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ANNUAL REPORT

2003-2004



Indian Council of Medical Research
DESERT MEDICINE RESEARCH CENTRE
NEW PALI ROAