapted village, Gadwala, on 28.04.03, 22.08.03, 20.12.03.

Participation in Camel competitions etc.

The centre participated in various competitions during Camel Festival-2004, organised by State Tourism Department and Local Administration (Fig. 4.4.4).

Fig.4.4.4 Shri Madhukar Gupta (DC, Bikaner) inaugurating exhibition during Camel Festival

Demonstration of centre's research activity

Various trainees, visitors (National/ International), scientists, students (from veterinary colleges, Medical College, SAUs, schools, Universities), livestock owners, administrators, Defence Officers, N.G.Os, Indian and foreign educationists, Journalists, Youth, farmers and farm women etc. were demonstrated about ongoing research activities, camel husbandry practices and technologies developed.

Collaboration

Collaboration was continued with NGOs namely LPPS, Sadri Pali, URMUL dairy and Trust, Bikaner, KVK, Beechwal and others Institutions viz., AIIMS-New Delhi, Medical College-Bikaner, Maharana Pratap College of Agriculture and Technologies-Udaipur, Central Institute of Agri Engineering-Bhopal, CSWRI-Avikanagar and RAU-Bikaner. An effort was made for popularisation of camel hair, milk, skin utility aspects of camel etc. An investigation was carried out on product making possibilities by using camel hair, skin etc.

Revenue generation programme

Multifarious efforts were made to strengthen the revenue / resource generation through various ways. Viz. Entry of tourists, still photography, Camel riding and also through sale of camel milk and hair and organization of short training (1 month and 2 month) for B.Sc. & M.Sc. Students in the field of Biotechnology, Microbiology, Molecular Genetics etc.

4.5. Surveillance, monitoring and control of camel diseases

Sub project 1: Comparative studies on the sensitivity of Polymerase Chain Reaction (PCR) and serological tests for the diagnosis of camel Trypanosomosis

Investigator : S.K. Ghorui
Associates : Raghvendra Singh

Trypanosoma evansi isolated from camel were maintained in albino rats, mice and rabbits upon intraperitoneal inoculation of 1×10^4 live parasites. Parasitaemia in these animals were monitored by examining the tail/ ear vein blood by wet- smear examination. These isolates of parasites used to produce fulminating parasitemia resulting in death of the mice and rats invariably 5-6 days post infection.

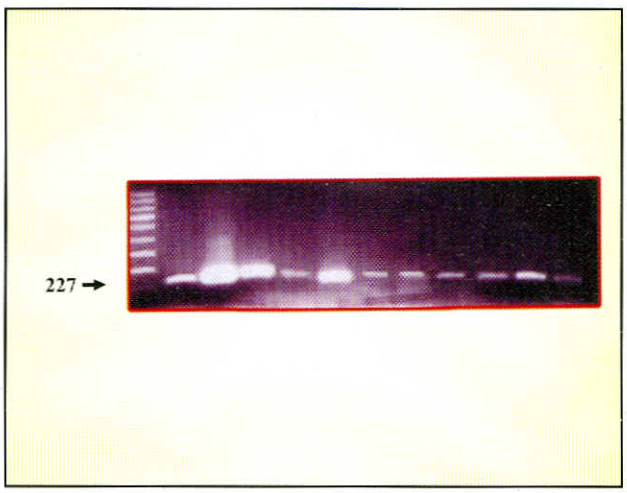


Fig.4.5.1 PCR for target specific amplification in detection of cameline surra

The parasites were also maintained in liquid nitrogen at -196^0C under 12% (v/v) glycerol as cryo protectant. The viability and pathogenicity of these stabilates were checked time to time in mice and rats. From the Table 4.5.1, it is evident that out of 79 blood samples examined, none of them showed the presence of live, motile trypanosomes under wet- smear/ direct examination.

Table 4.5.1. Comparative performances of parasitological and DNA based diagnosis of Trypanosomiasis in camel during 2003-04

S.N.	A. Parasitological	Number of samples examined	Number of positive samples
1.	Wet film	79	-
2.	Thick smears	-	-
3	Mice inoculation	-	-
	B. DNA Based	79	21 (26.58%)
4.	**C. Ab-ELISA**	79	34 (43%)

Twenty one (26.58%) samples showed positive results on PCR amplification using the same primer set (21 mer sense and 22 mer antisense), in which appeared a single parasite specific amplicon of 227 bp.

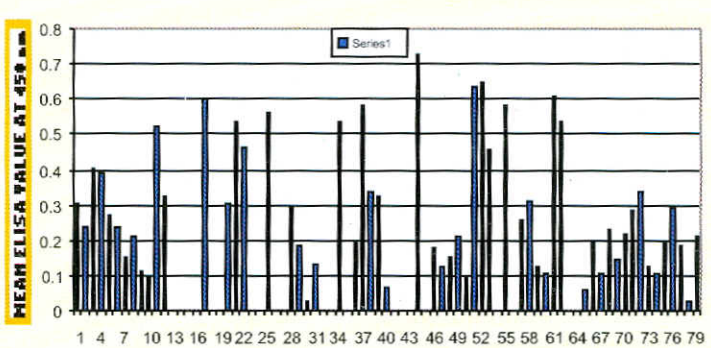
During the period under report, all the serum samples (79) have been analyzed in triplicate for the presence of antibodies against trypanosomes by indirect ELISA and these values are expensed in terms of mean ELISA value. The mean ELISA values have been found highly variable (Table 4.5.2 & Fig. 4.5.2) The ELISA cut off value was determined as 0.480 and this value was assumed from the ELISA value obtained from the control serum i.e. from new born camel calves. Thus, a value 2- fold greater than this cut off value, is considered for trypanosome positive samples, it is evident that 34 samples (43%) showed quiet higher in the infection level. However, some of the samples showed higher antibody level did not show any positive signals in PCR amplification. Otherwise, all the 21 samples found positive in PCR amplification also showed higher mean ELISA values. The animals which showed higher ELISA value but negative by PCR detection are reflected by the fact of recent application of trypanocidal drugs. These animals may not have the active carrier state of infection.

Table 4.5.2. Anti trypanosomal antibody label in camel

0.30	0.52	0.53	0.13	0.872	0.63	0.60	0.28
0.24	0.32	0.46	0.810	0.980	0.64	0.53	0.34
0.40	0.770	0.70	0.690	0.860	0.45	0735	0.12
0.39	0.580	0.625	0.53	0.72	0.670	0.811	0.10
0.27	0.630	0.56	0.735	0.640	0.58	0.05	0.19
0.23	0.665	0.652	0.19	0.18	0.669	0.20	0.29
0.15	0.60	0.660	0.58	0.12	0.26	0.10	0.18
0.21	0.595	0.29	0.34	0.15	0.31	0.23	0.02
0.11	0.780	0.18	0.32	0.21	0.12	0.14	0.21
0.09	0.30	0.02	0.06	0.09	0.10	0.22	

NUMERICAL VALUES ARE THE ELISA VALUES AT 450 nm

Fig. 4.5.2. BAR DIAGRAM OF
ANTITRYPANOSOMAL ANTIBODY LEVEL IN CAMEL



Thus, diagnosis of *T.evansi* in camel and other livestock is of considerable economic importance. Microscopy of wet blood film for direct detection of parasite is the least sensitive method. Indirect methods of diagnosis based on demonstration of specific antibodies or parasite antigen in the host blood or tissue have higher sensitivity and a greater variability and therefore, are more difficult to intercept in terms of disease status. Amplification of minute amounts of nucleic acid down to a single tryponosome has been authenticated active carrier stage of infection. With the current PCR detection method the drug sensitivity test, field monitoring for incidence and prophylaxis can be preformed with very high accuracy.

The study is in progress at the moment to determine the nucleotide sequence of PCR product obtained from *T. evansi* which could be used as a signature sequence to design species specific primer for further use.

Sub project 2 : Epidemiology of gastrointestinal helminth infection in camel

Report:

Faecal samples of camel collected from field around Bikaner and organized farm examined for gastrointestinal parasite infections. A total of 2778 and 2030 faecal samples, respectively from organized farm and field examined for a period of 2002-04. Out of these, 899 (32.36%) and 967 (47.63%) samples respectively from farm and field camels were found positive for the presence of different types of helminth infections (Table 4.5.3 and Fig. 4.5.3)

Fig.4.5.3 Overall helminthes infection (%) in farm field camels

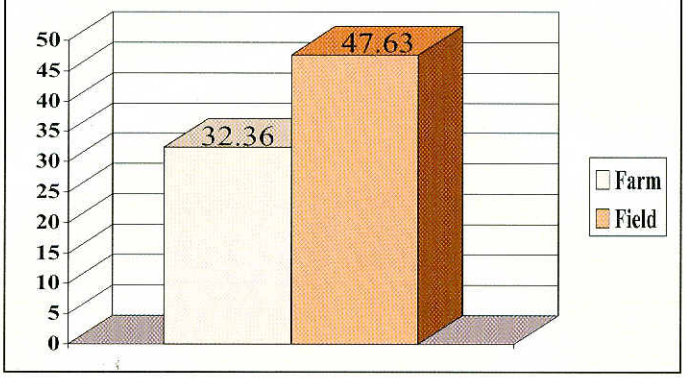


Table 4.5.3. Types of gastrointestinal helminth infection (%) in farm and field condition in and around Bikaner

Farm	Type	Field
47	Nematodirella/Nematodirus	12
27	Haemonchus	55
21	Strongyloides	25
1	Trichuris	2
4	Others	6

Month wise infection patterns were also recorded for the period under study. Both field and farm conditions, July to October months were found suitable for horbouring the patent helminth infection (Table 4.5.4 and Fig. 4.5.4). The post monsoon period, particularly in the month of August-September, maximum infections rate both in farm (32.98% to 37.71%) and field (66.93%) were recorded.

The egg per gram faces (epg) was also recorded. It varied from minimum 93 during the lean period (Feb. to May) and maximum 439 (July to Oct.) in farm condition and 147 to 724 under field conditions, respectively.

The different types of infection recorded were mostly Strongyles, like Haemonchus, Nematodirella/ Nematodirus, etc. besides Strongyloides, Trichuris infections were also noticed. In field condition, Haemonchus infection found predominant (55%), where as in farm condition Nematodirella infection found most common (47%) Table 4.5.3 and Fig. 4.5.3.

Fig. 4.5.3. Type of gastrointestinal helminth infection (%) in farm and field condition in and around Bikaner

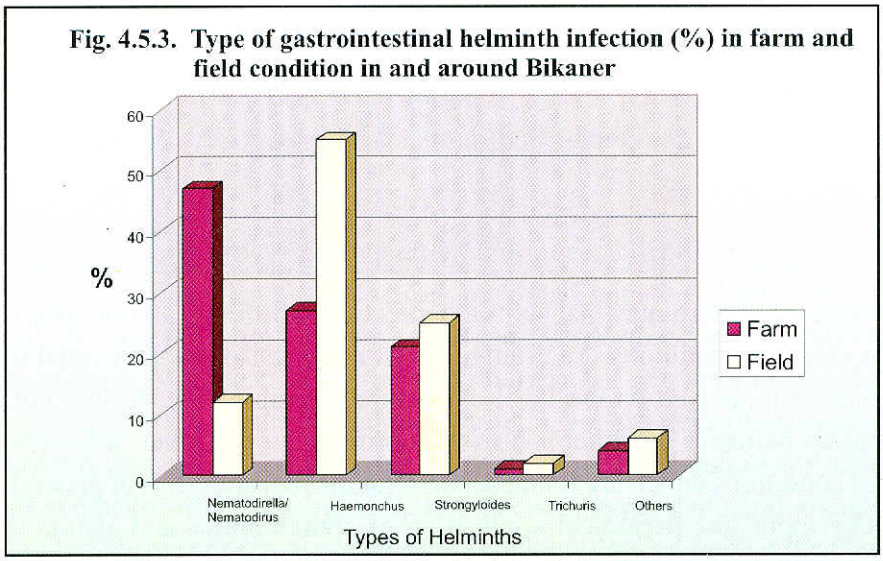


Fig. 4.5.4. Prevelence of gastroinestinal helminths round the year in farm and around Bikaner

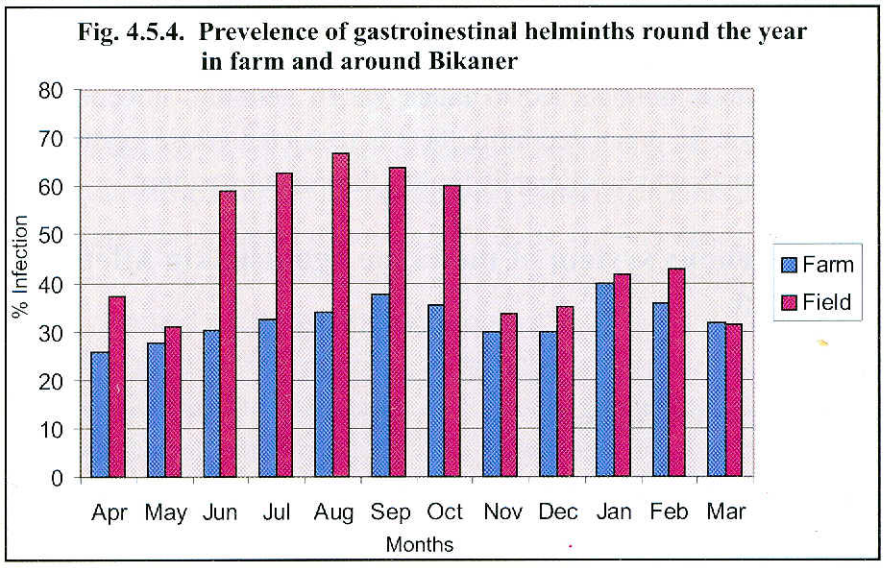


Table 4.5.4. Month wise percentage of infection (farm and field) for 2002-04 in and around Bikaner

Month	Farm			Field		
	Sample Examined	Sample positive	%	Sample Examined	Sample positive	%
Apr	34.5	89	25.79	51	19	37.25
May	22.8	63	27.63	297	92	30.97
Jun	286	87	30.41	205	121	59.02
Jul	178	88	32.58	218	137	62.84
Aug	388	128	33.98	202	135	66.83
Sep	472	178	37.71	250	159	63.6
Oct	178	63	35.39	35	21	60
Nov	114	34	29.82	220	74	33.63
Dec	144	43	29.86	140	49	35
Jan	115	46	40	130	54	41.53
Feb	134	48	35.82	154	66	42.85
Mar	196	62	31.63	128	40	31.25

The prevalence of gastrointestinal helminth infection in different animal species solely depends on the geo- agro climatic conditions. The rainy to post rainy seasons found suitable to maintain the fecundity of the parasite as well as the level of pasture contamination. In this hot arid region, the infection of helminth parasites in camel is also very prominent. However, it is very much restricted during a specified conditions which are found suitable for the parasites. It is of general tendency to rear camel with subdue input like periodical application of anthelmintics and also encourage helminth infection and thus induce poor performances in terms of production potential. It is also evident that the coexistence of camel with other livestock, particularly sheep and goat in field condition and vide migratory behaviour of these animals led to much varied helminth infection of field camels as compared to organized farm. In organized farm, there is restricted grazing pattern as well as no such coexistence with other animals which ultimately limited the infection pattern.

Sub-project 2: Indigenous system of medicine against skin affections in camel- mange

Investigator : S.K. Dixit
Associates : F.C.Tuteja and N. Sharma

Among most commonly occuring parasitic diseases in camels, sarcopticosis acquires most dominating position as regards to its spread and occurrence in animals. The present available drugs in

the market are either high tech driven, or/and creating resistance and other residual problems. To minimize these problems for the real users particularly dependency of farmers on high technology, efforts were made to evaluate the efficiency of ethno-veterinary medicine and to encourage use of ingredients which are commonly available at farmers doorstep and involve minimum technology in the preparation of herbal formulations so that the drugs can be prepared and used by the farmers themselves as and when required. Aiming at the mission of the project, three formulations were developed and scientifically evaluated for their clinical and therapeutic properties in phased manner. Initial studies conducted at Institutional level yield most promising results, which led to go for further therapeutic trial in the field in association with farmers, veterinary clinics and camel owners so as to observe the effectiveness of the drugs at the ultimate users and get feed back in real terms before subjecting them for further refinement and pharmacological studies. Two (FI & FII) of the three formulations were found to possess effective mangicidal action and F II seem to have additional coverage against some other skin diseases (Dermatitis, Pachydermia etc.). Both formulations relieved the animals from symptoms viz. intense itching, thickening and wrinkling of skin, excoriation etc. in addition to conditioning, nourishing and toning of skin. Haematological studies could not prove to be satisfactory indices in terms of marker for diagnosis or recovery except eosinophilia, which of course, appear to be additional unique, capable and comparable action of the immunohaemopoetic system against both kinds (challenge & reddressal) of stimuli.

Skin scrapings also failed to prove its authenticity in establishing the diagnosis as very often recovery of mites even in clinically positive cases remained negative. Nearly unaltered values of transaminases speak its successful story of being no or least hepatotoxic which otherwise seem to be a priority in the management of disease. Addition or withdrawal of one or more components remain a focal research area and processing of the formulation through lyophilizer or other means may open new ways in the propagation, extension and marketing of the drug. Isolation and identification of alkaloids and their chemical synthesis after their individual, collective, synergistic and antagonistic rigorous pharmacological studies are the priority areas for which collaborative research is heading.

Studies against dermatophytes/or other microorganism & intramammary infection in camel

Isolation and characterizatioon of bacteria namely staphs, β staphs, *E. coli,* Pseudomonas spp. (Twenty four isolates) was carried out. *In vitro* sensitiviy conducted against these isolates using garlic, lemon and onion juices gave preliminary encouraging results. Onion impregnated discs were found to possess antimicrobial activity against isolates viz. *E. coli* with plus 3 inhibition zone while isolate 27 was in plus 2 inhibition zone and β staphs with other isolates 54, 28, 4, 14, 17, 33, 24 varied from 1 to .5 IZ and remaining a few isolates 14 remained refractory to its pharmacological action. Lemon impregnated discs showed its plus 3 to 4 IZ against *E. coli* and 4 while plus 2 IZs were in the isolates 26, 18, 14 and plus 1 IZ in β staphs, staphs, 54, 28, 15, 55, 5, 25 and only 10 isolates remained unresponsive. Garlic discs were nearly least responsive with only 10 out of 24 were plus 1 to .5 IZ sensitive while others failed to show any positive correlation in terms of *in vitro* antimicrobial sensitivity.

Sub project 4: Mastitis in camel

Investigator : F.C. Tuteja

Associates : S.K. Ghorui and U.K.Bissa

Aseptically collected 148 quarter milk samples from 37 apparently healthy lactating camels between the age of 6-12 years were subjected to bacteriological examination as per standard procedures using five percent sheep blood agar and MacConkey's lactose agar. Bacteria isolated were identified by colony morphology and Gram's staining reaction. The differentiation between staphylococci and micrococci was made on the basis of oxidase test. The staphylococci identified on preliminary examination were differentiated into coagulase +ve and coagulase -ve staphylococci on the basis of tube coagulase test. The streptococci were further identified on the basis of CAMP test .

The infected camels as detected by cultural examination were divided into four groups. Out of these, three groups were given the treatment and the fourth group was kept as untreated control.

Drugs used - Amoxycillin and cloxacillin: was administered intramuscularly at the dose rate of 5 mg and 5mg per kg body weight each for three days.

Levamisole: was administered subcutaneous at the dose rate of 2.5 mg per kg body weight as a single dose.

Vitamin E and selenium: were administered intramuscularly at the dose rate of 55 IU and 1.5 mg per 25 kg body weight respectively as a single dose.

Group I: For 13 quarter infections six animals were treated with amoxycillin and cloxacillin

Group II: For 13 quarter infections five animals were treated with amoxycillin and cloxacillin + levamisole

Group III: For 13 quarter infections five animals were treated with amoxycillin and cloxacillin + levamisole + vitamin- E and selenium

Group IV: For six quarter infections three animals were kept as untreated control

On 3rd or 4th day following treatment, the quarter milk samples from these animals were collected and examined bacteriologically.

A total of 45 isolates of various species of organisms, recovered from intramammary infections, were subjected to *in vitro* chemotherapeutic sensitivity to 10 antimicrobials by the disc-diffusion method Chemotherapeutic sensitivity discs were obtained from Hi-Media Laboratories, Bombay. The concentration of different chemotherapeutic discs was oxytetracycline (30µg), cloxacillin (30µg), ampicillin (10µg), ciprofloxacin (5µg), penicillin (10 IU), gentamycin (10µg), neomycin (30µg),

kanamycin (30µg), erythromycin (15µg), amoxycillin (30µg). The susceptibility was interpreted according to the zone size interpretation chart supplied by the manufacturer.

On the basis of culture examination, the quarter wise prevalence of sub clinical mastitis in camels was recorded as 30.40 % (45/148).

The animals-wise prevalence of sub clinical mastitis in camels was recorded much higher (54.05 %) when compared with the quarter-wise prevalence (Table 4.5.5)

Table 4.5.5: Prevalence of sub clinical mastitis in camel

Examined	Positive for culture examination	% Positive
Quarters (n=148)	45	30.40
Animals (n =37)	20	54.05

Table 4.5.6 Relative frequency of various microorganisms in 45 isolates from sub clinical mastitis cases in camels

S.No.	Organism	No. of isolates	Per cent
1.	*Staphylococcus epidermidis*	17	37.8
2.	*Streptococcus dysgalactiae*	9	20.0
3	*Staphylococcus aureus*	8	17.8
4	*Streptococcus agalactiae*	7	15.6
5.	*Corynebacterium spp.*	4	8.9

Amongst different mastitogenic agents, *Staphylococcus epidermidis* was found to be the most predominant 37.78% of the total isolates followed by *Streptococcus dysgalactiae* (20.0%), *Staphylococcus aureus* (17.78), *Streptococcus agalactiae* (15.56%), and *Corynebacterium spp.* (8.88). (Table 4.5.6)

Amoxycillin and Cloxacillin could clear 100 % of the infection due to Streptococci and Corynebacterium spp. but the cure rate against staphylococci was 42.85 %. Similar results were obtained when levamisole was also given along with Amoxycillin and Cloxacillin. When Amoxycillin and Cloxacillin + levamisole+ Vitamin E and selenium were used, could clear 100 % of the infection due to streptococci. But the cure rate against staphylococci was increased to 77.78%. (Table 4.5.7)

In all the treatments cure rate for staphylococci was lower than other microbes. *In vitro* sensitivity testing showed staphylococci to be 100% sensitive against amoxycillin and cloxacillin.

Table 4.5.7 Comparative efficacy of treatment regimens against mastitis in camels

Organism	T1			T2			T3			T4		
	Quarters infected		% Cure	Quarters infected		% Cure	Quarters infected		% Cure	Quarters infected		% Cure
	B.T	A.T.		B.T	A.T		B.T	A.T		B.T	A.T	
Staphylococcus spp	7	4	42.8	7	4	42.8	9	2	77.7	1	1	0
Streptococcus spp	4	0	100	5	0	100	4	0	100	4	4	0
Corynebacterium spp.	2	0	100	1	0	100	0	0	-	1	1	0
Overall	13	4	69.2	13	4	69.2	13	2	84.6	6	6	0

B.T.=before treatment, A.T.=after treatment.

The overall efficacy of treatment was 69.23% for T1 (Amoxycillin and Cloxacillin), 69.23 % for T2 (Amoxycillin and Cloxacillin + levamisole) and 84.61% for T3 (Amoxycillin and Cloxacillin + levamisole + Vitamin E and selenium). As many as 45 isolates recovered from intramammary infections in camels were subjected to *in vitro* chemotherapeutic sensitivity testing by the disc-diffusion method using 10 antimicrobials (Table 4.5.8). The isolates comprised of *Staph. aureus* (8), *Staph. epidermidis* (17), *Str. agalactiae* (7), *Str. dysgalactiae* (9) and *Corynebacterium spp.* (4).

Table 4.5.8. *In vitro* antibiotic sensitivity testing

Antibiotic	Number sensitive						Percent sensitive
	Staph. aureus (8)	*Staph. epidermidis* (17)	*Str. agalactiae* (7)	*Str. dysgalactiae* (9)	*Corynebacterium Spp.* (4)	Total (45)	
Oxytetracycline	8	17	7	9	4	45	100
Cloxacillin	8	17	7	9	4	45	100
Amoxycillin	8	17	7	9	4	45	100
Gentamycin	8	17	6	8	4	43	95.5
Penicillin	7	14	7	9	4	41	91.1
Kanamycin	7	16	6	8	3	40	88.9
Ciprofloxacin	7	16	6	7	4	40	88.9
Neomycin	8	17	5	6	4	40	88.9
Ampicillin	7	13	7	9	3	39	86.7
Erythromycin	6	12	7	9	3	37	82.2

Variable chemotherapeutic sensitivity pattern was observed for different species of organisms. In considering overall efficacy, irrespective of the species of the organisms, 100 per cent of the isolates were found sensitive to Oxytetracycline, Cloxacillin and amoxycillin. More than 90 per cent were sensitive to gentamycin and penicillin. Sensitivity to Kanamycin, Ciprofloxacin, Neomycin, Ampicillin and Erythromycin was more than 80 per cent.

Sub project 5: Influence of camel milk in the management of type-1 diabetes

Investigator : F.C.Tuteja

Associates : M.S. Sahani, S.K.Ghorui, R.P.Agarwal, R.Singh and D.Suchitra Sena

Hypoglycemic activity of camel milk in experimentally produced hyperglycemia in rats

1st Trial: Thirty six white albino rats of approximately same age group having body weight (~150gm) were acclimatized under laboratory conditions for a week by keeping them on diet of wheat dalia and water *ad libitum*. Their fasting blood sugar level, by depriving food overnight but allowing free access to water, was estimated. The rats were divided into four groups (Gp.I, Gp.II, Gp.III and Gp.IV) of 8 rats each. Diabetes was induced in Rats of Gp.I, Gp.II and Gp.III by intraperitoneal administration of Streptozotocin (50 mg/kg b.wt.). Whereas rats in Gp.IV were kept as untreated controls. Fasting blood sugar levels of all these rats were estimated after three days of treatment. These rats besides normal diet of wheat dalia were offered with raw camel milk (Gp.I), raw cattle milk (Gp.II), water (Gp.III) and normal diet (Gp.IV). Rats of Gp.I and Gp.II were given 250 ml of milk daily through watering bottle instead of water. Whereas animals in Gp.III and Gp.IV were given simple water. The blood sugar levels of these rats were estimated at weekly interval for three consecutive weeks. Blood samples were drawn from cardiac puncture using tuberculin syringe from overnight fasted rats, serum samples were harvested and glucose level was determined spectrophotometrically employing glucose oxidase method (Table 4.5.9).

Initial mean blood sugar level of treated animals was191.33±7.46 mg/dl whereas in case of untreated controls it was 80.6±12.07mg/dl. In Gp.I after 1st, 2nd and 3rd week of trial mean blood sugar level indicated marked drop to 98.0±3.37, 89.0±5.23 and 86.25±12.77 mg/dl, Whereas in Gp.II it dropped at lower rate 158.4±11.34, 132.8±23.49 and 110.0±9.97 mg/dl, and in Gp.III it dropped at still lower rate 203.6±10.11, 132.8±23.49 and 124.5±24.21 mg /dl, respectively. On the other hand the mean blood sugar level in untreated control group was within the normal range (70 to 90 mg/dl). The overall mean of three weeks trial showed a significant decrease in mean blood sugar level of Gp. I rats getting camel milk, as compared to Gp. II rats getting raw cattle milk (Fig. 4.5.6).

Table 4.5.9. Weekly mean blood glucose status in different groups of diabetic rats.

Mean serum glucose level (mg/dl)	Raw Camel milk	Raw Cattle milk	Water	Untreated control
Normal rats	76.9±3.3	84.7±2.9	80.0±10.8	80.6±12.1
Before trial (diabetic)		191.3±7.5		80.6±12.07
7th day	98.0±3.4	158.4±11.3	203.6±10.1	77.6±8.7
14thday	89.0±5.2	132.8±23.5	132.8±23.5	86.2±12.4
21stday	86.2±12.8	110.0±10	124.5±24.2	80.0±10.8
Pooled	91.4±4.2	135.4±10.5	167.6±19.4	81.3±5.9

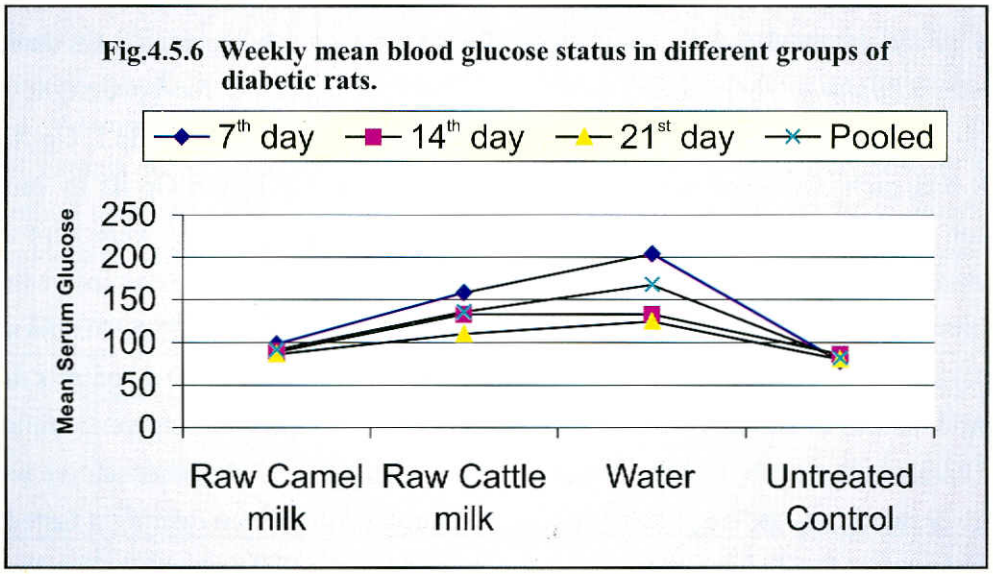


Fig.4.5.6 Weekly mean blood glucose status in different groups of diabetic rats.

In another trial forty white albino rats of approximately same age group having body weight (~150gm) were acclimatized under laboratory conditions for a week by keeping them on diet of wheat dalia and water adlibitum, their fasting blood sugar level, by depriving food overnight but allowing free access to water, was estimated. The rats were divided into five groups (Gp.I, Gp.II, Gp.III, Gp.IV and Gp.V) of 8 rats each. Diabetes was induced in rats of Gp.I, Gp.II, Gp.III and Gp.IV by intraperitoneal administration of Streptozotocin (50 mg/kg b.wt.). Whereas rats in Gp.V were kept as untreated controls. Fasting blood sugar levels of all these animals were estimated after three days of treatment. These animals besides normal diet of wheat dalia were fed with raw camel milk (Gp.I), pasteurized camel milk (Gp.II), raw camel milk+lactoferrin (Gp.III), cattle milk (Gp.IV) and untreated control-normal diet (Gp.V). Rats of Gp1 to Gp.IV were given 250 ml of milk daily by watering bottle instead of

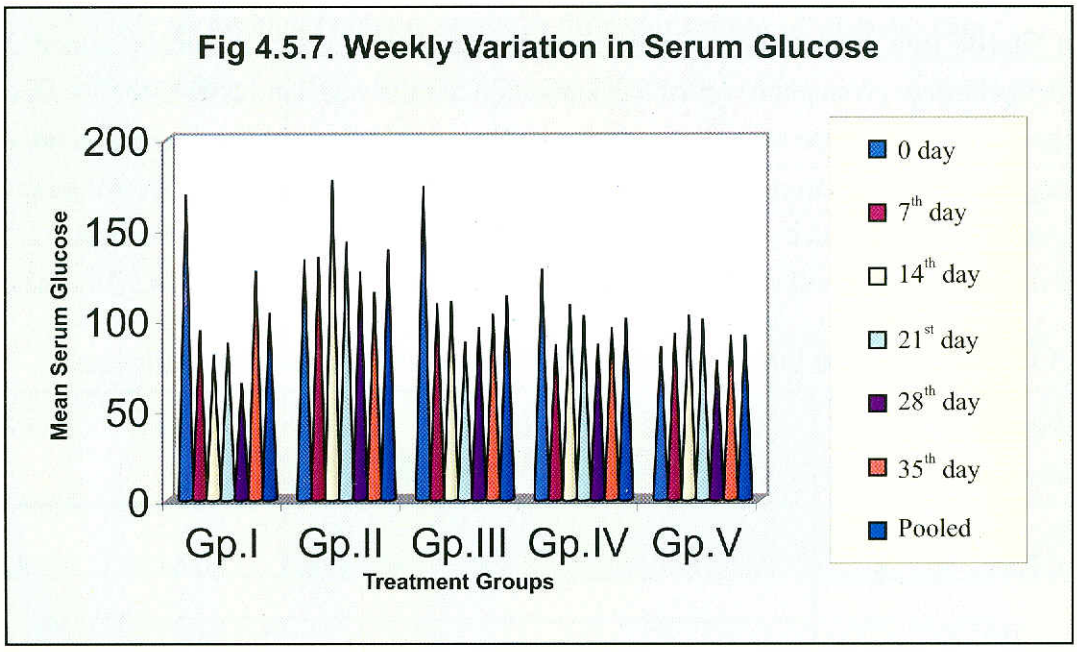
water. In Gp.III, 1mg of lactoferrin separated from camel milk was additionally added. Whereas animals in Gp.V were given plain water. Pasteurization of milk was done at 63°C for 30 minutes. The blood sugar level of all these animals was estimated at weekly interval for five consecutive weeks. Blood samples were drawn from cardiac puncture using tuberculin syringe from overnight fasted rats, serum samples were harvested and glucose level was determined spectrophotometrically employing glucose oxidase method. Results were statistically analysed using ANOVA.(Table4.5.10 and Fig.4.5.7)

Table 4.5.10. Weekly mean blood glucose status in different groups of diabetic rats

Mean serum glucose level (mg/dl)	Gp.I	Gp.II	Gp.III	Gp.IV	Gp.IV
Normal Rats	86.2±12.4	81.3±5.8	80.0±10.8	80.6±12.1	84.7±2.8
Diabetic	168.7±11.7	132.8±8.0	173.4±26.9	127.5±7.2	84.7±2.9
7th day	93.8±7.9	134.2±27.4	108.5±6.3	85.8±8.0	92.1±4.3
14th day **	80.3±7.6	177.0±23.2	109.9±4.3	108.1±6.6	102.1±4.9
21st day *	86.9±3.9	142.4±23.1	87.2±3.3	102.0±4.9	99.9±7.0
28th day **	64.3±13.4	126.2±13.0	95.4±4.0	86.0±1.6	76.9±3.3
35th day	126.7±12.8	114.9±16.8	102.8±5.6	95.2±3.5	90.9±3.9
Pooled **	103.4±6.7	138.2±8.0	112.8±6.5	100.4±3.2	91.0±2.0

Significance ** (P<0.01), *(P<0.05); Gp.I Raw camel milk; Gp.II- Pasteurized camel milk; Gp.III- Raw camel milk + Lactoferrin; Gp.IV- Raw cow milk; Gp.IV- Control

Initial mean blood sugar of treated rats in Gp.I, Gp.II, Gp.III, and Gp.IV Gp.V was 168.724±11.674, 132.75±7.950, 173.422±26.871, 127.465±7.163 and 84.691±2.876 mg/dl, respectively. During five weeks of trial it ranged; In Gp.I (64.319±13.498 to 126.656±12.805). Gp.II (176.964±23.188 to 114.882±16.780), Gp.III (109.895±4.264 to 87.231±3.261), Gp.IV (127.465±7.163 to 85.810±8.030) and in Gp.V (102.060±4.914 to 76.935±3.291) mg /dl, respectively, at weekly interval. Overall a significant decrease in mean blood glucose was observed in Gp.I rats getting raw camel milk compared to pasteurized milk.



Sub project 6: Tuberculin testing and its correlation with haematological parameters in camels

Investigator : F.C. Tuteja

Associates : S.K. Ghorui, S.K. Dixit, N. Sharma and D.Suchitra Sena

Two hundred thirty two camels of an organized farm (National Research Centre on Camel, Bikaner) were tested on lateral side of neck by single intradermal test using bovine PPD tuberculin (prepared from *M. bovis*, strain AN-5 containing 1 mg PPD per ml and supplied by Indian Veterinary Research Institute, Izatnagar, U.P.) The animals showing skin fold thickness of 5mm or more after 72 hours of inoculation were considered as positive reactors (Table 4.5.11). Animals were tested twice at four month interval and were grouped as follows:

Group I: Camels twice positive (++)

Group II: Camels first positive and second time negative (+ -)

Group III: Camels first negative and second time positive (-+)

Group IV: Camels twice negative (- -).

For hematological parameters, blood samples were collected with in a week of second testing from all the four groups and were analyzed for Differential Leucocyte Count (DLC), Haemoglobin (Hb), Packed Cell Volume (PCV), Erythrocyte Sedimentation Rate (ESR), Total Leucocyte Count (TLC), Albumin to globulin ratio (A: G), Globulin and Total Proteins.

Table 4.5.11: Tuberculin testing of camel herd of the farm

Tuberculin	No. of animals tested	No. of animals found positive
1st test	232	25
2nd test	232	25

Animals found positive for both the testing were 13 (Table 4.5.12). Twelve of the animals found positive during first testing showed self cure whereas 12 animals showed new infections.

Table 4.5.12: Grouping of animals based on 1st and 2nd testing.

Tuberculin testing results		No. of animals
1st testing	2nd testing	
+	+	13
-	+	12
+	-	12
-	-	195/232

Animals of less than two years were not found positive for the test (Table 4.5.13); this may be because of long incubation period as reported in other animals. Sex of the animal and pregnancy did not reflect any difference (Table 4.5.14).

Table 4.5.13 Age wise tuberculin testing

Age (Yrs)	No. of animals	1st test	2nd test
0 - 1	34	–	–
1 - 2	16	–	–
2 - 3	26	2	2
3 - 4	13	1	1
4 - 5	17	3	3
5 - 6	15	4	4
6 - 7	34	1	3
7 - 8	9	1	1
8 - 9	8	1	–
9 - 10	5	–	–
10 - 11	12	–	4
11 - 12	8	3	1
12 - 13	13	3	1
13 - 14	6	1	2
14 - 15	8	3	1
16 - 21	8	2	2

Table 4.5.14. Sex and pregnancy wise tuberculin testing

Sex	No. of animals	1st test	2nd test
Male	97	9	10
Female	135	16	15
Female (Pregnant vs. Non pregnant)			
Non pregnant	111	13	11
Pregnant	26	3	4

DLC revealed significant difference for neutrophil, and lymphocyte count (Table 4.5.15) between groups. The different cell types in the camel blood are characterized by high proportions of neutrophils (50-65%) followed by lymphocytes (30-45%). In the present study, lymphocytosis was recorded in animals of group (++). Almost equal proportion of lymphocytes and neutrophils were found in animals found positive for one time.

Table 4.5.15. Relationship between DLC and tuberculin results

Parameter	Tuberculin Result			
	- - (n=11)	- + (n=11)	+ - (n=11)	+ + (n=12)
Neutrophils**	56.2±1.7	44.2±1.2	43.4±2.6	32.7±1.3
Lymphocytes**	34.2±1.7	42.4±1.4	49.0±2.6	57.9±1.7
Monocytes	4.9 ±0.6	6.8 ±0.8	4.7 ±0.3	5.6 ±0.8
Eosinophils	3.2 ±0.6	4.2±0.9	2.0±0.3	2.3±0.5
Basophils	1.5±0.2	1.6 ±0.3	1.1 ±0.2	1.5± 0.3

n = number of animals ** ($P<0.01$)

No significant difference was observed between TLC, Hb, PCV, ESR, Total protein and A: G. whereas significant difference has been observed for globulin concentrations between groups (Table 4.5.16). Since the test samples were collected immediately after 2nd testing. Animals found positive for the 2nd testing showed rise in globulin concentrations, which can be interpreted in terms of increase in humoral immune response, when the test was read.

Table 4.5.16. Relationship between haematological parameters and tuberculin results.

Parameter	Tuberculin Result			
	- - (n=11)	- + (n=11)	+ - (n=11)	+ + (n=12)
Haemoglobin (g/dl)	12.3±0.5	11.5±0.4	12.1±0.6	12.2±0.5
PCV (%)	26.1±1.5	23.9±1.2	25.1±1.2	26.7±1.7
ESR (mm/hr)	1.3±0.1	1.3±0.1	1.2±0.1	1.0±0
TLC (/Cmm)	10792.7±701	14863.6±1176.8	12209.1±1405.6	14511.7±809.7
A: G	2.3 ±0. 3	1.6 ±0.2	2.1±0.2	1.8 ±0.2
Globulin*(g/dl)	1.9±0.2	2.4±0.2	2.0±0.1	2.2 ±0.1
Total Protein (g/dl)	5.8±0.2	6.2±0.2	5.7±0.2	6.1±0.2

n = number of animals *($P<0.05$)

As is evident from Table 4.5.12, almost 50% of the animals tested positive for the first time were negative for the second time, suggesting a high self cure rate in this species.

The almost 5% increase in new infections occurred in second time testing. The possible explanation for this could be, tuberculosis is reported to be rare among camels kept under nomadic conditions. Disease is reported to occur most frequently when camels are kept in close association with other camels or in close contact with cattle.

In conclusion, the tuberculin test in camels appears to be reliable but high self cure and new infection rates may warrant further confirmation. More study in this regard is required, to reach a very definite conclusion including correlating with cultural and postmortem findings are also essential.

4.6. Research Schemes under NATP and DBT

4.6.1. Improving the shelf life of milk and milk products of camel and goat

Investigator : Raghvendar Singh

Associates : Sanjay Shukla

I. Camel flavored milk

Camel flavored milk process was successfully standardized to make camel milk more palatable to those who do not like to drink it as such, as well as to enhance its utilization and sale.

The camel milk was processed with different combination of flavors (pineapple, vanilla, chocolate and kesar) and colours i.e., yellow, rose and pink. Fresh and filtered camel milk was collected in hygienic conditions and preheated (45° to 60°C) followed by adding of carrageenan stabilizer @ 0.04% and sugar at the rate of the 5% while sugar for chocolate milk is @ 3.5%. The desired flavors/essence i.e. pineapple, vanilla, and kesar @ 8-12 drops per liter of camel milk while for the chocolate camel milk (5gm powder per liter) was dissolved followed by the addition of colour i.e. green, yellow and pink @ 2-3 drops per liter of camel milk. After homogeneous mixing of above additions, it was pasteurized at 73°C for 15 minutes and cooled to 5°C. The prepared camel flavored milk was packaged and stored in refrigerated temperature for its further consumption.

Evaluation of Camel Flavored Milk

The camel milk was processed with different combination of stabilizers, flavors and colours.

The stabilizers are used carrageenan and sodium alginate with use of different flavors i.e. pineapple, vanilla, chocolate and kesar along with yellow, rose and pink colours. The chemical evaluation was done before its suitability and sensory evaluation. Data are given in Table 4.6.1.1.

Table 4.6.1.1. Composition camel flavored milks of different combinations of flavors and colors

Parameter (%)	A	B	C	D
Moisture	82.6-84.3	83.3-85.0	85.3-86.9	87.1-88.9
TSS	15.7-17.4	15.0-16.8	13.1-14.7	12.9-11.2
SNF	12.3-14.7	11.6-14.5	11.3-12.6	9.4-10.5
Fat	1.6-5.1	1.6-5.1	1.4-2.5	1.5-2.6
pH	6.40-6.48	6.38-6.50	6.45-6.54	6.52-6.59

A: Vanilla Flavor with Green Colour; **B:** Pineapple Flavor with Yellow Colour
C: Kesar Flavor with Pink Colour; **D:** Chocolate Flavor

Sensory Evaluation of Camel Flavored milk

A sensory evaluation test was carried out by using hedonic scale to assess the performance of all four different types of camel flavored milks prepared by the above said method. The camel milk of all the four flavors were given daily to the sensory evaluation panel of seven members for one week and their evaluation report was compiled as per hedonic scale Proforma as given in Table 4.6.1.2. It was observed that highest points in respect to taste, odour and colour was scored by the vanilla flavor with green colour.

Table 4.6.1.2. Average points of sensory evaluation performance of camel flavored milks using hedonic scale*

Parameter (%)	A	B	C	D
Taste	8.000.12	7.760.08	7.670.11	7.390.15
Smell	7.720.12	7.670.13	7.380.07	7.270.19
Colour	7.580.13	7.530.06	7.560.15	6.980.25

* Mean of hedonic scale points SE (9-Most desirable, 5-Optimum, 1- Most undesirable)

A: Vanilla Flavor with Green Colour; **B:** Pineapple Flavor with Yellow Colour

C: Kesar Flavor with Pink Colour; **D:** Chocolate Flavor

II. Preparation of camel milk tea and coffee

Mix the camel milk and water in ratio of 1:2 and boil it followed by addition tea leaves and sugar as per requirement. Give one boiling and filter before the use. For camel milk coffee add milk and water in 1:1 ratios, sugar as per taste and boiled followed by the addition of coffee as per requirement and is ready to use. The camel milk tea and coffee were served to Indian and foreign tourists during their visit of this center to carry out sensory evaluation, tested as well during camel festival. The overall acceptability was recorded as very good and results were encouraging.

III. Heat stability of camel milk

Heat stability of milk is expressed as the heat coagulation time (HCT) which elapse between placing a sample of milk, contained in small glass tube, in oil bath at a definite temperature, usually 140°C for unconcentrated milk. Milk is extremely heat stable and can tolerate the conditions applied in most thermal processes. However, under certain conditions, milk and milk products may be unstable to the processing conditions imposed. Camel milk samples were collected during late and early lactation and processed for heat stability test at different pH i.e., 6.0, 6.20, 6.40, 6.60, 6.80, 7.00 to 7.20 and data on HCT were recorded to evaluate suitability of camel milk for further thermal

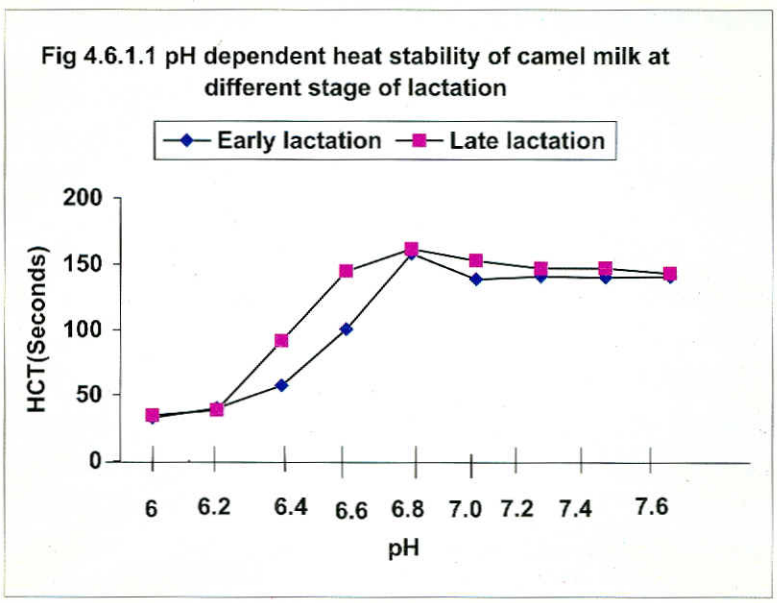


Fig 4.6.1.1 pH dependent heat stability of camel milk at different stage of lactation

processing and pH dependence of heat induced coagulation of camel milk. At pH 6.00, the HCT was observed lowest while it was observed highest at pH 6.80 in the both types of milks. Data are given in Table 4.6.1.3 and Figure 4.6.1.1. The HCT of camel milk get stable after pH 7.2 to 7.6.

Table 4.6.1.3. Comparative values of HCT of camel milk at different stage of lactation

pH	HCT (Seconds)	
	Early lactation	Late lactation
6.0	32.9 ± 2.9	32.8 ± 4.3
6.2	39.9 ± 4.3	38.8 ± 5.8
6.4	57.0 ± 5.5	91.4 ± 14.4
6.6	100.4 ± 11.0	144.6 ± 20.6
6.8	157.9 ± 13.7	161.4 ± 12.5
7.0	138.1 ± 5.9	152.4 ± 4.7
7.2	140.6 ± 5.8	147.0 ± 6.1
7.4	139.5 ± 6.5	142.66 ± 6.6
7.6	140.0 ± 6.0	139.5 ± 6.6

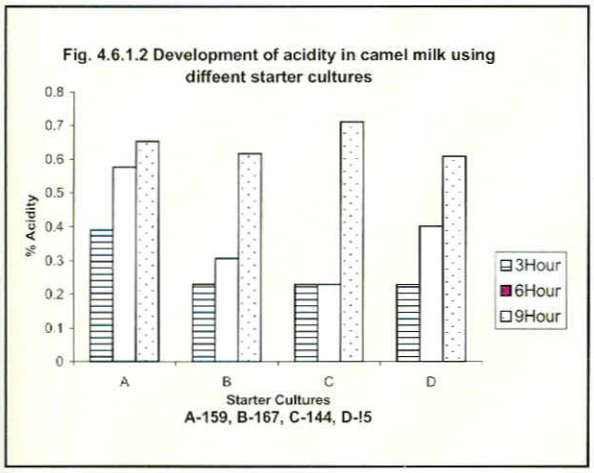
Mean SE of seven observations

The HCT of natural milk during early and late lactation were 63.7±2.1 and 79.81±7.5 recorded, respectively.

IV Evaluation of lactic cultures for camel milk fermentation

The camel and cattle ("Saras" from URMUL dairy, Bikaner) milks were fermented using four different lactic starter cultures which were purchased from National collection of dairy cultures, Division of dairy microbiology, N.D.R.I., Karnal.

The development of acidity and DMC were recorded up to the nine hour at the interval of three hour during incubation to study comparative rate of development of acidity in both the milks. The strains used in this study were 159 (Dahi culture), 167 (Dahi culture), 144 (Yogurt mix culture) and 15 (Lactobacillus acidophilus). It was observed that rate of development of acidity is comparatively slow in camel milk than cattle milk in all the four lactic strains. The data are given in Table 4.6.1.4 and 4.6.1.5. The growths of lactic culture 159 and 144 were recorded highest and lowest in first six hour in camel milk (Fig. 4.6.1.2). The growths of lactic culture 144 and 167 were recorded highest and lowest in first six-hour in cattle milk (Fig. 4.6.1.3).



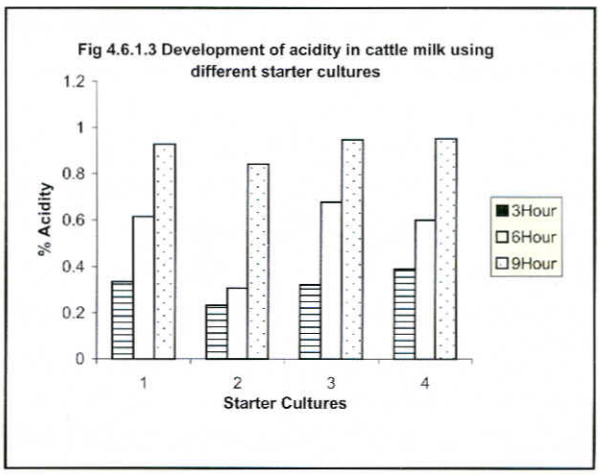


Table 4.6.1.4 Comparative study on development of acidity in camel and cattle milk due to different lactic cultures at different incubation intervals*

Lactic Cultures	Percent Acidity					
	Camel Milk			Cattle Milk		
	Incubation Intervals (Hours)			Incubation intervals (Hours)		
	3	6	9	3	6	9
159	0.4±0.1	0.6±0.1	0.6±0.1	0.3±0.1	0.6±0.1	0.9±0.1
167	0.2±0	0.3±0	0.6±0	0.2±0	0.3±0	0.8±0
144	0.3±0	0.5±0.1	0.7±0.1	0.3±0	0.7±0	0.9±0
15	0.3±0	0.4±0	0.6±0	0.4±0	0.6±0	1.0±0

* Mean value SE of five samples

159 (Dahi culture), 167 (Dahi culture), 144 (Yogurt mix culture) and 15 (*Lactobacillus acidophilus*)

Table 4.6.1.5. Comparative study on direct microscopic count (DMC) of camel and cattle milk using different lactic Cultures*

Lactic Cultures	Direct Microscopic Count (DMC)X10^{9}/ml milk					
	Camel Milk			Cattle Milk		
	Incubation Intervals (Hours)			Incubation intervals (Hours)		
	3	6	9	3	6	9
159	362	631	973	389	816	1450
167	394	523	800	441	783	1010
144	520	739	825	611554	754	1050
15	358	951	1010	554	1200	1280

* Mean value SE of five samples

159 (Dahi culture), 167 (Dahi culture), 144 (Yogurt mix culture) and 15 (*Lactobacillus acidophilus*)

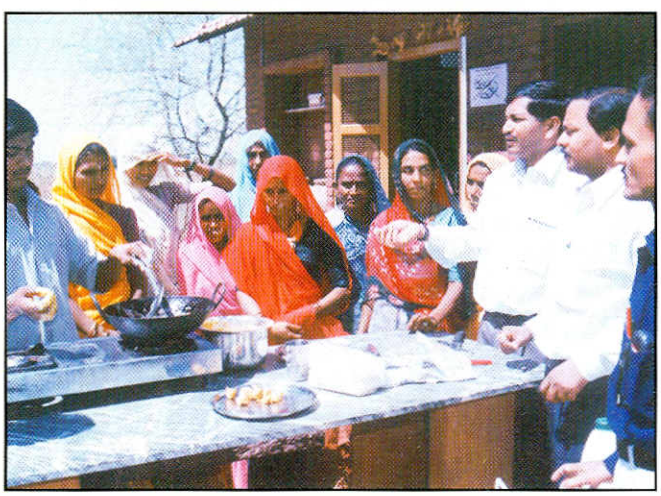
Second workshop on refinement and transfer of technology on milk and milk products of camel and goat

A two days workshop on 26-27th December, 2003 was organized under NATP Project "Improving the shelf life of milk and milk products of camel and goat" to evaluate research work carried out in project. The main objective of the workshop was to assess the ongoing research work on camel and goat milk and milk product technologies developed and their refinement if any required. Dairy experts from Urmul Dairy, Bikaner; NDRI, Karnal: Lokhit Pashu Palak Sansthan (LPSS), Sadari, Pali; CAZRI, Jodhpur and NRCC, Bikaner participated. The salient research achievements on camel and goat milk and milk products were presented by the respective project investigator and CCPI and their associates from NRCC, Bikaner and CAZRI, Jodhpur, respectively. The guest lecture on Milk proteins and their applications with special reference to lactoferrin delivered by the Dr. K. L. Bhatia, Ex Principal Scientist, NDRI, Karnal. The interaction with camel owners including representative of LPSS, Sadari, Pali was carried out to share their feed back on camel milk utilization. The chief guest and dairy expert Sh P.K. Malhotra, Managing Director, URMUL, Bikaner advocated for the availability of camel and goat milk in the market to meet the increasing demand in the society due to its growing awareness of its medicinal properties. Concluding remarks of experts to promote further camel milk and milk products were viz (i) Evaluation and identification of camel milk and milk products constituents for medicinal properties (ii) packaging of camel and goat milk and milk products for their marketing (iii) Transfer of camel and goat milk products technologies among their users.

A kissan ghosthee on 29th December, 2003 was organized at the centre. The camel milk and milk products were served to camel owners and chief guest Dr A.S. Faroda, Chiarman ASRB, New Delhi, along with other dignitaries and participants. The technical bulletins on camel milk and milk products were distributed to users.

Training on empowerment of farm women on development and popularization of camel milk and milk products and their utilization

The farm women training course of ten days funded by NATP "Improving the shelf life of milk and milk products of camel and goat" was organized from 24th March to 2nd April, 2004 by the NRCC, Bikaner with the help of Lokhit Pashu Palak Sansthan at Sadadi, Pali, Rajasthan. On farm training was imparted to twenty five farm women on technologies of preparation of camel milk products such as fermented milk (Lassie), besan cheese pakoara, flavored milk, tea and coffee. Each camel milk product was



Popularization of camel milk among farm women

demonstrated in detail in respect of its procedure, composition, sensory evaluation and its importance. Participants were made aware with importance of camel milk in treatment of diabetes, tuberculosis, typhoid, liver disease and constipation. During training, the technical bulletins on camel milk products were distributed among the participants during practice of preparation of these products by themselves. The feed back were taken from participants as well as from surrounding villages on camel milk production potential, consumer acceptance, marketing system and its economic returns to assess camel milk and milk products utilization in future. The demand of camel milk is increasing in the society due to getting awareness of camel milk importance as a health food. It can be concluded that camel milk and milk products utilization has potential and acceptance in the society if these are made available in the market.

4.6.2 Characterisation and conservation of Jaisalmeri breed of camel

Investigator : S. C. Mehta

A survey of the breeding tract for availability of pure Jaisalmeri camels was carried out. The whole breeding tract was initially divided into 12 strata. The Jaisalmer and Barmer districts were divided into four stratums whereas the Jodhpur and Bikaner districts were divided into two strata. During survey it was observed that in the Bikaner district pure Jaisalmeri animals were not available. Due to this, the survey was restricted to the four strata of the Jaisalmer and Barmer district and two of the Jodhpur district. In all 36 enumerators were employed for the characterisation work, of which 16 were in Jaisalmer, 15 in Barmer district and 5 in the Jodhpur district. In brief the work done is as follows, (Table 4.6.2.1 to 4.6.2.4)

- Breed descriptor prepared.
- Breed population estimated.
- Growth and production data incorporated in the descriptor.
- Reproduction parameters incorporated in the descriptor.
- Socioeconomic aspects incorporated in the descriptor.
- Cryopreservation of the semen is being carried out.
- Selected breedable males are being maintained.

Disqualification criteria of the breed

1. Presence of "STOP" (well marked depression above the eyes).
2. Presence of hairs on ears and eyelids (JHEEPRA).
3. Black colour (generally avoided).
4. Prominent forehead.
5. Deep supraorbital fossa.
6. Massive legs and body.
7. Droopy muzzle.

Table 4.6.2.1 Average land holding

District	Tehsil	Land holding (Hectare)	Irrigated Land holding (Hectare)	Un-irrigated Land holding (Hectare)
Breeding tract	Pooled	14.43	0.83	13.60
Jaisalmer	Pooled (Dist.)	13.41	2.17	11.24
	1	13.39	2.23	11.17
	2	13.98	00	13.98
Barmer	Pooled (Dist.)	15.23	0.02	15.21
	1	16.19	0.16	16.03
	2	13.68	00	13.68
	3	18.99	00	18.99
	4	12.47	00	12.47
	5	21.42	00	21.42
	6	05.17	0.00	05.17
	7	05.75	00	05.75
Jodhpur	Pooled (Dist.)	12.45	0.80	11.66
	1	18.70	1.18	17.51
	2	10.15	0.66	09.49
	3	0.50	0.00	00.50

Table 4.6.2.2 District and tehsil wise grazing distance and grazing time

District	Tehsil	Grazing distance (Km)	Grazing time (Hrs.)
	Pooled	5.2	8.5
Jaisalmer	Pooled (Dist.)	6.9	10.3
	1	7	10.5
	2	3.1	9.1
Barmer	Pooled (Dist.)	4.5	7.8
	1	4.8	9.9
	2	4.6	8.0
	3	3.9	6.3
	4	6.1	9.4
	5	1	4.0
	6	1.8	8.0
	7	8.6	9.3
Jodhpur	Pooled (Dist.)	4.4	6.2
	1	3.8	7.2
	2	4.5	4.0
	3	5.5	3.3

Table 4.6.2.3. Occupation wise income

Occupation	Percent occupation	Income (Rs.)
Agricultural	22.78	23936
Animal husbandry	9.89	17282
Agricultural & Animal husbandry	61.70	28502
Other with Agricultural & Animal husbandry	5.63	17581

Table 4.6.2.4 Availability of breedable males and females of Jaisalmeri breed in a herd

District	Average herd size	Availability of Jaisalmeri camels in an average herd		
		Jaisalmeri camels	Breedable males	Breedable females
Jaisalmer	4.19	3.99	1.2	1.28
Barmer	3.19	2.97	0.74	1.18
Jodhpur	6.43	5.74	1.96	1.35
Pooled	3.73	3.49	0.97	1.23

4.6.3. Improving reproductive efficiency of sheep, camel, goat, cattle and buffalo

CCPI : Aminu Deen
Co- PI : Sumant Vyas
S.R.F. : Mamta Jain

An experiment to hasten off-season breeding was conducted on 12 adult female camels which were divided into 2 groups of six each. Group 1 female were given hormonal treatment in the form of progestagen (Crestar-Intervet), while group 2 females served as untreated control. These animals were kept in an enclosure in company of a male. Blood samples were collected at appropriate intervals to monitor plasma progesterone profiles for detection of ovulation and pregnancy. Analysis of samples for progesterone are under progress. Interpretations will be derived after completion of analysis.

4.6.4. Environmental stress and its amelioration through shelter management

Investigator : C. Bhakat

Associates : N. Sharma, R. Singh and D. Chaturvedi (S.R.F.)

Pattern of rutting behavior of camel in different management conditions.

Under this experiment ten adult male camel (8-11 years old) are taken and were divided into two groups of five each. Group I was given exposure in front of female camel for 20 to 30 minutes everyday.

The study was conducted for ten weeks starting from last week of November (onset of winter season). At that time maximum and minimum temperature (^{0}C), RH (morning and evening) (%), THI (morning and evening) values were 31.5 ± 0.4, 14.7 ± 0.2, 88.9 ± 0.5, 53.9 ± 0.5 and 67.5 ± 0.2, 70.7 ± 0.1, respectively. At 10th week of study (1st week of Feb) above mentioned microclimatic variables were 19.6 ± 0.2, 4.1 ± 0.1, 51.7 ± 0.4, 28.7 ± 0.4 and 71.1 ± 0.1, 73.6 ± 0.7, respectively.

Table 4.6.4.1 presents Mean ± SE of rutting behavioral frequency in different periods. Rutting behavioral frequency of extrusion of soft palate, flapping of tail and frequency of micturition were almost similar type in both groups during 1st and 2nd week. From 3rd week onwards frequency of all these parameters gradually increased and the frequency of these parameters significantly (P<0.01) increased in exposed group as compared to unexposed group. In both groups, frequency of these parameters were significantly (P<0.01) high during morning as compared to evening time. The cardinal physiological responses and other rutting behavioral frequency are presented in Fig 4.6.4.1. The cardinal physiological responses like respiration and pulse rate significantly (P<0.01) increased during evening as compared to morning, in both groups. It is mainly due to diurnal variation. The variation of cardinal physiological responses between these two groups was non-significant.

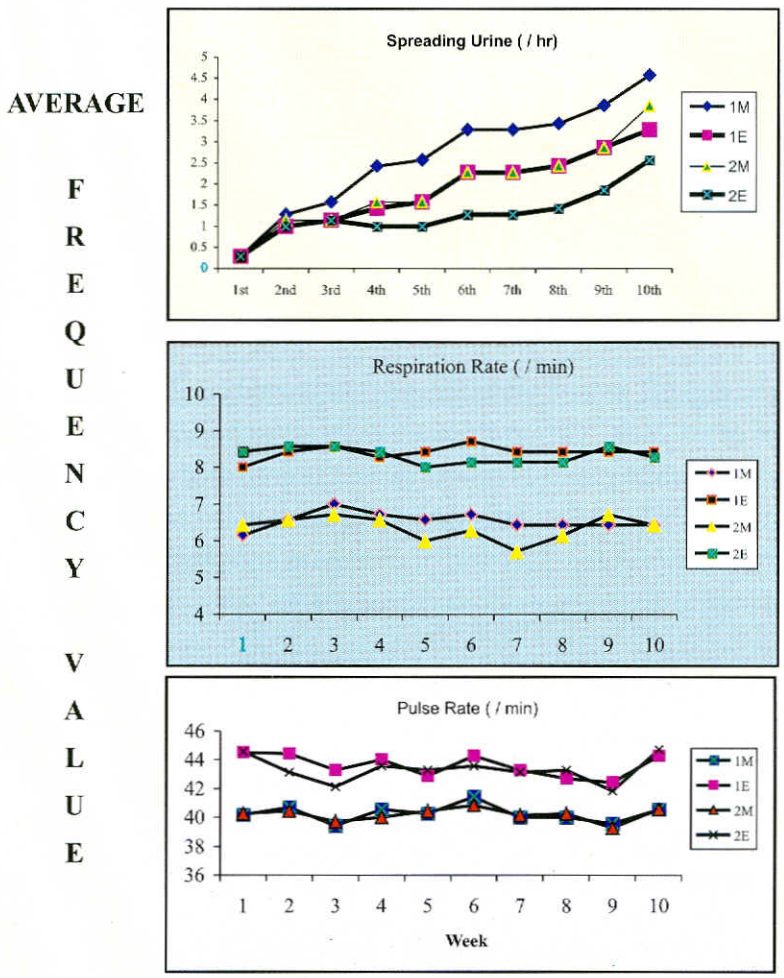


Fig 4.6.4.1. Cardinal physiological responses and other behavioral frequency

Table 4.6.4.1. Mean ± SE of rutting behavioral frequency of exposed and unexposed groups during breeding season

Wk	Exposed Group n=5						Unexposed Group n=5					
	Extrusion of Soft Palate /min		Flapping of Tail /min		Micturition frequency /hr		Extrusion of Soft Palate /min		Flapping of Tail /min		Micturition frequency /hr	
	M	E	M	E	M	E	M	E	M	E	M	E
1st	0.3 ± 0.2	0.3 ±0.2	2.9 ±0.5	2.4 ±0.4	1.0 ±0.1	1.0 ±0.1	0.3 ±0.2	0.3 ±0.2	2.3 ±0.5	1.7 ±0.3	1.0 ±0.1	1.0 ±0.1
2nd	1.3 ±0.2	1.1 ±0.1	5.3 ±0.3	4.3 ±0.3	1.3 ±0.2	1.0 ±0.1	1.1 ±0.1	1.1 ±0.1	4.9 ±0.4	4.0 ±0.3	1.0 ±0.1	1.0 ±0.1
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3rd	1.5 ±0.2	1.0 ±0.1	7.3 ±0.4	6.3 ±0.4	1.9 ±0.3	1.1 ±0.1	1.3 ±0.1	1.0 ±0.1	6.6 ±0.3	5.6 ±0.3	1.1 ±0.1	1.0 ±0.1
4th	2.4 ±0.2	1.4 ±0.2	9.3 ±0.3	8.3 ±0.3	2.7 ±0.2	1.7 ±0.2	1.6 ±0.2	1.0 ±0.1	8.8 ±0.8	7.8 ±0.7	1.7 ±0.2	1.0 ±0.1
5th	3.1 ±0.3	2.1 ±0.3	11.3 ±0.7	9.4 ±0.6	3.3 ±0.2	2.3 ±0.2	2.1 ±0.3	1.3 ±0.2	9.6 ±0.4	8.3 ±0.4	2.3 ±0.2	1.3 ±0.2
6th	3.7 ±0.2	2.9 ±0.3	21.7 ±1.5	19.7 ±1.6	3.9 ±0.1	2.9 ±0.1	2.7 ±0.2	1.7 ±0.2	18.6 ±1.7	16.3 ±1.6	2.9 ±0.1	1.9 ±0.2
7th	4.3 ±0.2	3.4 ±0.2	33.1 ±1.3	31.1 ±1.3	3.9 ±0.2	2.9 ±0.1	3.3 ±0.2	2.6 ±0.4	30.4 ±1.5	28.6 ±1.6	2.9 ±0.1	1.9 ±0.1
8th	4.5 ±0.1	4.0 ±0.1	43.0 ±1.2	40.1 ±0.9	4.3 ±0.2	3.33 ±0.2	4.0 ±0.1	3.0 ±0.1	41.6 ±1.1	39.4 ±0.9	3.3 ±0.2	2.3 ±0.2
9th	4.8 ±0.2	4.4 ±0.2	45.4 ±1.1	41.7 ±1.0	4.4 ±0.1	3.4 ±0.2	4.4 ±0.2	3.4 ±0.2	42.6 ±1.02	40.7 ±1.0	3.4 ±0.2	2.4 ±0.2
10th	4.8 ±0.1	4.8 ±0.1	46.9 ±1.0	44.3 ±1.2	4.2 ±0.1	4.0 ±0.3	4.7 ±0.2	3.9 ±0.1	43.1 ±1.2	41.9 ±1.2	3.9 ±0.1	2.7 ±0.2

** Data 3rd week onward are significant at 1% level.

Table 4.6.4.2 reveals Mean ± SE of rutting behavioral intensity in different periods. The behavioral intensity of frothing of salivary secretion, making metallic sound and making gurgling sound were very low during first two weeks in both groups. During 3rd and 4th weeks intensities were fair (noticeable degree), during 5th, 6th, 7th, 8th weeks intensities were medium to prominent and on 9th, 10th weeks intensities were very prominent. The significant ($P<0.01$) variation between groups was found. In both groups, intensity of these parameters was significantly ($P<0.01$) high during morning as compared to evening time. Fig 4.6.4.2 express the rutting behavioral intensity (back leg separate apart, flow of poll gland secretion and marking territory) in different periods. Significant ($P<0.01$) variation between groups and periods were observed on 3rd week onwards. All behavioral frequency and intensity parameters of both groups highly negatively correlated with micro-climatic variables (max. and min. temperature). In case of all frequency parameters correlation values varied from 85% to 97% and 74% to 95% in exposed and unexposed group, respectively. Similarly in case of all intensity parameters correlation values varied from 86% to 96% and 71% to 93% for group I and II, respectively. All values were significant at 1% level. The levels of testosterone and cortisol during different period of rut in Indian camel are given in Table 4.6.4.3. The levels of testosterone greatly varied among studs in Group I and II. In second sample onwards (4th week) testosterone level significantly ($P<0.01$) increased in exposed group as compared to unexposed group. The level of cortisol was non-significant during 2nd week in I and II group but significantly increased levels of cortisol were found on 4th week onwards in exposed group as compared to unexposed group. Since during rutting period the energy requirement of breeding male is increased, so levels of glucocorticoid hormone like cortisol levels was found to be increased.

Table 4.6.4.4 reveals Mean ± SE of physical parameters of rutting camel in different periods. During first two weeks feed intake, water intake and body weight changes were non-significant between group I and II. But from3rd week onwards, feed intake and body weight significantly ($P<0.01$) reduced in exposed group as compared to unexposed group. The water intake was also reduced but the variation between two groups was found to be non-significant. In both groups, all behavioral frequency and intensity parameters were highly negatively correlated with feed and water intake, body weight changes. In case of all frequency parameters correlation values varied from 86% to 98% and 74% to 98% for group I and II, respectively. Similarly in case of all intensity parameters correlation values varied from 83% to 97% and 61% to 95% for exposed and unexposed group, respectively.

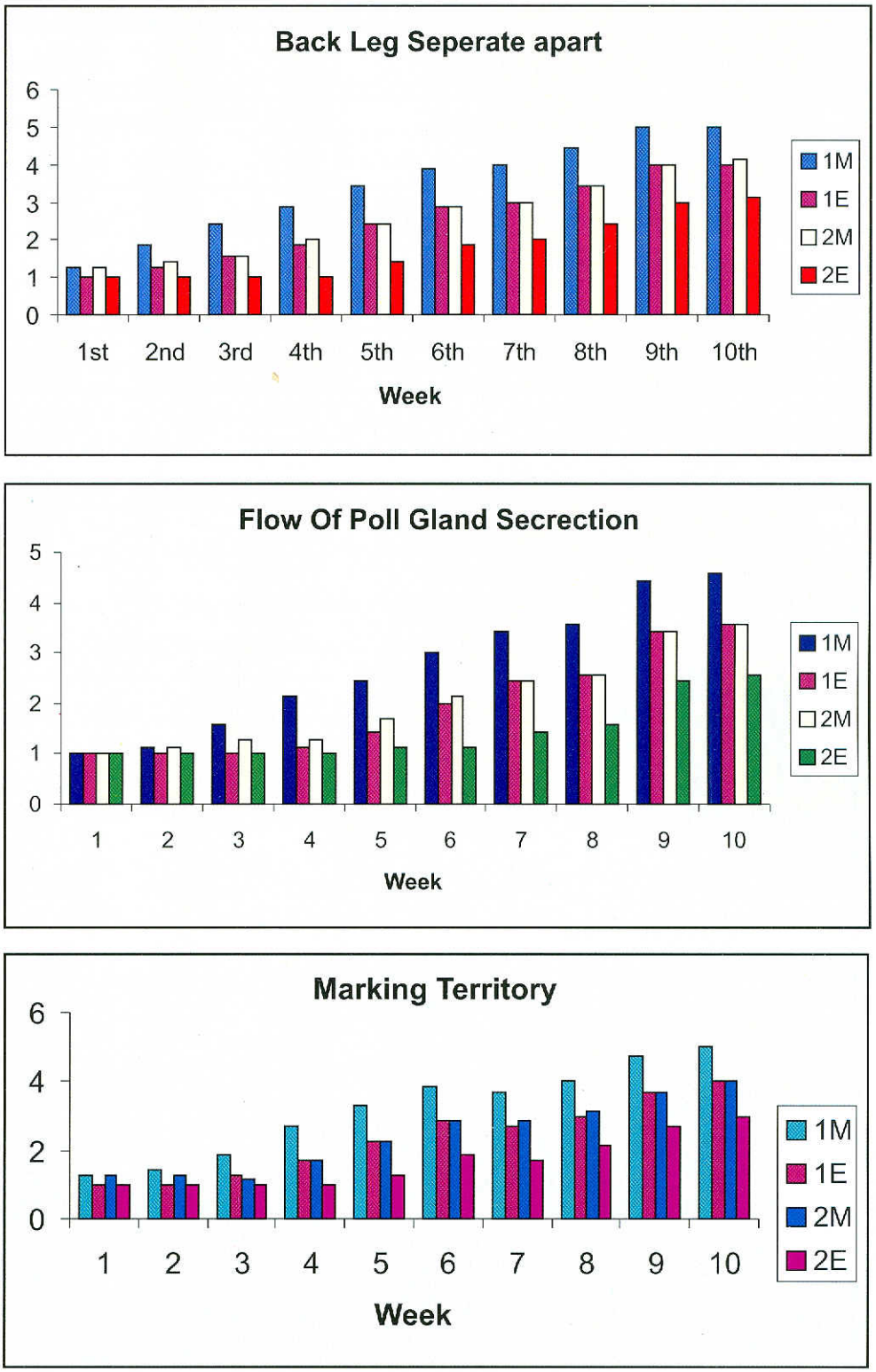


Fig 4.6.4.2 Rutting behavioral intensity

Table 4.6.4.2 Mean ± SE of rutting behavioral intensity in exposed and unexposed groups during breeding season

Wk	Exposed Group n=300						Unexposed Group n=300					
	Frothing of Salivary secretion		Metallic Sound secretion		Gurgling Sound		Frothing of Salivary secretion		Metallic Sound secretion		Gurgling Sound	
	M	E	M	E	M	E	M	E	M	E	M	E
1st	1.0 ±0.1	1.0 ±0.1	1.0 ±0.1	1.0 ±0.1	1.0 ±0.1	1.0 ±0.1	1.0 ±0.1	1.0 ±0.1	1.0 ±0.1	1.0 ±0.1	1.0 ±0.1	1.0 ±0.1
2nd	1.3 ±0.2	1.1 ±0.1	1.4 ±0.2	1.1 ±0.1	1.3 ±0.2	1.1 ±0.1	1.1 ±0.1	1.0 ±0.1	1.3 ±0.2	1.0 ±0.1	1.1 ±0.1	1.1 ±0.1
	**		**		**		**		**		**	
3rd	1.9 ±0.1	1.0 ±0.1	1.9 ±0.1	1.0 ±0.1	1.7 ±0.2	1.0 ±0.1	1.0 ±0.1	1.0 ±0.1	1.6 ±0.2	1.0 ±0.1	1.3 ±0.2	1.0 ±0.1
4th	2.7 ±0.2	1.9 ±0.1	2.6 ±0.2	2.3 ±0.2	2.4 ±0.2	1.4 ±0.2	1.6 ±0.2	1.0 ±0.1	1.6 ±0.2	1.1 ±0.1	1.6 ±0.2	1.0 ±0.1
5th	3.1 ±0.3	1.9 ±0.3	2.9 ±0.1	2.0 ±0.1	3.0 ±0.2	2.0 ±0.2	2.0 ±0.3	1.6 ±0.2	1.9 ±0.1	1.1 ±0.2	2.0 ±0.2	1.1 ±0.1
6th	3.7 ±0.2	2.7 ±0.2	3.8 ±0.1	2.6 ±0.3	3.7 ±0.2	2.7 ±0.2	2.7 ±0.2	1.7 ±0.2	3.1 ±0.1	2.1 ±0.2	2.7 ±0.2	1.7 ±2.0
7th	3.9 ±0.1	2.7 ±0.2	3.6 ±0.2	2.4 ±0.3	4.0 ±0.1	3.0 ±0.1	2.9 ±0.1	1.7 ±0.2	3.0 ±0.1	2.0 ±0.1	3.0 ±0.1	2.0 ±0.1
8th	3.9 ±0.1	2.9 ±0.3	4.0 ±0.1	2.9 ±0.1	4.3 ±0.2	3.3 ±0.2	2.9 ±0.1	1.4 ±0.2	3.1 ±0.1	2.1 ±0.2	3.3 ±0.2	2.3 ±0.2
9th	4.9 ±0.2	3.6 ±0.3	4.7 ±0.2	3.7 ±0.2	4.6 ±0.2	3.6 ±0.2	3.3 ±0.2	2.1 ±0.3	3.7 ±0.2	2.7 ±0.2	3.9 ±0.3	2.9 ±0.3
10th	5.0 ±0.2	4.1 ±0.3	4.9 ±0.1	4.0 ±0.2	5.0 ±0.1	3.7 ±0.2	4.4 ±0.2	2.3 ±0.2	3.9 ±0.1	2.9 ±0.2	4.1 ±0.2	3.1 ±0.1

** Data 3rd week onward significant at 1 % level.

Table 4.6.4.3. Levels of Testosterone and Cortisol during different period of rut in Indian camel

Period (wk)	Exposed Group		Unexposed Group	
	T (ng/ml)	C (ng/ml)	T (ng/ml)	C (ng/ml)
	n = 25	n = 25	n = 25	n = 5
2nd	7.8 ± 2.1	8.3± 0.5	5.5 ± 1.3	6.3 ± 0.4
	**	**	**	**
4th	23.4 ± 1.5	13.0 ± 0.9	8.4 ± 2.8	10.4± 0.8
6th	43.4 ± 6.0	11.2 ± 0.8	13.9 ± 5.3	9.2 ± 1.5
8th	42.4 ± 4.5	13.4 ± 0.4	18.4 ± 4.3	10.9 ± 0.8
10th	49.4 ± 5.3	12.6 ± 1.4	27.7 ± 6.7	9.8 ± 0.4

** Data 4th week onward significant at 1 % level, T- Testosterone, C- Cortisol

Table 4.6.4.4. Mean ± SE of physical parameters of rutting camel in exposed and unexposed group during breeding season

	Exposed Group			Unexposed Group		
	D.M (Fodder) Intake (kg)	Water Intake (kg)	Body weight (kg)	D.M (Fodder) (kg)	Water Intake (kg)	Body weight (kg)
n	100	100	50	100	100	50
Initial	12.8 ± 0.1	28.5 ± 0.2	683.6 ± 9.7	12.8 ± 0.1	28.6 ± 0.2	685.2 ± 9.8
1st	12.8 ± 0.1	29.2 ± 0.2	683.0 ± 10.3	12.5 ± 0.1	29.2 ± 0.1	680.0 ± 9.7
2nd	12.1 ± 0.2	28.5 ± 0.6	679.4 ± 11.3	11.9 ± 0.2	28.8± 0.3	675.2 ± 10.0
	**	NS	**	**	NS	**
3rd	10.8 ± 0.0	27.2 ± 0.4	674.0 ± 8.7	12.4 ± 0.1	27.6 ± 0.3	678.2 ± 9.6
4th	10.0 ± 0.2	26.2 ± 0.3	669.0 ± 10.2	10.4 ± 0.1	26.4 ± 0.3	676.2 ± 10.0
5th	8.9 ± 0.1	25.8 ± 0.3	664.2 ± 10.4	10.3 ± 0.1	26.8 ± 0.2	674.2 ± 9.2
6th	8.1 ± 0.1	24.8 ± 0.3	654.6 ± 10.2	9.4 ± 0.2	26.2 ± 0.4	669.2 ± 8.1
7th	7.3 ± 0.0	22.6 ± 0.3	644.8 ± 10.1	8.7 ± 0.1	23.6 ± 0.3	654.2 ± 11.6
8th	7.2 ± 0.1	21.2 ± 0.2	634.8 ± 9.4	8.5 ± 0.1	22.2 ± 0.2	644.2 ± 10.2
9th	7.0 ± 0.2	20.2 ± 0.1	627.0 ± 11.4	8.5 ± 0.1	21.2 ± 0.1	634.2 ± 9.9
10th	7.0 ± 0.1	20.0 ± 0.5	617.8 ± 10.0	8.5 ± 0.1	21.0 ± 0.3	627.6 ± 8.9

** Data 3rd week onward significant at 1 % level, NS Non-Significant.

4.6.5. Evaluation of locally available feed and fodder to improve and formulate economic rations with high roughage diets.

Investigator : A. K. Nagpal

Associates : Manju Arora (SRF till 10.09. 03)

Nutrient utilization of gram straw (*Cicer arietinum*) based complete feed blocks in camel calves

Phase I

Four camel calves (10-12 months, 241-276 kg) were randomly selected from the camel herd and fed in-group on sole roughage ration of gram straw (GS) for 16 days followed by 5 days digestibility trial for its nutritional evaluation.

Phase II

Twelve camel calves (approx. 10 months; 187-240 kg) were randomly distributed into 3 groups of 4 each on the basis of body weights. The camels were given complete ration consisting of gram straw, chaffed dry groundnut forage and concentrate in the ratio of 70.3:15.0:14.7 in loose form (CR1-L), complete ration as that given to CR1-L but in the form of feed blocks (CR1-FB) and given complete ration consisting of gram straw, groundnut forage and concentrate in the ratio of 60.3:25.0:14.7 in feed block form (CR2-FB) for 98 days. Approximately 60 quintals of complete feed blocks weighing 3-5 kg were prepared at 2500 psi on feed block making machine developed at IARI, New Delhi.

Physical composition of complete rations given to camel calves as well as chemical composition of complete ration, groundnut forage, gram straw (GS) and drinking water offered is depicted in Table 4.6.5.1. Chemical composition varied due to different proportions of gram straw and groundnut forage used in complete rations. Fresh water had low potassium and phosphorus levels.

No significant difference was observed for dry matter intake kg/100 kg body weight and water intake kg/kg dry matter intake among CR1-L, CR1-FB, CR2-FB and GS (Table 4.6.5.2). Dry matter intake kg/100 kg body weight ranged from 1.82 in GS to 2.25 in CR1-L which indicated the potential of gram straw as maintenance ration. The need for water intake kg/kg dry matter intake was slightly higher for GS due to its fibrous nature. The digestibility coefficients of all proximate principles (except CF) and cell wall components were significantly different among 4 groups. The digestibility coefficients were lower in GS than other groups of complete rations due to its poor chemical composition. Perusal of plane of nutrition data in Table 4.6.5.2 showed no significant variation for DCP, TDN and ME intake / kg W 0.75 among groups given complete rations in loose or block form but was significantly ($P<0.05$)

higher than GS. The DCP intake was maximum in CR2-FB and TDN intake maximum in CR1-L and minimum in GS. This might be due to difference in physical and chemical composition in diets. The dry matter intake kg/ 100 kg body weight was observed to be lower (1.99-2.25) and daily body weight gain was higher (376-421 g/d) in the present experiment in comparison to 2.4 kg dry matter intake/100 kg body weight for 100 g/d growth rate for camels weighing 250 kg recommended by ICAR (1985) feeding standards. Gram straw alone was sufficient to provide energy but low in protein.

Table 4.6.5.1 Composition of experimental feeds and drinking water

Parameter	CR1-L	CR1-FB	CR2-FB	G'nut forage	Gram straw	Water
Physical composition (%)						
Gram straw	70.3	70.3	60.3	-	-	-
Groundnut forage	15	15	25	-	-	-
Molasses	4	4	4	-	-	-
Guar churi	6	6	6	-	-	-
Wheat bran	4	4	4	-	-	-
Mineral mixture	0.2	0.2	0.2	-	-	-
Common salt	0.5	0.5	0.5	-	-	-
Chemical composition (% DM basis)						
CP	11.68	11.68	12.09	12.89	9.10	-
EE	1.57	1.57	2.03	2.49	1.05	-
CF	23.36	23.36	20.64	18.62	27.10	-
TA	11.97	11.97	11.78	10.62	12.34	-
NFE	51.42	51.42	53.46	55.38	50.41	-
NDF	41.63	41.63	41.10	35.36	42.81	-
ADF	31.11	31.11	29.39	26.37	31.45	-
Mineral composition (g/kg)				**mg/l**		
Na	2.672	2.672	2.630	0.989	0.975	345.0
K	10.725	10.725	14.19	7.845	16.219	4.68
Ca	19.54	19.54	19.98	16.00	24.71	67.13
P	2.341	2.341	2.520	2.887	1.371	10.630
Mg	14.88	14.88	12.72	16.98	8.52	40.7

Table 4.6.5.2 Intake of dry matter, water intake and nutrient utilization in camel calves

	Phase I	----------Phase II----------		
Parameters	GS	CR1-L	CR1-FB	CR2-FB
No. of calves	4	3	4	3
Body weight (kg)	260.50±7.58	251.33±2.96	259.50±10.87	263.33±17.29
DMI (kg/d)	4.74±0.08	5.66±0.43	5.17±0.36	5.78±0.31
DMI kg/100 kg B.Wt.	1.82±0.07	2.25±0.15	1.99±0.12	2.20±0.04
Water intake (l/d)	8.46±0.51	9.58±0.89	8.19±0.40	9.75±0.17
Water intake l/ kg DMI	1.79±0.10	1.70±0.13	1.60±0.12	1.69±0.08
Digestibility (%)				
DM**	53.48^{a} ±1.45	69.23^{b}±0.61	63.70^{c} ±0.41	63.10^{c} ±0.18
OM**	63.98^{a} ±1.61	77.44^{b} ±0.02	76.73^{bc} ±0.75	74.18^{c} ±0.43
CP*	59.72^{a} ±1.71	72.30^{b} ±0.91	74.70^{b} ±2.13	72.58^{b} ±0.50
EE**	31.52^{a} ±2.53	72.69^{b} ±0.82	62.87^{b} ±1.83	66.54^{b} ±2.55
CF	59.10±2.84	67.77±3.23	69.00±3.33	62.49±1.26
NFE**	68.06^{a} ±1.15	83.14^{b} ±1.52	81.13^{bc}±0.40	79.34^{c} ±1.31
NDF**	32.33^{a} ±1.92	55.36^{b} ±2.03	39.84^{c} ±1.21	39.84^{c} ±1.22
ADF**	24.40^{a} ±3.66	51.21^{b} ±2.06	36.40^{c} ±1.19	36.31^{c} ±1.96
Plane of Nutrition				
DCP (g/d)	257.47±9.98	478.70±38.48	449.75±30.22	507.72±29.80
TDN (kg/d)	2.679±0.11	3.942±0.30	3.560±0.27	3.882±0.20
DM (g/kg $W^{0.75}$)	73.17±2.29	89.65±6.27	79.90±4.73	88.51±1.06
DCP (g/kg W 0.75)**	4.01^{a} ±0.09	7.58^{b} ±0.58	6.96^{b} ±0.38	7.77^{b} ±0.15
TDN (g/kg W 0.75) *	41.41^{a} ±2.15	62.40^{b} ±4.37	55.05^{b} ±3.61	59.42^{b} ±0.46
ME (MJ /kg W 0.75)*	0.624^{a} ±0.03	0.940^{b} ±0.07	0.829^{b} ±0.05	0.895^{b} ±0.01

Means having different superscripts in a row differ significantly; *P<0.05 , **P<0.01.

The intake and apparent absorption of major minerals viz., Na, K, Ca, P and Mg are given in Table 4.6.5.3. The intake of various minerals was almost similar except for Na, P and Mg in GS, which was attributed to low mineral contents of gram straw. It is also seen from the Table that contribution of drinking water towards total mineral intake was very low except in case of sodium. Significant (P<0.5)

Table 4.6.5.3 Intake and apparent absorption (%) of macro minerals in camel calves

	Phase I	Phase II		
Parameters	GS	CR1-L	CR1-FB	CR2-FB
Na intake (g/d)				
Feed	4.62±0.08	15.13±1.14	13.80±0.96	15.21±0.82
Water	2.92±0.18	3.31±0.31	2.82±0.14	3.36±0.06
Total	7.54±0.21	18.44±1.33	16.62±1.01	18.57±0.86
Faecal outgo (g/d)	2.62±0.14	2.77±0.92	2.20±0.26	2.61±0.38
Absorbed (g/d)	4.91±0.19	15.66±0.58	14.43±0.77	15.96±0.50
Na absorption (%) *	65.19^{a} ±1.72	85.50^{b} ±4.09	86.89^{b} ±0.86	86.08^{b} ±1.48
K intake (g/d)				
Feed	76.80±1.33	60.74±4.58	55.39±3.86	82.07±4.43
Water	0.04±0.00	0.04±0.00	0.04±0.00	0.05±0.00
Total	76.84±1.33	60.78±4.58	55.43±3.86	82.11±4.43
Faecal outgo (g/d)	7.96±1.18	5.56±1.04	4.79±0.65	5.45±0.33
Absorbed (g/d)	68.87±1.86	55.23±4.10	50.64±3.23	76.66±4.46
K absorption (%)	89.62±1.54	90.90±1.36	91.47±0.61	93.31±0.56
Ca intake (g/d)				
Feed	117.00±2.03	110.66±8.34	100.92±7.03	115.55±6.23
Water	0.57±0.03	0.64±0.06	0.55±0.03	0.65±0.01
Total	117.57±2.04	111.3±8.37	101.47±7.04	116.21±6.24
Faecal outgo (g/d)	98.72±2.14	71.81±8.09	59.62±6.54	70.28±5.03
Absorbed (g/d)	18.85±4.09	39.50±0.42	41.85±0.78	45.92±1.58
Ca absorption (%)*	15.87^{a} ±3.32	35.88^{b} ±2.65	41.76^{b} ±2.54	39.63^{b} ±1.30
P intake (g/d)				
Feed	6.49±0.11	13.26±1.00	12.09±0.84	14.57±0.79
Water	0.09±0.01	0.10±0.01	0.09±0.00	0.10±0.00
Total	6.58 ±0.11	13.36±1.00	12.18 ±0.84	14.68 ±0.79
Faecal outgo (g/d)	6.06±0.26	6.07±0.49	5.64±0.40	7.11±0.43
Absorbed (g/d)	0.52±0.24	7.29±0.62	6.54±0.50	7.57±0.39
P absorption (%)**	7.91^{a} ±3.65	54.56^{b} ±1.63	53.66^{b}±1.09	51.60^{b} ±0.75
Mg intake (g/d)				
Feed	40.34±0.70	84.27±6.35	76.86±5.36	73.56±3.97
Water	0.34±0.02	0.39±0.04	0.33±0.02	0.40±0.01
Total	40.69±0.70	84.66±6.37	77.19±5.36	73.96±3.97
Faecal outgo (g/d)	9.12±1.50	29.46±4.18	30.84±3.45	43.02±6.31
Absorbed (g/d)	31.57±1.86	55.20±2.93	46.35±3.10	30.94±4.90
Mg absorption (%)*	77.50^{c} ±3.81	65.53^{b} ±2.76	60.29^{ab} ±2.95	42.09^{a} ±6.70

Means having different superscripts in a row differ significantly; *P<0.05 , **P<0.01.

variation in apparent absorption of Na, Ca, Mg and P. was observed among 4 groups. The apparent absorption of Na, Ca and P of complete ration fed camels were statistically similar and significantly ($P<0.05$) higher than GS and that of Mg was significantly ($P<0.05$) higher in GS and lower in CR2-FB. The apparent absorption of Na and K from the gut seems to be very good because of their free ionic nature. The low Ca and P absorption might be because of wide Ca, P ratio as well as presence of some antimetabolite such as oxalates, phytates etc. Magnesium is present in green herbage in sufficient quantities because of its association as constituent of chlorophyll and its bioavailability increases with plant maturity, the reason might be different nature of feeds given to camel calves. The mineral absorption depends on several factors viz., binding capacity of transport proteins, solubility, composition of diet, mineral intake, mixture of minerals present in the intestine, anti-metabolites and the physiological factors such as age, hormonal status.

Growth rate as well as feed gain ratio was similar among CR1-L, CR1-FB, and CR2-FB with no significant difference (Table 4.6.5.4). Average daily gain ranged from 377.55 g/d in CR1-L to 420.92 g/d in CR2-FB and feed/gain ratio from 13.51 in CR1-FB to 14.30 in CR2-FB. Feed intake was 5.60% higher in CR1-FB and 8.42% in CR2-FB as compared to CR1-L due to higher feed density of complete feed blocks. Feeding cost (Rs./d) was higher in CR2-FB because of higher feed intake but because of higher feed efficiency in CR1-FB, cost/kg gain was minimum.

Table 4.6.5.4. Growth performance and feed efficiency of camel calves

Parameters	CR1-L	CR1-FB	CR2-FB
No. of camel calves	4	4	4
Performance			
Initial Body Wt. (kg)	213.00±1.96	218.25±10.48	217.25±13.65
Final Body Wt. (kg)	250.00±2.48	259.50±10.87	257.25±13.66
Total gain (kg)	37.0±0.91	41.25±0.48	40.00±1.91
Growth rate (g/d)	377.55±9.32	420.92±4.88	408.16±19.54
Total feed intake (kg)	527.72	557.3	572.18
Feed intake kg/ kg gain	14.26	13.51	14.30
Cost (Rs./q)	347.03	347.03	349.53
Cost (Rs./d)	18.69	19.74	20.41
Cost (Rs./kg gain)	49.49	46.88	49.99

Cost (Rs./q): Gram straw- 300 , Groundnut forage-325, Molasses-400, Wheat bran-520, Guar churi- 686, Mineral mixture- 4400 and common salt- 84.

Cost of feed ingredients was exceptionally high due to severe drought conditions.

The results indicated that gram straw alone is not sufficient for camel calves. No significant difference was observed among loose and complete feed block feeding to camels in respect of plane of nutrition, growth and feed efficiency. Feeding of complete feed blocks CR1-FB consisting of gram straw, groundnut forage, concentrate may be used for optimum nutrient utilization and growth of camel calves for getting additional advantage of less storage space, low transport cost and ease in feeding management.

Evaluation of complete feed blocks in draft camels of suburban camels under field conditions.

Five draft camels (range 592-775 kg body weights) engaged in water supply were selected from Shivbari area of Bikaner city. These draft camels were harnessed in camel carts with 700 litre capacity water tanks made of GI sheets placed firmly on the carts. These carts were used by their owners for supplying water to the local people for house construction and drinking purpose. The camel owners purchased water at the rate of Rs.10/- per water tank from the tube well located in Shivbari area and sold to the needy people at the rate of Rs. 20/- to Rs.45/- per water tank, depending upon the distance of destination to earn their livelihood. The socio-economic status of the families was surveyed to study the role played by camel in the lives of camel owners. Daily record of working hours, number of water tanks supplied, distance covered, feed intake of each camel were maintained. Two digestibility trials each of 3 days duration were conducted on five draft camels in March, 2004, first trial with sole source of fodder (guar phalgati / moth chara) provided by the camel owners and second trial with complete feed blocks provided from the project (Fig. 4.6.5.1 and 4.6.5.2). One of the camels could not be included in second trial as it developed swelling on its shoulder. Feed and faecal samples were pooled and the chemical analysis is in progress.

Fig. 4.6.5.1 Digestibility trial in progress on draft Camels

Fig. 4.6.5.2 Inauguration of Complete feed block experiment on rural draft camels by Swami Som Giri Ji Maharaj of Bikaner

All the camel owners are in this occupation for the last 30-40 years and water trading is the main occupation and source of income for their families. To supplement the family income, they also keep dairy animals or engage in fodder/small shop business (Table 4.6.5.5).

Table 4.6.5.5 Social status of the camel owner

Owner's name	Age (Yrs.)	Family	Camels	Cows	Goats	Main occupation	Other business
Kishana Ram	45	Single	2	1	-	Water trading	Milk
Rameshwar	45	Single	2	3	-	-do-	Milk
Hanuman	65	Joint	1	-	-	-do-	Fodder /Shop
Chaggan Ji	45	Single	One	-	2	-do-	-
Ram Narain	45	Single	One	2	-	-do-	Milk

The description of camels, breeds, age and body measurements is given in Table 4.6.5.6. The average draft power of the camel works out to be 1216+700=1916/635.4=3.015. Means the camels were able to pull load equivalent to 3 times of their body weights.

Table 4.6.5.6. Details of camel owners, their camels and camel carts.

Owner's name	Breed	Age yrs	B. Wt. kg.	Length cm.	Height cm.	Heart girth	Hump girth	Wt. of Cart & empty water tank (kg)
Kishna Ram	Bikaneri	14	592	175	205	222	104	1180
Rameshwar	Kachchhi	9	775	186	215	235	102	1420
Hanuman	Bikaneri	12	544	170	192	216	95	1100
Chaggan Ji	Bikaneri	8	602	170	204	220	95	1140
Ram Narain	Bikaneri	15	664	170	209	220	85	1240
Average		11.6	635.4					1216

The details of working pattern of individual camels are given in Table 4.6.5.7. The draft camels worked daily for 9 to 12 hours. The daily distance covered by draft camels depended on the destination of the client. Average daily income of the camel owners depended on the demand and varied between Rs.195 to Rs. 313. Net income followed the same pattern.

Table 4.6.5.7. Average daily working pattern and economics of draft camels (16.02.04 to 27.03.04)

Owner' name	Daily Working hours	Distance covered Km.	Total rounds of water supply	Purchase cost of water in tanks Rs.	Total sale of water in tanks	Daily fodder intake kg.	Fodder cost Rs.	Total cost of water and fodder Rs.	Net income from water supply
a	b	c	d	e	f	g	h	i=e+h	j=f-i
Kishna Ram	11.14	27.16	10.89	108.90	290.13	15.60	31.20	140.10	150.03
Rameshwar	9.36	20.06	14.5	145.00	313.42	16.91	33.82	178.82	134.60
Hanuman	10.56	21.97	10.29	102.90	270.92	15.72	31.44	134.34	136.58
Chaggan Ji	9.08	19.46	6.27	62.7	195.0	17.01	34.02	96.72	98.28
Ram Narain	10.26	18.63	12.18	121.80	261.60	12.93	25.86	147.66	113.94

Cost of : Rs.10/- per 700 water /tank, Rs. 2/- per kg kg fodder

Daily DMI (dry matter intake) and water intake was higher in draft camels in phase when camels were given complete feed blocks (Table 4.6.5.8). The digestibility of CP, EE was higher and that of CF was low in phase II as compared to that in phase I. The nutrient intake in terms of DCP, TDN and ME g/d or on metabolic body weight basis were higher in draft camels given complete feed blocks in phase II (Table 4.6.5.9). The Draft camels had better condition, alertness and faecal pellets were soft, dark brownish in phase II than fatigue appearance and brittle, light brown color of faecal pellets in phase II which indicated the beneficial effect of feeding complete feed blocks to draft camels.

C. Popularisation of complete feed blocks among camel owners

With the objective to popularize this technology among camel owners five exhibitions were organised in Bikaner city/village to explain the benefit of feeding complete blocks to camel cart owners and wider publicity to these exhibitions was given through local newspapers. The complete feed blocks were freely distributed to 249 camel cart owners. Handouts in Hindi language on "Santulit Aahar ki einten" were distributed among camel owners. The camel cart owners showed keen interest in complete feed blocks.

Table 4.6.5.8 Daily DM intake and its digestibility in draft camels

Parameter	Phase I	Phase II
No. of camels	5	4
Feeding	Guar phalgati/ moth chara	Complete feed block
Body weights	634.00±37.76	641.25±47.84
DMI (kg/d)	12.25±0.85	15.76±0.60
DMI kg/100 kg B. Wt.	1.93±0.09	2.48±0.10
Water intake (kg/d)	35.29±1.92	45.99±2.74
Digestibility (%)		
DM	67.45±2.41	64.93±1.80
OM	73.94±1.71	69.87±1.49
CP	54.54±4.96	68.76±1.95
EE	-55.25±43.29	38.15±6.71
CF	68.62±5.07	51.11±2.33
NFE	78.70±2.44	79.44±0.76

Table 4.6.5.9 Plane of nutrition of draft camels

Parameter	Phase I	Phase II	ICAR (1985) recommendations
No. of camels	5	4	
Feeding	Guar phalgati/ moth chara	Complete feed block	
Body Weights kg.	634.00±37.76	641.25±47.84	650
Nutrient intake			
DMI kg/d	12.25±0.85	15.76±0.60	15.0+25%=18.75
DCP (kg/d)	1.006±0.18	1.770±0.07	600+25%= 750
TDN (kg/d)	7.662±0.71	10.982±0.62	7.0+25%=8.75
ME (MJ/d)	115.40±10.68	165.41±9.32	
DM (g/kgW $^{0.75}$)	96.89±4.47	124.20±3.18	
DCP (g/kgW $^{0.75}$)	7.81±0.98	13.95±0.36	
TDN (g/kgW $^{0.75}$)	60.31±3.13	86.42±2.61	
ME (MJ/kgW $^{0.75}$)	0.91±0.05	1.30±0.04	

Keeping quality of Complete Feed Blocks

Approximately 60 quintals of complete feed blocks were prepared at 2500 and 4000 psi on Feed Block Making Machine from Chane ki khar, groundnut haulms and concentrate (70:15:15 & 60:25:15) in October, 2002. It was difficult for the camel calves to consume feed blocks prepared at 4000 psi, so the pressure of machine was reduced to 2500 psi which were readily consumed by camel calves. The approximate size and weight of the complete feed blocks made at 4000 psi was 8x8x4 inch and 4 kg. respectively. The bulk density was 4.86. These blocks were kept in storeroom as such. Till date, no visible fungal growth has been noticed. No change in texture, colour and appearance of feed blocks has been observed.

4.6.6. Study on the mineral status of feed and fodder in arid zone of Rajasthan bio-availability and preparation of area specific mineral mixture for improved productivity in camel (Competitive Grant Programme Under NATP).

PI : G.P. Singh

Trace mineral status of feed and fodder used on the farm of NRCC including samples collected from Agro forestry unit.

Nineteen samples of feed and fodders used for feeding to camels and samples from Agro forestry unit of NRC on Camel were collected, processed and analysed for trace element (Cu, Zn, Co, Mn and Fe). Average copper contents in samples were 16.55 with the range of 6.80 to 42.30 mg/kg DM. However, 31.6% samples were found to have Cu content below 10 mg/kg DM. The deficiency of Cu was observed in straws especially Sewan (*Lesirus scindicus*), Bakeria (*Tribolus ilatus*), wheat straw (*Triticum vulgerus*), Moong Straw (*Phaseolus moonga*), Chane ki Khar (*Cicer arietinum*) etc (Table 4.6.6.1). Therefore, feeding crop residue must be supplemented with copper for optimum productivity and maintenance of camel.

Similarly, average Zinc content in feed and fodders collected from NRCC livestock unit and Agro forestry units was 30.82 mg/kg DM of feed whereas minimum requirement of Zn in feed and fodder is 40 mg/kg DM. Zinc contents were found to vary from 9.7 to 52.0 mg/kg DM Contrary to copper, Zinc content was lower than minimum requirement in 73.7 percent of feed and fodder samples.

Cobalt, being one of most important trace mineral required for Vit.B_{12} synthesis in ruminant animals, was deficient in 26.3 percent samples of feed and fodders collected from our own farm. Average Co content was 0.13 mg/kg DM with minimum of 0.03 mg./kg. DM and maximum 0.38 mg/kg DM Average Co content of 0.13 mg/kg DM may not be very comfortable when bioavailability of Co will be considered later on.

Table 4.6.6.1 - Trace mineral status of feed and fodder in Arid zone of Rajasthan

Requirement of trace mineral (mg/kg DM)*	10 Copper	40 Zinc	0.1 Cobalt	40 Manganese	50 Iron
NRCC					
Total No. 19					
Minimum Value (mg/kg DM)	6.8	9.7	0.028	16.6	24.5
Maximum Value (mg/kg DM)	42.3	52	0.382	165	205.8
Average (mg/kg DM)	16.55	30.82	0.13	63.05	87.05
Below required level	6	14	5	6	4
Above required level	13	5	14	13	15
Nagaur					
Total No. 78					
Minimum Value (mg/kg DM)	1.8	7.8	0.03	18.5	11.8
Maximum Value (mg/kg DM)	41.3	164	2.8	247.5	190.62
Average (mg/kg DM)	13.37	26.77	0.48	86.55	63.67
Below required level	32	70	39	19	32
Above required level	46	8	39	59	43
Churu					
Total No. 82					
Minimum Value (mg/kg DM)	2	0.8	0.0016	15.2	4.94
Maximum Value (mg/kg DM)	37.8	87.4	0.198	143.4	216.8
Average (mg/kg DM)	21.06	43.13	0.08	59.03	62.90
Below required level	16	29	57	30	33
Above required level	66	53	25	52	48
Bikaner					
Total No. 87					
Minimum Value (mg/kg DM)	2.4	12.2	0.05	16.8	19.76
Maximum Value (mg/kg DM)	41.8	138.5	2.18	151.2	153.08
Average (mg/kg DM)	12.99	30.81	0.30	52.23	63.56
Below required level	37	68	35	37	36
Above required level	50	19	52	50	49
Jaisalmer					
Total No. 47					
Minimum Value (mg/kg DM)	9.8	10.2	0.04	16.8	22.76
Maximum Value (mg/kg DM)	67.2	64.8	0.166	231.2	183.4
Average (mg/kg DM)	45.15	20.64	0.09	56.09	78.34
Below required level	1	44	27	21	15
Above required level	45	2	19	26	26

* NRCC, 2001

Average content of both manganese and iron in samples of NRCC farm were 63.05 and 87.05 mg/kg DM; respectively, while Mn content varied from 16.60 Mg in Guar to 165.0 mg/kg DM in Bui, Fe content varied from 24.50 mg in Pala (Jujupus numularia) to 205.8 mg/kg DM in Moong straw (*Phaseolus moonga*). The deficiency of Mn and Fe were observed in 31.6% and 21.1% samples, respectively.

Trace mineral status of feed and fodder of Bikaner district of Rajasthan

Copper content in feed and fodder

The average copper content in feed and fodders of Bikaner based on 87 samples collected was 12.99 mg/kg DM slightly above the required level of 10 mg/kg DM. The minimum value of 2.40 mg/kg DM was found in Bajra straw (*Pennisetum typhoideus*) and maximum value of 41.8 mg/kg DM was observed in Chawala (*Vigna unguiculata*). However, 42.5% samples of feed and fodders were deficient in Cu (below 10 mg/kg DM) and 57.5% samples were found contain more than 10 mg/kg DM but bioavailability of particular mineral play very important role in deciding the level of minerals (Table 4.6.6.1).

Zinc content in feed and fodder

Zinc content in the feed and fodders of Bikaner was found to vary from 12.20mg/kg DM in guar chara to 138.50 mg/kg/DM in Khejri loong (*Prosopis spicigera*) from Dhoopalia village of Bikaner. Overall average content of Zinc in the feed and fodder samples of Bikaner was 30.81 mg/kg DM against the minimum requirement of 40 mg/kg DM. Seventy eight percent of feed and fodder samples were found deficient in Zinc content. Since, Zn is very important trace element for living being, therefore, special supplementation is required.

Cobalt content in feed and fodder

Average cobalt content in feed and fodders of Bikaner was 0.30 mg/kg DM more than three times of minimum required value of 0.10 mg/kg DM. It does not mean that all feed and fodders are over sufficient in Cobalt content because 40% sample of feed and fodders were found to contain less than 0.10 mg/kg DM. Range of Co content in feed and fodders was from 0.05 mg/kg DM to 2.18 mg/kg DM. Therefore, feeding of Camel from fodders of Bikaner require special attention in respect of Cobalt requirement.

Manganese content in feed and fodder

Manganese, one of the most important trace element for animals, was found to vary from 16.8 mg/kg DM in wheat straw to 151.2 mg/kg DM in Guar Churi (*Cyamopsis tetragonolobus*) with average of 52.23 mg/kg DM in the feed and fodder samples of Bikaner district. The average value of Mn content

in feed and fodder of Bikaner was higher than minimum required value of 40 mg/kg DM. Although average value of Mn content was above required level but 42.5% feed and fodder samples were found to contain less than 40 mg/kg DM.

Iron content in feed and fodder

Average Iron content in the feed and fodder was 63.56 mg/kg DM whereas minimum requirement is 50 mg/kg DM. Iron content in feed and fodders of Bikaner was found to vary between 19.76 and 153.08 mg/kg DM and 41.4% samples were deficient in Iron. Therefore, a special mineral mixture was required which can take care of deficient Fe feed and fodder.

Trace mineral status of feed and fodder of Churu district of Rajasthan

Copper content in the feed and fodder

The average copper content in the feed and fodder of Churu was 21.06 mg/kg DM and the requirement of Copper is 10 mg/kg DM. However, 19.5% samples of feed and fodder were deficient in respect of Copper. Minimum Copper content was 2.00 mg/kg DM (Table 4.6.6.1) in Guar phalgati *(Cyamopsis tetragonolobus)* of Dadrewa village and highest copper content was 37.8 mg/kg DM in Khejri Loong *(Prosopis spicigera)* of same Dadrewa village.

Zinc content in feed and fodder

Although requirement of Zn is 40 mg/kg DM but the average content of Zn in the feed and fodder of Churu district was 43.13 mg/kg DM. Zinc value in feed was found as low as 0.80 mg/kg DM in Chana Straw (*Cicer arietinum*) in Sodisar village and highest value of Zn was as high as 87.40 mg/kg DM in Beri Pala (*Zizyphus nummularia*) in Ranasar village. At the same time 35.4% samples of feed and fodder were contain lower Zn than the requirement of 40 mg/kg DM. Therefore, supplementation of Zn is required only when deficient feed and fodder fed to camel.

Cobalt content in feed and fodder

Cobalt contents in feed and fodder of Churu district was deficient being the average value of 0.08 mg/kg DM against the requirement of 0.10 mg/kg DM. Zero cobalt was observed in Beri Pala (*Zizyphus nummularia*) and 0.2 mg/kg DM was found in Chana Straw (*Cicer arietinum*) and wheat straw (*Triticum aestivum*) in Soniasar village. Cobalt content in feed and fodders of Churu district were deficient in 69.5% samples collected.

Manganese content in feed and fodder

Average Mn Content in feed and fodders was 59.03 mg/kg DM against required value of 40

mg/kg DM showing Mn richness in the feed and fodder of Churu district. However, here again 36.6% samples of feed and fodder collected from Churu district were deficient. Mn content of Churu district was found to vary from 15.20 mg/kg DM in Guar Guna (*Cyamopsis tetragonolobus*) collected from village Soniasar to 143.40 mg/kg DM in Khejri leaves (*Prosopis spicigera*) collected from Kalana village.

Iron content in feed and fodder

Feed and fodders samples of Churu District had shown 62.90 mg/kg DM average iron content against requirement of 50 mg/kg DM. Variation in iron content was very wide and iron contents varied from as low as 4.94 mg/kg DM in wheat straw collected from Ranasar village to 216.80 mg/kg DM in Beri Pala (*Zizyphus nummularia*) collected from Kohina village. Other most interesting fact observed that while average iron content in feeds and fodders was above the required level, 40 percent samples were found to be deficient in respect of iron content.

Trace mineral status of feed and fodder of Nagaur district of Rajasthan

Copper contents in feed and fodder

Average copper content in the feed and fodders of Nagaur district was 13.37 mg/kg DM where as requirement is 10 mg/kg DM. Although average value of Cu is more than required but at same time 41% of samples were deficient in Cu. The variation in Cu content in the sample was from 1.80 mg/kg DM in wheat straw collected from Tankla village to 41.30 mg/kg DM in Khejri Loong collected from Toshina village (Table 4.6.6.1).

Zinc content in feed and fodder

Nagaur district feed and fodders seemed to be very poor source of Zn and average Zn content was 26.77 mg/kg DM, whereas requirement is 40 mg/kg DM in feed. Although Zn content of feed and fodder varied from 7.80 mg/kg DM in wheat straw collected from Lamba Jatan to 164 mg/kg DM in moth chara, collected from Khudi village. Majority of feed and fodders specifically straws and fodders were poor source of Zn and 89.7% samples of feed and fodders were found to contain less than 40 mg/kg DM.

Cobalt content in feed and fodder

Contrary to Zinc content, feed and fodders of Nagaur district were very rich in cobalt being average Co content of 0.48 mg/kg DM against requirement of 0.10 mg/kg DM. Although average value of Co in feed and fodders was much higher than the minimum required value but at the same time 50% feed and fodder samples were found to be deficient in Cobalt. While, 0.03 mg/kg DM Cobalt was observed in wheat straw, 2.80 mg/kg DM in Beri Pala (*Zizyphus nummularia*) collected from Deshwal village.

Manganese content in feed and fodder

Average Manganese content in the feed and fodders of Nagaur was 86.55 mg/kg DM, whereas requirement of Mn in feed and fodder is 40 mg/kg DM. showing the richness of feed and fodder in respect of Mn. However, here again 24.4% samples contained less than 40 mg/kg DM. Manganese content was found to vary from 18.50 to 247.50 mg/kg DM.

Iron content in the feed and fodder

Iron content in the feed and fodder of Nagaur were found to contain as low as 11.80 mg/kg DM in gaur phalgati (*Cyamopsis tetragonolobus*) collected from Lamba Jaton and as high as 190.62 mg/kg DM with average value of 63.67 mg/kg DM. However, Iron requirement in feed and fodders is 50 mg/kg DM. Iron was also deficient in 41.02% samples of feed and fodder collected from Nagaur.

Trace mineral status of feed and fodder of Jaisalmer District of Rajasthan:

Copper content in feed and fodder

Average Cu content based on 47 samples collected was 45.15 mg/kg DM (Table 4.6.6.1) with range of 9.80 mg/kg/DM in Guar Guna (*Cyamopsis tetragonolobus*) and 67.20 mg/kg DM in guar phalgati (*Cyamopsis tetragonolobus*); Overall average indicated that samples of Jaisalmer were found to contain Cu above requirement (10 mg/kg DM). However, final statement is possible only after considering the bioavailability of nutrient.

Zinc Content in feed and fodder

Zinc is one of the most important and required trace mineral for body function. Average Mn content of feed and fodders of Jaisalmer was 20.64 mg/kg DM which is much lower than required value of 40.0 mg/kg DM. The minimum value of Zn content was 10.20 mg/kg DM and the maximum value was 64.80 mg/kg DM. The most interesting finding was that 95.65% samples were found to content Zn below required level of 40 mg/kg DM. Thus, feed and fodders of Jaisalmer district were deficient in respect of Zn and special care may be taken to add Zn in mineral mixture.

Cobalt content in feed and fodder

Cobalt is a trace element required for Vit B_{12} synthesis in ruminants. The average content in feed and fodders of Jaisalmer was 0.09 mg/Kg DM which was lower than required value of 0.10 mg/kg DM. The range observed was between 0.04 and 0.17 mg/kg DM Cobalt being the precursor of Vitamin B_{12} was deficient in 58.7% samples of feed and fodders. Thus, feed and fodder samples were deficient in Cobalt. Special care may be taken for feeding Co to animal through mineral mixture.

Manganese Content in feed and fodder of Jaisalmer

The average Mn content in feed & fodder collected from Jaisalmer district of Rajasthan was

56.09 mg/kg/DM. This average was higher than required amount of Mn (40 mg/kg/ DM). However, bioavailability of this particular element will decide the actual levels of Mn. Out of 47 samples of feed and fodders collected, 21 samples were deficient in Mn i.e. about 45% of sample were deficient in Mn.

Iron content in feed and fodder of Jaisalmer:

The position of iron in the feed and fodder of Jaisalmer seems to be comfortable because of 78.34 mg/kg DM Fe was average of district against the minimum requirement of 50 mg/kg DM. However, here again actual picture will come only after consideration of bioavailability, 36.6% samples were found to contain lower iron content than requirement of 50 mg/kg DM. The minimum value of iron was 22.76 mg/kg DM in Guar phalgati (*Cyamopsis tetragonolobus*) and maximum value was 183.40 mg/kg DM in wheat straw (*Triticum aestivum*).

Trace mineral content in feed and fodder of Hanumangarh:

Survey of Hanumangarh District and certain observation based on survey:

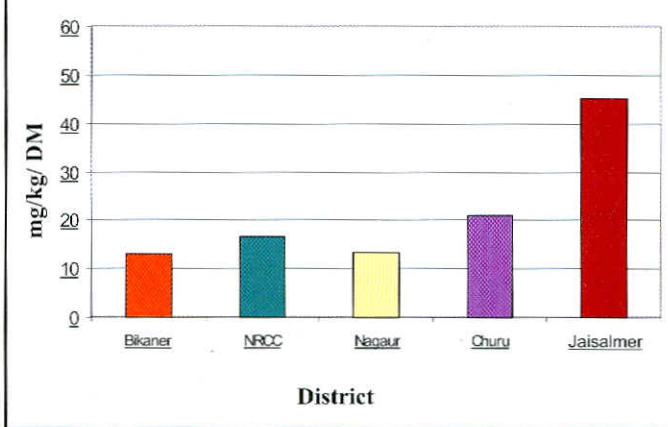
In this district 12 villages were selected randomly feed and fodder samples were collected for estimation of trace mineral. In addition to collection of feed and fodder samples, the information about feeding practices, use of salt and mineral mixture for feeding were also collected. Farmers in 75% villages were using common salt in the diet and in 50% villages mineral mixture was used for feeding milch animal particularly to buffaloes but not to camels. Major animal population in descending orders were buffaloes, sheep, goat, cow and lastly camels. In this district also camel population was decreased at a very fast rate and it is continuing. Occasional use of camel milk as such or as Kheer was reported only in 17% villages. Feed & fodder of Hanumangarh district was different from Bikaner, Churu, Nagaur and Jaiselmer. Wheat Straw, Guar Phalgati, Berseem, oat and Jawar were main fodders.

Trace mineral contents in feed and fodders of different district of arid zone of Rajasthan:

Average Copper content in arid zone:

Average Copper contents in the feeds and fodders of Jaisalmer were 45.15 mg/kg DM which is four and half times of minimum value required (10.0 mg/kg DM) (Fig. 4.6.6.1). Next is the Churu District, where feed and fodder contained 21.06 mg/kg DM average copper. However, 16% samples of feed and fodder were deficient in Cu content than the required value of 10 mg/kg/DM. Samples of feed and fodder used for feeding to

Fig. 4.6.6.1 Comparative Copper Content in Feed and Fodders of Arid Zone

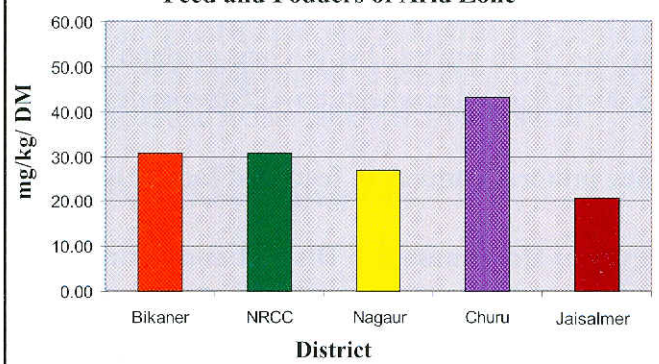


camel at NRCC were also analysed along with green fodder (Tree leaves & grasses) and average content of Cu was 16.82 mg/kg DM but at the same time 31.6% samples were found to be deficient in respect of copper element specially straw like sewan *(Lesirus scindicus)*, bakeria *(Tribolus ilatus)*, wheat straw *(Triticum vulgerus)*, groundnut chara *(Arachis hypogea)*, moong straw *(Phaseolus moonga)*, chane ki khar *(Cicer arietinum)* etc.

Average Zinc content in feed and fodder of Arid zone:

From the Fig. 4.6.2.2 it is quite obvious that average Zn content in feed and fodder of Churu district was higher (43.13 mg/kg DM) than NRCC, Bikaner (30.82 mg/kg DM), Bikaner district (30.81 mg/kg DM), Nagaur district (26.77 mg/kg DM) and Jaisalmer (20.64 mg/kg DM). Majority of feed and fodder samples of NRCC, Nagaur, Churu, Bikaner and Jaiselmer were deficient in Zn Content.

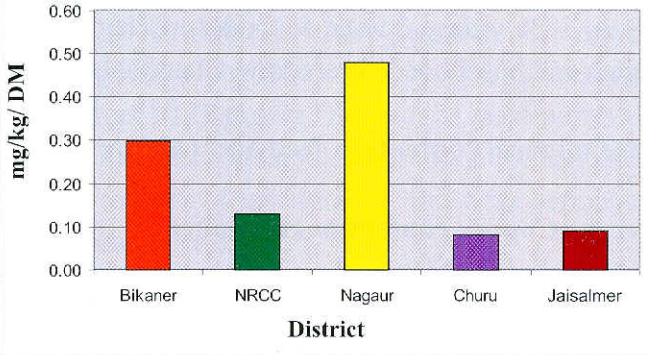
Fig. 4.6.6.2 Comparative Zinc Content in Feed and Fodders of Arid Zone



Cobalt content in the feed and fodder of arid zone Rajasthan:

Feeds and fodders of Nagaur district were rich in cobalt (0.48 mg/kg DM) content as compared to feed and fodders samples of NRCC, Bikaner, Churu and Jaisalmer (Fig. 4.6.6.3) and samples from Churu and Jaisalmer were of poor source of Cobalt. About 26% samples of NRCC, 50% samples of Nagaur, 69.5% samples of Churu, 40% samples of Bikaner and 57% samples of Jaisalmer were found to contain less than 0.10 mg/kg DM. The feed and fodders of arid zone in general, is poor source of Cobalt. Therefore, feeding of cobalt through mineral mixture is essential for optimum synthesis of Vitamin B_{12}.

Fig. 4.6.6.3 Comparative Cobalt Content in Feed and Fodders of Arid Zone



Manganese content in the feed and fodder of arid zone of Rajasthan:

The minimum manganese content in feed and fodder is 40 mg/kg DM. Average manganese content in feed and fodders of NRCC, Bikaner, Churu, Nagaur and Jaisalmer were above 40 mg/kg DM which is requirement (Fig. 4.6.6.4). However, 31.5 percent samples of NRCC, 42.5% samples of

Bikaner, 24% samples of Nagaur, 36.6% sample of Churu and 44.7% samples of Jaisalmer were found to contain Mn less than 40 mg/kg DM. Under the present situation supplementation of Mn is essential depending on feed and fodder being fed.

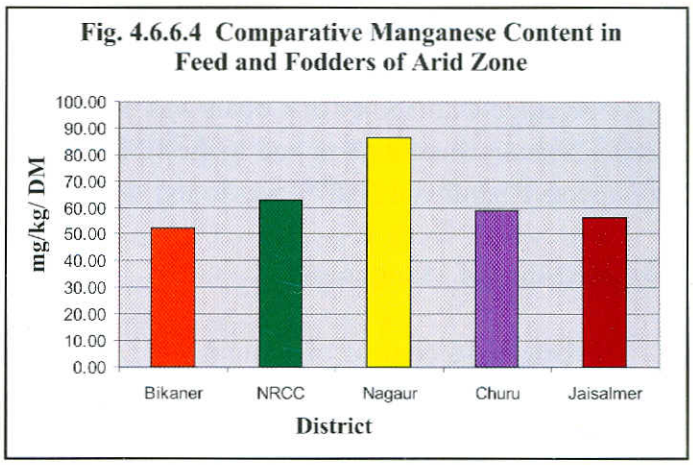


Fig. 4.6.6.4 Comparative Manganese Content in Feed and Fodders of Arid Zone

Iron content in the feed and fodder of arid zone of Rajasthan

Iron is another trace element required for many of body function: Since 50 mg/kg DM in feed and fodder is the requirement and average Fe content in feed and fodders of NRCC, Bikaner, Nagaur, Churu and Jaisalmer were 87.05, 63.56, 63.67, 62.90 and 78.34 mg/kg DM feed, respectively (Fig. 4.6.6.5). Inspite of that a large number of feed and fodders of arid zone were found containing Iron less than requirement. Jaisalmer district of Rajasthan was observed rich in Fe as compared other district.

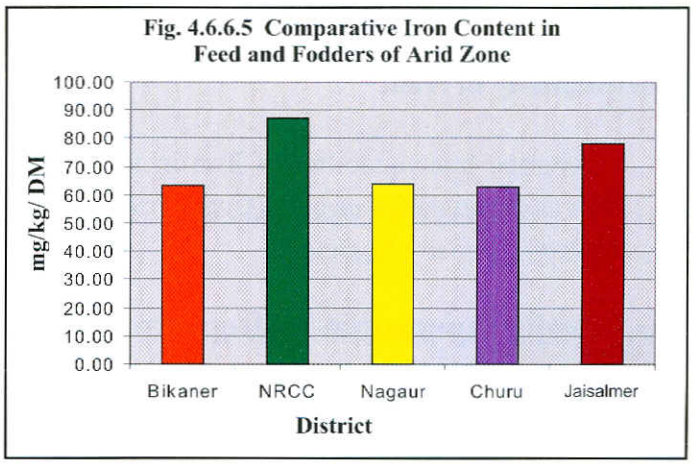


Fig. 4.6.6.5 Comparative Iron Content in Feed and Fodders of Arid Zone

Bioavailability of trace mineral of feed and fodder of arid zone:

Since only mineral content in feed and fodder is not important. The most important factor is the availability of minerals present in feed to animal. Therefore, attempt has been made to determine the availability of mineral by *in vitro* and *in vivo* techniques to prepare area specific mineral mixture.

Bioavailability of Copper:

Highest bioavailability of Copper was observed in groundnut green fodder (*Arachis hypogea)* and value was 77.27%, whereas lowest bioavailability of 30.69% was observed in Moong Straw *(Phaseolus moonga)* and average bioavailability was found to be 51.89%.

Bioavailability of Zinc:

Overall average bioavailability of Zn % in arid zone's feed and fodder was 59.76% with highest bioavailability of 82.84% in Groundnut Chara (*Arachis hypogea*) and lowest bioavailability of 34.85% in wheat straw (*Triticum vulgerus*). In general Zinc status in feeds and fodders was poor in all the district under studies but bioavailability of Zinc was high.

Bioavailability of Cobalt:

Average availability of Cobalt was 51.10% in the feed and fodder. Green guar (*Cyamopsis tetragonolobus*) was found to had highest bioavailability and value was 72.68%, on the other hand lowest bioavailability of 28.57% was found in Chane Ki Khar (*Cicer arietinum*).

Bioavailability of Manganese:

Manganese content of ground nut (*Arachis hypogea*) green leave was highly soluble and available resulting in highest bioavailability of 79.96% and Chane Ki Khar (*Cicer arietinum*) was found to have lowest Bioavailability of Manganese. Overall average bioavailability of Manganese was 54.95%.

Bioavailability of Iron:

Average bioavailability of Iron in feed and fodder was 60.41%. Highest bioavailability of 87.27% was observed Green guar (*Cyamopsis tetragonolobus*) and lowest bioavailability of 45.07% in Sewan Grass (*Lesirus scindicus*).

4.6.7 Project sponsored by Department of Biotechnology, Government of India

Project Title: A digitized inventory of animal bio-resources

Sub project: A digitized inventory of camel genetic resources.

CCPI : Dr. S.C. Mehta

India has seven breeds of camel viz. Bikaneri, Jaisalmeri, Kachchhi, Mewari (or Malvi), Sindhi, Mewati and Marwari. NRC on Camel, Bikaner maintains the elite herd of Bikaneri, Jaisalmeri and Kachchhi breeds and has characterized and evaluated them scientifically. The information from the respective breeding track of these breeds and the scientific information on Mewari and Mewati camels was largely lacking. Under this project extensive surveys were made to know the present status of these breeds in the breeding tract. A breed descriptor of Mewari breed has been published. In the descriptor all relevant aspects of camel husbandry, such as habitat, approximate population of the breed in breeding tract, availability of the breedable males and females, specific use of the breed/species, products, bye-products, commercial values, future perspectives etc. have been included. Limited information on Sindhi camel has also been collected. Recently, biometry of 152 Kachchhi camels was accomplished in the breeding tract and necessary information has been collected for the preparation of breed descriptor of this breed. The Mewat area was also surveyed but no breed pattern was observed. The camels were either of Bikaneri or of Mewari breed depending on the use and community involved in the rearing of camel.

Agriculture Farm Unit

कृषि वानिकी इकाई– केन्द्र का कुल क्षेत्रफल 689 हैक्टेयर है, जो कुल 5 खण्डों मे विभाजित है। खण्ड 1 व 2 में ही मुख्य रूप से कृषि कार्य किया गया । दीर्घकालीन चारा संसाधनों मे सुधार हेतु, वर्ष 1999 से 2002 तक केन्द्र पर विभिन्न परियोजनाओ के अन्तर्गत राजस्थान वन विभाग, बीकानेर द्वारा केन्द्र के समन्वय से पेड़ पौधें लगाए गये । जिनमें विलायती बबूल, झाड़बेरी, खेजड़ी, नीम एवं सजावटी पेड़–पौधें थें। प्रथम चरण मे कैम्पस व आस–पास के क्षेत्र में लगाए पौधों का जीवित प्रतिशत लगभग 85 रहा। नियमित देखभाल, ऊँटों की खाद, दवा व ट्री– गार्ड इत्यादि के प्रयोग से दूसरे व तीसरे चरण मे फार्म क्षेत्र में लगाऐ पेड़ पौधों का प्रतिशत लगभग 40 रहा हैं।

वर्ष के दौरान लगभग 2500 पेड़ो का रखरखाव व रोपण कार्य किया गया । लगभग 5 हैक्टेयर क्षेत्र में 1 नं, खण्ड में फार्म पर ग्वार बीजा गया था जिसमें से 15 क्विटल ग्वार दाना व 35 क्विटल ग्वार चारा सूखा प्राप्त हुआ।

4.6.8. Investigation of the cellular functions of the tetraspanin membrane protein CD63

Ph.D. Scholar : Gorakh Mal
Supervisor : Dr. L. J. Partridge, Department of Molecular Biology and Biotechnology, University of Sheffield, UK

The GY motif of the CD63 was mutated to alanine and transfected into RBL-2H3 cells for functional studies. The CD63 G233A and Y234A were sorted twice to get high percentage of positive cells. In comparison to CD63 Wt these mutants showed high levels of surface expression, with very little intracellular expression as determined by FACS analysis. These effects were more pronounced for CD63 Y234A. The results are in agreement with those obtained previously with the C- terminal deletion mutants CD63-1 and CD63-7, and confirm a crucial role for the GY motif in CD63 internalization and cell surface expression. Internalization assays (internalization induced by cross-linking with anti- CD63 antibody) were performed for CD63 Wt, CD63 G233A and CD63 Y234A at different time intervals starting from 1 to 45 minutes and it was found that CD63 Wt start to internalize form the very beginning and increased up to 5 minutes and later remaining constant. However, no internalization was observed for CD63 G233A and Y 234A.

Immunofluorescence microscopy also revealed the similar observations. No/ very faint staining was observed with negative controls.

Internalization assays were carried out using cells grown on Labtech slides at various time points (0, 15, 45 min.) for CD63 Wt, CD63 -7, CD63 G233A and CD63 Y 234A. The images captured by the immunofluorescence microscopy support the FACS results i.e. CD63 Wt is internalized rapidly, whereas the C- terminal mutants appear to remain on the cell surface.

Western blotting carried out for C-terminus mutants revealed the same banding pattern as of

CD63 Wt. The major band observed was ranging from 47- 55kDa and the other band was from 62-68kDa. A non- specific mouse IgG was included as a negative control for which no bands were observed.

Experiments on up- regulation of CD63

CD63 is mainly expressed intracellularly although surface expression is increased in activated basophils. RBL-2H3 cells can be activated by addition of phorbolester+ calcium ionophore (PMA+CI: non-specific activators of secretion). This stimulates RBL-2H3 cells to secrete histamine etc. from secretory granules and induces increased cell surface expression of CD63.

Alternatively cross- linking IgE bound to the high affinity receptor can stimulate RBL-2H3 cells. This also stimulates secretion of histamine etc. and increased cell surface expression of CD63. Cells were pre-incubated with IgE to allow binding to the high affinity IgE receptor. The effects of an anti-IgE antibody, or cross- linked antigen DNP-HSA (Di-nitrophenol hapten linked to human serum albumin carrier) on CD63 expression were observed by examining cell surface expression of CD63 at various time points (0, 15, 30, 60 min.) after incubation at 370C. Initial experiments carried out in 24 well cell culture plates showed up- regulation for CD63 Wt after cross- linking with IgE- biotin, DNP-HSA and PMA+ CI (1 hour incubation). Repeated experiments showed the up- regulation for CD63 Wt after cross- linking with PMA+CI at different points (0, 15, 30, 60 min.). However, there was no clear evidence of up-regulation observed for CD63-1, CD63-7, CD63 G233A and CD63 Y234A

CD63 glycosylation mutants

Previously these motifs have been mutated with alanine. Mutant N130A, N150A, N172A and N3A (all N-linked glycosylation sites were mutated) were transected into RBL-2H3 cells. Cells were sorted 2-4 times to obtain the most positive population expressing CD63.

CD63 N3A transfected 3rd time in RBL-2H3 cells showed no surface expression but only intracellular expression. The number of +ve cells expressing CD63 N3A was around 30-35%. After single cell cloning percentage of +ve cells expressing N3A was around 50%. One week later it was reduced significantly. In later experiment when tested simultaneously with FACS and Western blotting, no cells were found +ve for CD63 N3A and no bands were observed. From these experiments it can be concluded that no surface expression is either due to incorrect folding of the protein (although still recognized by anti - CD63 H5C6) or it may be cytotoxic to cells hence expression is not stable.

Total expression for CD63 N172A was found to be higher as compared to CD63 N130A and CD63 N150A and showed least intracellular expression. Internalization assays performed for CD63 N130A, CD63 N150A and CD63 N172A also revealed low internalization for CD63 N172A. To

confirm these results of CD63 N172A, it was re-transfected in RBL-2H3 cells and permeabilisation/ internalization assays were carried out. The previous results were confirmed and showed that this mutant might have role in intracellular localization. To check that these results are due to this particular glycosylation mutant and not due to other unwanted mutations, it was re- sequenced. No additional mutations were found. Immunofluorescence microscopy for CD63 N130A and CD63 N150A showed similar intracellular staining pattern to CD63 Wt. However, cytoplasmic staining was weaker for CD63 N172A. Internalization assays carried out on Labtech slides for CD63 N172A revealed that it remains on the cell surface with little internalization after 45 minutes. In addition, patching of the antigen was also observed.

Western blotting carried out for glycosylation mutants revealed different banding pattern as compared to CD63 Wt. The major band in CD63 N130A and CD63 N150A was ranging from 38-44kDa and 42-48kDa respectively. However it was 35-43kDa in CD63 N172A. A common band of 27kDa was observed in all the mutants after tunicamycin treatment. No staining was observed for negative controls.

5. TECHNOLOGY ASSESSED AND TRANSFERRED

Technologies developed (2003-04)

A. Camel milk products

I. Camel milk soft cheese

Camel milk soft cheese was prepared successfully. Cheese is a product prepared from milk by the coagulation of casein and carrying with it the rest of the milk ingredients.

The camel milk was filtered, pasteurized by HTST method and cooled to 2-5^{0}C. The calcium chloride was added at the rate of the 0.02% followed by the 50% diluted HC at the rate of 4 ml per liter and milk was heated to 21^{0}C. After addition of rennet at the rate of the 50 mg per liter and kept for setting at 25^{0}C for one hour. After cutting the cheese curd, the cooking was performed at 42^{0}C and whey was drained out. The prepared product was washed three times with water at 26^{0}C, 15^{0}C and 10^{0}C respectively followed by salting of cheese curd with NaCl at the rate of the 2% and stored at refrigerated temperature for utilization.

Camel milk soft cheese

Evaluation of camel milk cheese

The fresh camel milk was processed for preparing cheese

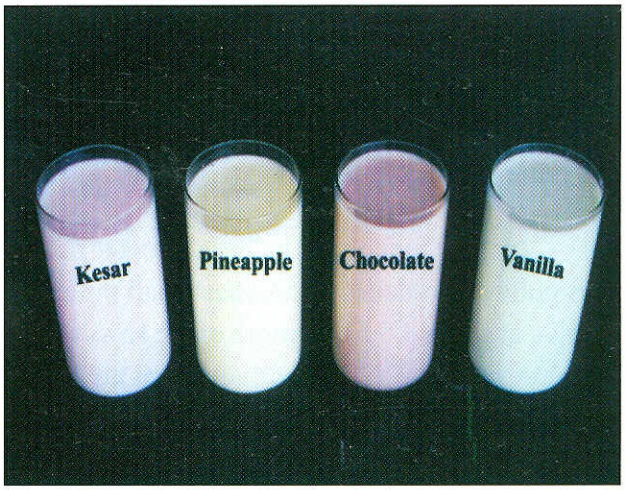
Properties of camel milk cheese:

Parameter (%)	(Average + SE)
Moisture	61.07 + 4.29
Total Solid	38.99+4.22
Fat	9+1.53
Acidity	0.068+ 0.01
Yield of cheese	12.17+ 0.64

High acceptability was observed in the form of sandwich, cheese spread and pakoras.

II Camel Flavored Milk

Camel flavored milk was successfully standardized with the aim to make camel milk more palatable to those who do not like to drink it as such, as well as to promote its utilization and sale.



Camel Flavored Milk

Process of Camel Flavored Milk

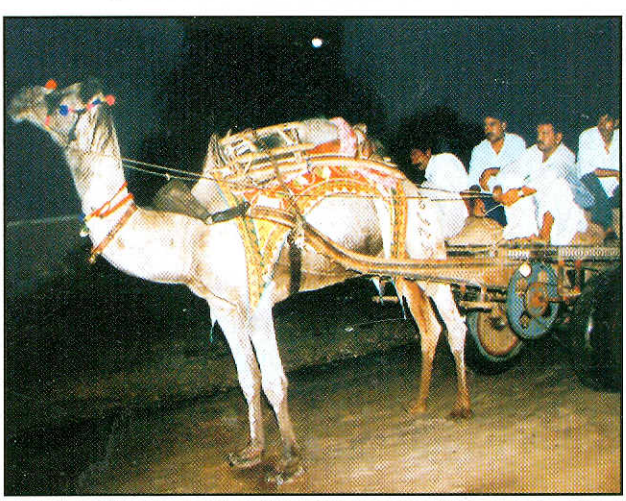
The camel milk was processed with different combination flavors i.e., pineapple, vanilla, chocolate and kesar and colours i.e. yellow, rose and pink. Fresh and filtered camel milk was collected in hygienic conditions and preheated (45^0 to 60^0C) followed by adding of carrageenan stabilizer @ 0.04% and sugar @ 5% while for chocolate milk is @ 3.5%. The desired flavors/essence i.e., pineapple, vanilla, and kesar @ 8-12 drops per liter of camel milk while for the chocolate camel milk (5g powder per liter) was dissolved followed by the addition of colour i.e., green, yellow and pink @ 2-3 drops per liter of camel milk. After homogeneous mixing of above additions, it was pasteurized at 73^0C for 15 minutes and cooled to 5^0C. The prepared camel flavored milk was packaged and stored in refrigerated temperature for its further consumption.

Sensory Evaluation of Camel Flavored milk

A sensory evaluation was carried out by using hedonic scale to assess the performance of all four different types of camel flavored milk. The camel milk of all the four flavours were given daily to the sensory evaluation panel of seven members for one week and their evaluation report was compiled as per hedonic scale. It was observed that highest points in respect to taste, smell and colour was scored by the vanilla flavor with green colour followed by pineapple with yellow colour.

B. Electrification of traditional two wheeled camel cart

Camel cart is important means of communication/ transport (short distance 30-40 km/day) in desert and areas adjoining desert i.e., arid and semi- arid region. It is used mainly to transport fodder, water, fuel wood, agriculture produce and construction material. Since, last few years there is an increase in incidence of road



Electrification of traditional two wheeled camel cart

accidents during nights. The main factor responsible for the increase in accidents is absence of lights on camel carts. The accidents can be reduced if there is light on camel carts. The National Research Centre on Camel, Bikaner has devised a system by which traditional two wheel camel cart is electrified like other motorized vehicles.

In this device a 22 inches diameter pulley is attached/fitted with the scan of camel cart wheel. This pulley is attached to another small pulley of 5 inches diameter which enable the small pulley to revolve at about 4.5 times more of the revolving speed of camel cart wheel, on the axis of small pulley one more pulley of 22 inches diameter is attached which in turn is connected by v- belt to small pulley of dynamo. This enables the pulley of dynamo to revolve at about 20-22 times more than the speed of camel cart wheel. Thus dynamo can revolve at 450 to 600 rpm and can produce 3-4 ampere of electric current, which is used to charge a 12 volt 25 amp battery fitted underneath camel cart. This battery is sufficient for two head lights and two indicator rear lights with a total consumption of 12 volts and 1.5 ampere.

This charged battery can be used by farmers to arrange lights in the remote Dhanis/villages where electricity has not reached. This will also be beneficial in executing the day to day domestic work and study of children in the night. The battery once charged can serve for 20-22 hours. The total cost of this system comes around Rs. 2000 to 2500/-.

The following is the list of equipments required for this system.

1. Two pulleys of 22" diameter
2. One pulley of 5" diameter
3. Old dynamo (of Car or Jeep)
4. Two V- belts
5. One dry cell battery 12 volts 15 ampere to 25 ampere
6. Two head and two rear lights.

6. EDUCATION AND TRAINING

Dr. Raghvendra Singh

Summer school on "Analytical techniques in Dairy Chemistry with special reference to Chemical quality of milk and milk products"; National Dairy Research Institute, Karnal from June 03-23, 2003.

Shri Ram Kumar

Training on "Land use Planning based on Agro-ecological Zoning" organized at National Bureau of Soil Survey & Land Use Planning, Nagpur from December 15 - 24, 2003.

Dr. S.K. Ghorui,

Short term training course in Animal Biotechnology for Teachers/ Scientists on "New Generation Veterinary Vaccines" organized at National Biotechnology Centre, IVRI, Izatnagar during March 9 - 29, 2004.

7. AWARDS AND RECOGNITION

Dr. S. C. Mehta

Best Poster Award 2004. In the "National symposium on livestock biodiversity vis-à-vis resource exploitation: An Introspection" organised by the SOCDAB and NBAGR, Karnal during 11th to 12th Feb, 2004.

Dr. Raghvendra Singh

District Honor/Appreciation Award 2002-2003, Bikaner Presented on 15th August, 2003 for research on camel milk and milk products.

Dr. D. Suchitra Sena

Third prize for oral presentation at XXII Annual Convention of ISVM and National Symposium on "Latest Approaches and Biotechnological Tools for Health Management of Farm and Companion Animals" at IVRI, Izatnagar from February 11-13, 2004.

8. LINKAGES AND COLLABORATIONS

1. National Level

RAU, Bikaner	-	Research work of M.Sc./M.V.Sc. and Ph.D student
CCSHAU, Hissar (Haryana)	-	Research work of M.V.Sc. and Ph.D student
MAFSU, Nagpur (Maharastra)	-	Research work of M.V.Sc. and Ph.D student
NDRI, Karnal (Haryana)	-	Camel milk analysis especially on protective proteins
CSWRI, Avikanagar (Raj.)	-	Camel hair its utilization in form of blends with other fibres viz. wool, hair, synthetic etc.
CIAE, Bhopal (M.P.)	-	Camel drawn implements and their performance
S.P. Medical College, Bikaner	-	Camel milk as nutritional adjuvant on treatment of Tuberculosis and type-I diabetes
AIIMS, New Delhi	-	Structure of protective proteins and its functional activity
Lokhit Pashupalan Sansthan	-	NGO at Sadri (Dist. Pali) extension

2. International level

CIRAD-EMVT, France	-	Research and training

M.V.Sc. Thesis

1. Studies on Some Important Blood Biochemical and Thyroid Hormonal Profile of Marwari Goat

M.V.Sc. (Vety Biochemistry) Scholar	:	Vijay Pandey
Advisor	:	Meenaxi Sareen, RAU Bikaner
Co-advisor	:	Raghvendar Singh

The investigation was carried out to study the effect of age and sex on serum blood biochemical parameters and thyroid hormonal profile of Marwari goats. The blood biochemical parameter included serum metabolites (Protein profile, glucose, urea, cholesterol and creatinne), minerals (calcium, inorganic phosphorus and magnesium) and electrolytes (sodium, potassium and chloride). The thyroid

hormonal profile included serum thyroxine (T_4) and triiodothyronine (T_3). The animals were grouped according to age (0-1 year, 1-2 years and above 2 years) and sex (male and female) and age and sex related variations were observed on above blood parameters, accordingly. As per the analysis of variance (ANOVA) in metabolites, significant increasing pattern was observed on total serum protein, albumin, cholesterol and blood urea while significant decreasing trend was observed on blood glucose. According to sex, significantly higher ($P < 0.01$) values of serum creatinine was observed in male animals while non-significant ($P > 0.05$) effect of sex was observed on other metabolites. In minerals and electrolytes, significant increasing trend was observed in case of serum chloride while significantly decreasing pattern were observed on serum calcium, inorganic phosphorus, magnesium, sodium and potassium. According to sex variation, significantly higher mean values of calcium, magnesium and sodium were observed in male animals. In thyroid hormonal profile no significant ($P > 0.05$) effects of age were observed on serum thyroxine and triiodothyronine. According to sex variations significantly higher ($P < 0.05$) values of serum triiodothyronine was observed in female animals than male animals.

2. Studies on thyroid hormonal profile and some important blood biochemical parameters in Magra sheep

M.V.Sc. (Vety Biochemistry) Scholar : Shalini Sharma

Advisor : Meenaxi Sareen, RAU, Bikaner

Co-advisor : Raghvendar Singh

The investigation was carried out to study the effect of age and sex on Thyroid hormonal profile and some important blood biochemical parameters in Magra Sheep. The animals were selected from the farmer's stock of villages, viz Naurangdesar, Garhwala and Kilchu of Bikaner district. The blood samples were collected in morning hours in mid of March, 2003. Thyroid Hormones included into the investigation were Thyroxine (T_4) and Triiodo thyronine (T_3). Blood biochemical parameters included metabolites and electrolytes. Among the metabolites - Blood glucose, serum cholesterol, serum protein profile, blood urea and serum creatinine were studied and the electrolytes consisted of calcium, inorganic phosphorus, magnesium, chloride, sodium and potassium. The animals were grouped according to age (0-1 year, 1 -2 years and above 2 years) and sex (male and female) and age and sex related variations of blood/serum parameters were deserved, accordingly. The overall mean values of total serum Thyroxine and total serum Triiodo thyronine were 3.80 ± 0.12 µg/dl and 111.86 ± 3.67 ng/dl, respectively. A highly significant ($P<0.01$) effect of age and sex was observed on serum Thyroxine levels. Thyroxine levels declined with age and female animals had significantly higher thyroxine values than males. Triiodothyronine levels did not differ significantly among different age groups and sexes. The overall mean values of various blood/serum metabolites were glucose (mmol/l) 2.72 ± 0.05, cholesterol (mmol/l) 1.66 ± 0.08, total protein (g/l) 66.48 ± 1.05, albumin (g/l) 34.53 ± 0.72, globulin (g/l) 31.94 ± 1.54, A: G ratio 1.42 ± 0.13, urea (mmol/1) 10.60 ± 0.38 and creatinine (µmol/1) 93.22 ± 2.24. A highly significant effect ($P \leq 0.01$) of age was observed on the metabolites studied.

glucose, albumin and A : G ratio declined with age whereas urea, creatinine, total protein, globulin and cholesterol increased with advancing age. Sex differences were found only in albumin and urea levels where males had significantly higher values than females.

The overall mean values of various serum electrolytes were calcium (mmol/l) 2.89 ± 0.08, Phosphorus (mmol/l) 1.40 ± 0.03, Magnesium (mmol/l) 0.54 ± 0.01, chloride (mmol/l) 105.33 ± 0.70, sodium (mmol/l) 147.43 ± 0.63 and potassium (mmol/l) 5.2 ± 0.05. Among the electrolytes studied, a highly significant ($P \leq 0.01$) effect of age was observed on serum calcium, phosphorus, magnesium and potassium and a significant effect ($P \leq 0.05$) of age was observed on serum sodium and all these parameters declined with the advancement of age. Significant ($P \leq 0.05$) differences were found between sexes for calcium and magnesium levels where males had lower values for calcium but higher values for magnesium than females.

3. Studies on some serum enzymes and blood biochemical parameters in Magra sheep

M.V.Sc. (Vety Biochemistry) Scholar : Bharti Jain
Advisor : Meenaxi Sareen, RAU, Bikaner
Co-advisor : Raghvendar Singh

The investigation was carried out to study the effect of age and sex on some important serum enzymes and blood biochemical parameters in Magra sheep. The animals were selected from farmers' stock of villages, viz. Naurangdesar, Garhwala and Kilchu of Bikaner district. The blood samples were collected in morning hours in mid of March, 2003. Serum enzymes included were aspartate aminotransferase (AST), alanine aminotransferase (ALT), acid phosphatase (ACP), alkaline phosphatase (ALP), lactate dahydrogenase (LDH) and -amylase. Blood biochemical parameters included metabolites, minerals and electrolytes. The metabolites were blood glucose, serum cholesterol, serum protein profile, blood urea and serum creatinine. The minerals and electrolytes consisted of calcium, inorganic phosphorus, magnesium, chloride, sodium and potassium. The animals were grouped according to age (0-1 years, 1-2 years and above 2 years) and sex (male and female) and age and sex related variations of blood/serum parameters were observed, accordingly. Interaction between age and sex was also studied.

4. Epidemiological, diagnostic and therapeutic aspects of subclinical mastitis in camel (*Camelus dromedarius*)

Scholar (Vet. Medicine) : Lenin Bhatt
Major Advisor : Anju Chahar
Co-Advisor : F.C.Tuteja

The prevalence of subclinical mastitis was found to be 41% on quarter basis and 72% on animals basis. Staphylococci was the most prevalent organism (68.29 %) among bacterial isolates

followed by streptococci (19.51 %), Corynebacterium spp. (7.32 %) and Bacillus spp. (4.68 %). Mean values of somatic cell count, electrical conductivity and pH of culturally positive quarters were significantly higher than the mean values of culturally negative quarters. The California Mastitis Test showed 70.79 % sensitivity.

Treatment with enrofloxacin alone was found to be 60 % effective while treatment with enrofloxacin + levamisole resulted in a cure rate of 62.5%. Spontaneous recovery was seen in 15.38% quarters in control group. There was significant decrease in the mean value of somatic cell count after treatment but the decrease in pH and EC was not significant. *In vitro* antibiotic sensitivity of 41 isolates against 10 antimicrobials revealed more than 95 % sensitivity for chloramphenicol, ceftriaxone, amoxycillin, cloxacillin, enrofloxacin and ciprofloxacin.

9. AICRP/COORDINATION UNIT/NATIONAL CENTRES

AICRP on Improvement of Feed Sources and Nutrient Utilization in raising animal production

M.S.Sahani, Nirmala Saini, Sumant Vyas, S.C. Mehta and Ram Kumar

B.D. Kiradoo (SRF), D. Chaturvedi and A. Bhardwaj (JRFs)

Agro-climatic condition

Year-wise study of meteorological data indicates vast variability from 1994 to 2004 with regards to temperature, relative humidity and rainfall. The maximum temperature varies between 40°C to 49°C in peak summer and minimum temperature between 0.8°C to 7°C in winter. The total average rainfall is in between 250-300mm. The maximum rainfall i.e., 450 mm was recorded during 1998 and minimum 75.5 mm in 2002 during these years. The meteorological data indicates, vast variation in climate which is not condusive to the growth of natural vegetation in various seasons. (Table 9.1)

Soil status of area

The change in soil fertility due to grazing of camel from 1994 to 2003 is shown in Table 9.2. A high pH was recorded in 2003 with value 8.25 which was constant as compared to 1994, only 0.02 times increase was recorded, whereas EC was increased 0.14 m mhos/cm in 2003. There was steep increase in O.C. of 0.04 % vis a vis the available P_2O_5 was recorded 45% more than year 1994 due to high organic matter incorporation in soil which also increase significantly the K_2O to 16% over the year 1994 in the silvipasture area.

Table 9.1 Agro-climatic condition of Bikaner (1997-2003)

Year	Temperature (°C)		Humidity (%)		Rainfall (mm)
	Maximum	Minimum	Maximum	Minimum	
1997	45.0 (May)	5.0 (Jan)	90 (April)	19 (April)	427.0
1998	45.5 (May)	3.8 (Dec)	82 (July)	09 (April)	450.0
1999	45.7 (May)	1.8 (Jan)	86 (June)	07 (April)	174.5
2000	46.2 (May)	4.6 (Dec)	89 (July)	03 (April)	193.6
2001	47.0 (May)	2.2 (Dec)	82 (July)	04 (May)	211.6
2002	47.9 (May)	1.2 (Dec)	90 (Aug.)	06 (May)	216.3
2003	46.6 (May)	0.7 (Jan.)	94 (Dec)	19 (Nov.)	57.5

Table 9.2. Soil fertility status of silvipasture Area

Parameter	1994	2003	Normal value
pH	8.23±0.04	8.25 ± 0.05	7.0-8.5
EC (m mhos/cm)	0.36±0.01	0.22±0.02	-
Carbon %	0.28±0.03	0.32±0.01	0.5-0.75
Available phosphorus (Kg/ha)	19.43±3.54	28.26±4.90	22.0-56.0
Available potash (kg/ha)	268.57±16.82	312.0±24.30	141.0-340

The effect of different manure on plant growth.

An experiment was conducted at NRCC farm on Beri, Khejri and Ardu trees on quantitative and qualitative analysis of camel and sheep manure. For this experiment three type of plant i.e. Khejri, Ardu and Ber of same age (two year) were taken. Ten kg manure was mixed and spread with plant in the months of April & July and watering was done at the interval of 15 lt. The data were recorded at

Ardu (*Athelanths Exclas*)

Plantation of fodder trees under AICRP

Beri (*Gigiphas Morshiyana*)

monthly intervals on plant height and extension. It was concluded that after one year, growth of all plant i.e. in term of monthly average height (7.5 and 13.5 cm) was found more with sheep manure, while the height of beri was found maximum with both manure as compared to Khejri and Ardu. Similarly, dimension of plants were also recorded with maximum growth with sheep manure in all the plants i.e. 7.5 to 11.0 cm and in case of camel manure dimension was 6.0 to 9.5 cm.

The analysis of urine and manure for micronutrients of camel, sheep and calf depicts that the camel manure contains a high amount of micronutrients viz. Zn, Cu, Co, Fe, Mg and macrominerals Ca, Na, and K as given in (Table 9.3 and 9.4) as compared to other samples of urine.

Table 9.3. Comparative analysis of minerals present in faeces of sheep, camel and cow manure (%)

Minerals	Sheep	Camel	Cow
Organic Carbon	0.75±0.004	0.84±0.005	0.60±0.005
Nitrogen	0.60±0.005	0.50±0.003	0.40±0.005
Zinc	10.9±0.133	8.0±0.05	8.5±0.05
Copper	3.3±0.06	2.2±0.05	2.0±0.05
Cobalt	5.0±0.05	5.0±0.09	4.7±0.05
Iron	22.1±0.05	13.6±0.05	12.5±0.05
Lead	0.17±0.005	0.21±0.005	---
Calcium	4.4±0.05	10.2±0.05	---
Phosphorus	0.50±0.005	0.30±0.005	0.20±0.005
Potassium	0.45±0.005	1.01±0.008	0.10±0.005

Table 9.4. Comparative analysis of minerals present in urine of sheep, camel and cow manure (µg/ml)

Minerals	Sheep	Camel	Cow
Zinc	0.10	0.54	0.06
Copper	0.16	0.13	0.13
Cobalt	0.66	0.79	0.43
Molybdenum	1.42	1.03	0.86
Iron	1.64	3.02	1.13
Magnesium	17.0	23.3	16.3
Magnese	0.09	0.04	0.06
Lead	0.92	1.15	0.76
Calcium	49.8	78.96	45.94
Sodium	1.53	2.20	1.66
Potasium	7.63	8.53	8.17

II. Studies on ongoing feeding system and identification of macro nutrient deficiency at farmer level

In order to collect the information on ongoing feeding system in arid regions and identification of macro nutrient deficiency at farmer level, field survey of ten selected arid districts of Rajasthan i.e. Bikaner, Hanumangarh, Nagaur, Jaiselmer, Barmer, Jodhpur, Sikar, Pali, Churu and Jhunjhunu will be conducted. Five tehasils and two villages from each tehesil and minimum ten farmers will be interviewed to meet the objectives. Survey proforma has been prepared including all the information regarding livrstock population, feeding pattern milk yield, soil type, fertility, irrigation facilities and reproductive problems. Samples of feed and fodder and soil collected from villages of Nokha and Dungargarh tehesil. Camels were mostly fed Guar chara, Mungphali and Moth chara, depending on availability. Concentrate and mineral mixture are generally not given to animals. Analysis of soil samples of two tehesils revealed that soil were deficient in available P_2O_5, K_2O and nitrogen content while calcium, megnesium and sulphate concentration were well above the critical level.

Table 9.5. Effect of Camel and Sheep manure on plant growth

Name of Plant	Sheep						Camel						Untreated					
	Height (cm)			Extension (cm)			Height (cm)			Extension (cm)			Height (cm)			Extension (cm)		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
Ardu	160	292	12-0	100	232	11-0	130	262	11-0	105	220	9-5	90	200	9-0	85	180	8-0
Beri	80	242	13-5	52	172	10-0	110	290	15-0	100	190	7-5	90	210	10-0	70	154	7-0
Khejri	70	142	7-0	60	150	7-5	80	152	6-0	65	137	6-0	60	117	4-8	60	08	4-0

I = Initial II = After One Year III = Average monthly growth

Table 9.6. Average soil macrominerals status of Nokha and Dungargarh tehsils.

Parameters	Nokha	Dungargarh
N (kg/ha)	81.14±1.21	80.75±0.93
P_2O_5 (kg/ha)	10.38±0.63	11.15±0.48
K_2O (kg/ha)	178.84±1.01	177.96±0.85
Calcium (meq/l)	0.95±0.37	1.22±0.50
Magnesium (meq/l)	1.29±0.51	1.78±0.79
Sulphate (meq/l)	0.77±0.40	1.16±0.39

Table 9.7. Soil macrominerals status of Nokha and Dungargarh tehsils (%)

Parameters	Nokha	Dungargarh
Calcium	0.26-1.21	0.32-0.86
Magnesium	0.13-0.16	0.08-0.18
Sodium	0.02-0.11	0.02-0.09
Potassium	1.74-2.38	1.91-2.23
Sulphur	0.90-0.20	0.8-0.22

10. LIST OF PUBLICATION

A. Research Papers (Published)

Agarwal, R.P., Swami, S.C., Beniwal, R., Kochar, D.K., Sahani, M.S., Tuteja, F. C. and Ghouri, S.K. (2003). Effect of camel milk on glycemic control, risk factors and diabetes quality of life in type-1 diabetes: A randomized perspective controlled study. *Journal of Camel Practice and Research*.10: 45-50. (6·6)

Agarwal, R.P., Swami, S.C., Beniwal, R., Kochar, D.K., Sahani, M.S., Tuteja, F.C. and Ghouri, S.K. (2003). Effect of camel milk on glycemic control, lipid profile and diabetes quality of life in type-1 diabetes: A randomized perspective controlled cross over study. *Indian Journal of Animal Sceiences*.73: 105-1110. (6·6)

Bhakat C., Chaturvedi D. and Sahani M.S. (2003). Studies on farming use of camel and bullock systems in hot arid villages of Thar desert. *Indian Journal of Animal Research*, 37(1): 1-7. (6·4)

Bhakat, C., Mehta, S.C. and Sahani, M.S. (2003). Annual hair yields attribute in indigenous camel breeds. *Indian Journal of Animal Sciences*. 73 (10): 1189-1191. (6·6)

Bhakat, C. and Sahani, M.S. (2003). Scope and Utilisation status of camel skin. Full length paper published in compendium of National Seminar on Leather industry in today's perspective, at Kolkata, 14 - 15 Nov 03: 73 76.

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Deen, A., Vyas, S., M.S. Sahani (2003). Semen collection, cryopreservation and artificial insemination in the dromedary camel. *Animal Reproduction Science* 77: 223-233. (7·6)

Deen, A., Vyas, S., Jain, M. and Sahani, M.S. (2004) Explanation of no or low motility in camel semen. *Israel Journal of Veterinary Medicine* 54 (1/2) (6·7)

Dixit, S.K., Tuteja, F.C.and Singh, A.P. (2003) Medicinal plants in popular indigenous/ ethno veterinary practices. *Veterinary Practitioner* 4 (1): 65-71 (6·0)

Dixit, S.K., Tuteja, F.C. and Singh, A.P.(2003)Alternative therapeutic system in veterinary medicine-Homeopathic principles and other basic issues. *Veterinary Practitioner* 4 (1): 72-74 (6·0)

Dixit, S.K., Tuteja, F.C., Dadhich, H. Singh, A.P. and Sharma, N.(2003) Herbal formulation in the management of camel pox. *Veterinary Practitioner*.4 (2): 116-119 (6·0)

Kumar, R., Gorakhmal, D. Suchitra Sena and Sahani, M.S. (2003) Comparative efficacy of fenvelarate, deltamethrin, amitraz and ivermectin against mange in camels. Indian Veterinary Journal, 2003 (6.0)

Mehta, S.C., Mishra, B.P. and Sahani, M.S. (2003). Genetic differentiation of Indian camel breeds using random oligonucleotide primers. *ICAR News*. 8 (4): 15-16.

Mehta, S.C., Chirania, B.L., Bithu, H.K. and Sahani, M.S. (2003). Analysis of causes of death in camel. *Indian Journal of Animal Sciences*. 73 (8): 35-36. (6.6)

Nagpal, A.K., Arora, M. and. Singh, G.P. (2003). Utilization of moth chara, wheat straw and bui leaves based complete rations in camel calves. *Indian Journal of Animal Sciences* 73: (10) 1267-1270. (6.6)

Nagpal, A.K., Arora, M. and. Singh, G.P. (2003). Utilization of mixed and complete rations by lactating camels. *Indian Journal of Animal Nutrition.* 20 (2) 178-184. (4.6)

Nagpal, A.K., Arora, M. and. Singh, G.P. (2003). Nutrient utilization of gram straw (*Cicer arietinum*) based complete feed blocks in camel calves. *Indian Journal of Animal Sciences* (accepted). (6.6)

Raghvendar, S., Rai, A.K. and Sahani, M.S (2003). The performance capabilities of camels in arid and semi - arid regions of India. *Draught Animal News*.38, 19-22.

Sahani, M.S., Vyas, S. and Deen, A. (2003). Improvement in reproductive efficiency in farm camels under hot arid region. *Indian J. Anim. Reprod.* 24 (2): 95-98. (2.6)

Sharma, T. Singh, A.P and Dixit, S.K. (2003) Anti-nutritional factors in animal feeds *Veterinary Practitioner* 4 (2) :134-137 (6.0)

Tuteja,.F.C., Dixit, S.K, Ghorui, S.K, Deen, A. and Sahani, M.S.(2003). Prevalance, characterization and antibiotic sensitivity of intramammary infection in camel. *Journal of Camel Practice and Research*.10: 61-77 (6.6)

Tuteja,.F.C. and Dixit, S.K.(2003) Control of Mastitis. *Veterinary Practitioner* 4 (2) 130-133. (6.0)

B. Papers presented in Symposium/Workshop/Conference/Seminar

Bhakat, C. and Sahani M.S. (2003). Scope and Utilisation status of camel skin. Full length paper published in compendium of National Seminar on Leather industry in today's perspective, at Kolkata, 14 - 15 Nov 03 pp. 73 76.

Bhakat, C., Mehta, S.C. and Sahani, M.S. (2004). Studies on hair attributes and production potential of Indian camel breeds. National Symposium on Livestock Biodiversity Vis-a-vis Resource Exploitaion: An Introspection At NBAGR, Karnal, 11- 12 Feb., 2004 pp. 166.

Bhakat, C. and Chaturvedi, D. (2004). Studies on behavioural pattern of camel calf in different systems of management. National Symposium on Livestock Biodiversity vis-a-vis Resource Exploitaion: An Introspection At NBAGR, Karnal, 11- 12 Feb., 2004 pp. 167.

Bhakat, C., Chaturvedi, D. and Raghaventra, S. (2004). Studies on Camel Management under various microenvironment of shelter systems. 4th IVC & XI Annual conference of IAAVR & Symposium on "Newer concepts and challenges in animal health and production in the wake of WTO, IPR, IT, trade barriers and certification of standards", 27 28 Feb, 2004 at IVRI, Izatnagar. pp. 88-89.

Bhakat, C. and Chaturvedi, D. (2004). Studies on behavioral pattern of adult camel in different systems of Management. 4th IVC & XI Annual conference of IAAVR & Symposium on "Newer concepts and challenges in animal health and production in the wake of WTO, IPR, IT, trade barriers and certification of standards", 27 28 Feb, 2004 at IVRI, Izatnagar. pp. 89.

Bhakat, C., Chaturvedi, D. and Sahani, M. S. (2004). Studies on camel production and management systems in different agro-ecological zone of Rajasthan. 4th IVC & XI Annual conference of IAAVR & Symposium on "Newer concepts and challenges in animal health and production in the wake of WTO, IPR, IT, trade barriers and certification of standards", 27 28 Feb, 2004 at IVRI, Izatnagar. pp. 89-90.

Bissa, U.K., Yadav, S.B.S., Vyas, S., Sharma, N. and Sahani, M.S. (2003) Reproductive performance and factors affecting it in Indian camels. Abstr. in XIX annual convention of Indian Society for Study of Animal Reproduction on 22-24 August, 2003 at Kolkata, pp101.

D. Suchitra Sena and Pandey, N.N. (2004). Therapeutic evaluation of Oral electrolyte solutions in diarrhoea of calves at the XXII Convention of ISVM and National Symposium on "Latest Approaches and Biotechnological Tools for Health Management of Farm and Companion Animals" held at Indian Veterinary Research Institute, Izatnagar from 11th to 13th February, 2004.

Ghorui S. K. Singh Raghavendra, Sahani M. S. Tuteja F. C and Dixit S. K. (2003) Comparative studies on polymerase chain reaction and parasitological tests in detection of cameline surra. Fourteenth National Conference of Veterinary Parasitology, Oct. 15th-17th, 2003, Nagpur

Ghorui S. K. Singh Raghavendra, Sahani M. S. Tuteja F. C and Dixit S. K. (2003) Polymerase chain reaction and serum antibody level-A comparative evaluation for cameline surra. Fourteenth National Congress of Veterinary Parasitology, Oct. 15th-17th, 2003, Nagpur

Singh, G. P. Mineral status of feed and fodder at Jaiselmer district of Rajasthan,Submitted for presentation at *XI Animal Nutrition Conference* held at J.L.N. Krishi Vishav Vidalaya, Jabalpur, from 5th - 7th Jan., 2004.

Mehta ,S.C., Gautam, L. and Sahani, M. S. Molecular Characterisation of Jaisalmeri camel. National Symposium on Livestock Biodiversity vis-à-vis Resource Exploitation: An Introspection Organised by Society for Conservation of Domestic Animal Biodiversity and National Bureau of Animal Genetic Resources, Karnal at Karnal from 11th to 12th Feb, 2004 pp.

Nagpal, A.K., Arora, M. and Singh, G.P. (2004). Nutrient utilization in camel calves fed gram (*Cicer arietinum*) straw based complete feed blocks. Submitted for presentation at *XI Animal Nutrition Conference* held at J.L.N. Krishi Vishav Vidalaya, Jabalpur, from 5th- 7th Jan., 2004.

Nagpal, A.K., Arora, M. and Singh, G.P. (2004).Voluntry intake and nutrient utilization of mixed and complete rations by lactating camels and their calves. Submitted presentation at *XI Animal Nutrition Conference* held at J.L.N.Krishi Vishav Vidalaya, Jabalpur from 5th- 7th Jan., 2004. pp.

Sharma, K.K., Vyas, S., Kashyap, S.K. and Deen, A. (2003). Isolation and identification of bacteria from lower genital tract of female dromedary camel. Abstr. in XIX annual convention of Indian Society for Study of Animal Reproduction on 22-24 August, 2003 at Kolkata, pp128.

Sahani, M.S. and Mehta, S.C. Camel Genetic Diversity and its Significance in Indian Economy. National Symposium on Livestock Biodiversity vis-à-vis Resource Exploitation: An Introspection Organised by Society for Conservation of Domestic Animal Biodiversity and National Bureau of Animal Genetic Resources Karnal, at Karnal from 11th to 12th Feb, 2004.

Tuteja, F.C. and D. Suchitra Sena (2004). Control of Rinderpest. Seminar on National Project on Rinderpest Eradication. March, 09,2004. Bikaner. pp:15-19.

Vyas, S., Deen, A., Jain, M. and Sahani, M.S. (2003) Ultrasound examination for the presence of ovulating size follicle before mating in Kachchi breed of dromedary camel. Abstr. In XIX annual convention of Indian Society for Study of Animal Reproduction on 22-24 August, 2003 at Kolkata, pp131

C. Technical and Popular papers (Published)

Deen, A., Sahani, M.S., Tuteja, F.C., N. Kishore and M. Goyal (2003) Importance of camel in desert eco-system in relation to cart transportation and agricultural operations. Technical bulletin Published by NRCC, Bikaner in both English and Hindi

भक्त, सी. ,चतुर्वेदी दीपक एंव साहनी, एम. एस. (2003) थार रेगिस्तान में ऊँट की उपयोगिता एंव प्रबन्ध प्रणाली, वार्षिक हिन्दी पत्रिका, करभ I : 38–42

बीठू, हरिकरण एंव मेहता एस. सी. (2003) दक्षिण अमेरिकी उष्ट्र वंश– एक परिचय वार्षिक हिन्दी पत्रिका, करभ 56.60

बीठू, हरिकरण एंव मेहता एस सी (2003) उष्ट्र पालन से संबन्धित शब्दावलियॉ, वार्षिक हिन्दी पत्रिका, करभ–72.74

दीक्षित एस. के., टूडेजा एफ. सी. एवं बीठू, हरिकरण (2003) पशु चिकित्सा क्षेत्र में भारतीय चिकित्सा पद्वति व औषधीय पौधे – एक विवेचन वार्षिक हिन्दी पत्रिका, करभ–19–21

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ऊँटों में खुजली (पॉव) के लक्षण, बचाव के उपयोग एंव निदान एम. एस. साहनी, एन. शर्मा, घोरूई एस. के., बिस्सा यू. के. एंव चिरानियॉ बी. एल. 2003

सिंह, जी. पी., नागपाल ए. के. और सैनी निर्मला 2003 मरू भूमि में पशुओं की देखभाल कैसे ? करभ पेज 10–16.

Sahani, M. S., Sharma N, Ghorui S. K., Bissa U. K. and Chirania B. L., Sarcoptic Mange (scabies) in Camel- Preventive measures and treatment,

Singh, G.P., Ratnu, L.S. Saini N. and Nagpal,. A.K. 2004. Selenium: An Essentially required trace element. Indian Dairyman. 56(1) : 59-64.

अरोडा, मंजु, नागपाल ए. के. और सिंह जी. पी . 2004 संतुलित आहर बनाम स्वस्थ ऊँट. खेंती 57(2) 5 –9.

Saini, N., Singh, G.P. and Nagpal, A.K.2003. Trace Mineral deficiencies in camel and their remedies. Indian Dairyman. 55(11): 67-72.

Raghvendar, S., Shukla, S.K., Jayant, P. and Sahani, M.S. (2003). Ushtra Dugdh ki upyogita, Krishi Chayanica, 32 - 34.

राघवेन्द्र, एस , शुक्ला एस. के. एंव साहनी, एम. एस. 2003 भारत मे उष्ट्र दुग्ध एंव दुग्ध उत्पादों की बढती लोकप्रियता वार्षिक हिन्दी पत्रिका, करभ–1, 23.27

राघवेन्द्र, एस, शुक्ला एस. के., सिहं ऐ. के. एंव साहनी, एम. एस, 2003 उष्ट्र दुग्ध उत्पाद चीज (12 पेज तकनीकी बुलेटिन)

Raghvendar, S., Shukla, S. K, Singh, A.K. and Sahani, M.S. (2003) Camel Milk Product- Flavored Milk (12 pages,Technical Bulletin).

Raghvendar, S., Sahani, M.S. and Shukla, S.K. (2004) Preparation of camel milk products and their utilization. (Technical brochure in Hindi and English).

11. LIST OF APPROVED ONGOING PROJECTS (X PLAN)

11.1 Genetic characterization, evaluation and conservation of Indigenous camel breed.

11.2 Improvement of the working efficiency of camel under arid and semi arid conditions.

11.3 Improvement of reproductive efficiency and to study the causes of reproductive failure in camels.

11.4 Studies on feed requirement and feed resources evaluation in camel for optimum production.

11.5 To study the economics of different camel management practices under arid and semi arid eco system.

11.6 Surveillance, monitoring and control of camel diseases.

12. MANAGEMENT COMMITTEE, RAC, SRC MEETING

Institute Management Committee of NRCC, Bikaner

RAC Committee

RAC Committee meeting was held on April 8th-9th, 2003 at Bikaner and July 29th-31st ,2003 at New Delhi along with Directors meeting

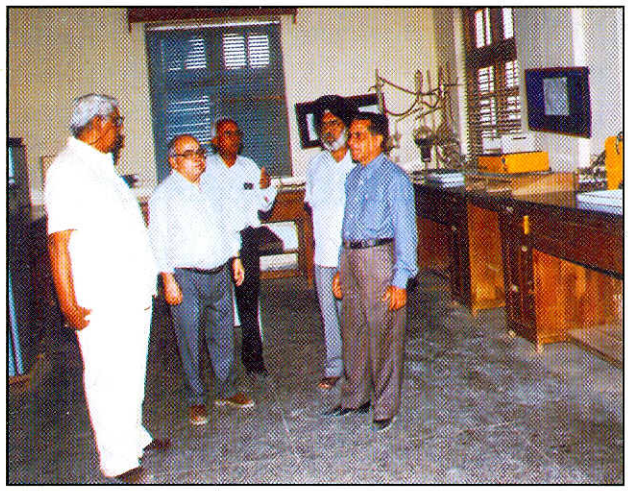
Dr. N. R. Bhasin	: Chairman
Dr. N. D. Khanna	: Member
Dr. A. K. Rai	: Member
Dr. S. P. Agarwal	: Member
Sh. D. R. Choudhary	: Member
Dr. Aminu Deen	: Member secretary

RAC meeting with scientists at NRCC on 08/04/03

QRT

QRT meeting held on April 9th -10th 2003 at Bikaner, May, 31st to 1st June, 2003 at Bikaner, 4th August, 2003 at Jaipur and 24th-26th November, 2003 at Jaipur.

Dr. N. R. Bhasin	:Chairman
Dr. G. R. Purohit	: Member
Dr. O. P. Mathur	: Member
Dr. K. Pradhan	: Member
Dr. J.S. Bhatia	: Member Secretary



QRT team visiting NRCC lab on 10/04/03

SRC meeting

Annual meeting of Scientific Research Council was held on 09.07.2004 to discuss the progress of research activities of the centre under the Chairmanship of Director, NRCC, Bikaner. The following subject matter experts have participated

1. Dr. S. S. Sharma, Prof & Head, Dept of Vet. Gynae & Obst. CVAS, Bikaner
2. Dr. K. M. L. Pathak, Director Research (Vet.) CVAS, Bikaner
3. Dr. B. K. Beniwal, Associate Prof. & Head, CVAS, Bikaner
4. Dr. Tribhuwan Sharma, Assistant Prof. & Incharge, Dept. of Ani. Nutrition

The research work carried in different discipline during the year 2003-2004 under the various approved research projects and scheme of the institute were discussed in light of recommendations of Research Advisory Committee and Vision 2020 of centre.

13. Partici[pation of scientists in conference, meetings, workshops and symposium

Dr. M.S. Sahani

National Seminar on Leather Industry in today's perspective at Kolkata , 14th-15th Nov,2003

Dr. G. P. Singh

National seminar on opportunities and challenges in nutrition and feeding management of sheep, goat and rabbit for sustainable production at CSWRI, Avikanagar, Jaipur from February 10th-12th, 2004.

Dr. A. K. Nagpal

XI Animal Nutrition Conference at JNKVV, Jabalpur from January 5th-7th, 2004.

Dr. S. K. Ghorui

International conference and exhibition on Biotechnology, Biotech Consortium India Ltd and CIDEX, New Delhi at Hyderabad from September 24th to 27th, 2003.

Dr. S. K. Dixit

International seminar for Plant based Medicine September, 2003 at Jaipur

Dr. Sumant Vyas

18th annual convention and national symposium of Indian Society for study of Animal Reproduction, held at Kolkata on 22nd-24th Aug., 2003.

Dr. Raghvendra Singh

International Seminar on Ethnic foods organized by Bikaner Zila Udyog Sangh and Papad Bhujia Manufacturing Association, Bikaner, 21st May, 2003.

Dr. S. C. Mehta

National Symposium on Livestock Biodiversity vis-à-vis Resource Exploitation: An Introspection Organised by Society for Conservation of Domestic Animal Biodiversity at N.B.A.G.R., Karnal from 11th to 12th Feb, 2004.

International conference and exhibition on Biotechnology, organised by Biotech Consortium India Ltd and CIDEX, New Delhi at Hyderabad from September 24th to 27th, 2003.

Dr. C. Bhakat

National Seminar on Leather Industry in today's perspective at Kolkata, 14th- 15th Nov., 2003.

Dr. D. Suchitra Sena,

XXII Annual Convention of ISVM and National Symposium on "Latest Approaches and Biotechnological Tools for Health Management of Farm and Companion Animals" at IVRI, Izatnagar from February 11th-13th, 2004.

14. WORKSHOP, SEMINAR AND SUMMER INSTITUTE

Second workshop on refinement and transfer of technology on milk and milk products of camel and goat

A two days workshop dated 26th and 27th December, 2003 was organized under NATP Project "Improving the shelf life of milk and milk products of camel and goat" in order to evaluate research work carried out in said project. The main objective of the workshop was to assess the ongoing research work on camel and goat milk and milk products technologies developed and their refinement if any required. In this regard, dairy experts from Urmul Dairy, Bikaner; NDRI, Karnal: Lokhit Pashu Palak Sansthan (LPSS), Sadari, Pali; CAZRI, Jodhpur and NRCC, Bikaner have participated. The salient research achievements on milk and milk products of camel and goat were presented by the concerned project investigator and CCPI and their associates from NRCC, Bikaner and CAZRI, Jodhpur, respectively. The guest lecture on milk proteins and their applications special reference to lactoferrin delivered by the Dr. K. L. Bhatia, Ex Principal Scientist, NDRI, Karnal. The interaction with camel owners including representative of LPSS, Sadari, Pali was carried out to share their feed back on camel milk utilization. The chief guest and dairy expert Sh. P.K. Malhotra, Managing Director, URMUL, Bikaner advocated for the availability of camel and goat milk in the market to meet the increasing demand in the society due to its growing awareness of their medicinal properties. In concluding remarks of experts to promote further camel milk and milk products were viz. (i) Evaluation and identification of camel milk and milk products constituents as a medicinal properties (ii) to package the camel and goat milk and milk products for their marketing (iii) to transfer camel and goat milk product technologies among their users.

Training on empowerment of farm women on development and popularization of camel milk and milk products and their utilization

The farm women training course of ten days funded by NATP "Improving the shelf life of milk, and milk products of camel and goat" was organized from 24th March to 2nd April, 2004 by the NRCC, Bikaner with the help of Lokhit Pashu Palak Sansthan at Sadari, Pali, Rajasthan. On farm training was imparted to twenty five farm women on technologies of preparation of camel milk products such as fermented milk (Lassie), besan cheese pakoara, flavored milk, tea and coffee. Each camel milk product was demonstrated in detail in respect of its procedure, composition, sensory evaluation and its importance. Further awareness on importance of camel milk in treatment of diabetes, tuberculosis, typhoid, liver disease and constipation. During training, the technical bulletins on camel milk products were distributed among the participants to help in procedures during practice of preparation of these products by themselves. The feed back were taken from participants as well as from surrounding villages on camel milk production potential, consumer acceptance, marketing system and its economic returns to assess camel milk and milk products utilization in future. The demand of camel milk is increasing in the society due to getting awareness of camel milk importance as a health food. It can be concluded that camel milk and milk products utilization have potential and acceptance in the society if these are mode available in the market.

Training for M.Sc. Biotechnology students

The Centre, gave two months training in Biotechnology for 2 students of M.Sc. Biotechnology, University of Rajasthan, Jaipur from 13.01.2004 to 12.03.2004

15. VISIT OF DIGNITARIES

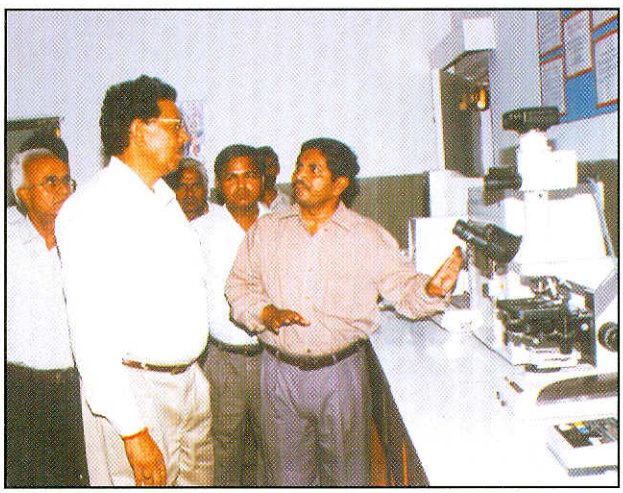
11.04.2003 Dr. Mangala Rai, Secretary DARE, DG, ICAR

20.04.2003 Ravinder Kumar, IRS, Additional Commissioner of Income Tax, Mumbai

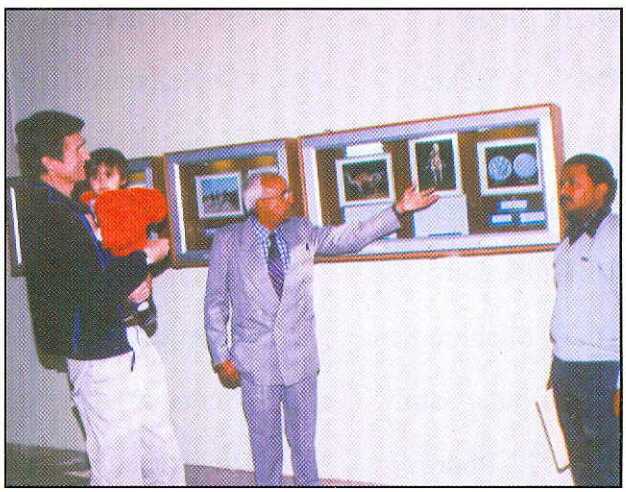
24.12.2003 Justice N. Mhatre, Mumbai High Court.

29.12.2003 Robert Black, US (Charge de Affears) US Embassy, New Delhi

30.01.2004 Dr. Mandaz, Principal Accountant General Rajasthan, Jaipur



Dr. Mangala Rai, Secretary DARE, DG, ICAR (New Delhi) Visiting NRCC, Bikaner



Robert Black (US High Commissioner) observing technology developed by NRCC, on 29/12/03

16. Personnel

Name of staff members (2003-2004)

Dr. M. S. Sahani	Director

Scientific Staff

Dr. G. P. Singh	Principal Scientist (Ani. Nut.)
Dr. Aminu Deen	Principal Scientist (Ani. Rep.)
Dr. A. K. Nagpal	Sr. Scientist (Ani. Nut.)
Dr. S. K. Ghorui	Sr. Scientist (Vet. Para.)
Dr. S. K. Dixit	Sr. Scientist (Vet. Med.)
Dr. A. K. Roy	Sr. Scientist (Ani. Phy.)
Dr. Sumant Vyas	Sr. Scientist (Ani. Rep.)
Dr. R. Singh	Sr. Scientist (Ani. Bio)
Dr. S. C. Mehta	Sr. Scientist (AG&B)
Dr. F. C. Tuteja	Scientist Sr. Scale (Vet. Med.)
Sh. Gorakh Mal	Scientist Sr. Scale (Ani. Biochem.) on study leave
Dr. C. Bhakat	Scientist Sr. Scale (LPM)
Dr. D. Suchitra Sena	Scientist (Vet. Med.) joined on 24.10.2003 after study leave
Dr. Nirmala Saini	Scientist (Ani. Nut.)
Dr. S. K. Bhure	Scientist (Biochem. Ani. Sci.) joined on 27.10.2003

Technical Staff

Dr. U. K. Bissa	Sr. Vet. Officer, T-9
Dr. N. Sharma	LFS, T-8
Sh. Ram Kumar	Farm Manager, T-8
Dr. B. L. Chirania	Vet. Officer, T-7
Sh. Dinesh Munjal	Technical Officer, T-5
Sh. M. K. Rao	Technical Officer, T-5

Administrative Staff

Sh. A. K. Mallick	Asstt. Admin. Officer (Sep., 2003)
Sh. P. K. Tiwari	Asstt. Fin. & Account Officer
Sh. K. P. Sharma	Asstt. Admin. Officer (Oct., 03 to continue)

17.0 INFRASTRUCTURAL DEVELOPMENT

The following approved works have been taken up by the CPWD and are under progress.

1. Community Centre
2. Administrative cum Library building
3. Small animal laboratory (House)

केन्द्र के हिन्दी पखवाड़ा (2003) के समापन समारोह के अवसर पर मंचस्थ (बांए से) डॉ. राघवेन्द्र सिंह, डॉ. मोहनसिंह साहनी, श्री मधुकर गुप्ता, श्री हरीश भादानी एवं श्री भवानी शंकर व्यास।

आई.सी.ए.आर. खेलकूद प्रतियोगिता में विजेता रहीं रा. उ. अनु. केन्द्र की वॉलीबाल (शूटिंग) व बैडमिन्टन की टीमें केन्द्र के निदेशक महोदय के बीच पुरस्कारों के साथ।

NATIONAL RESEARCH CENTRE ON CAMEL

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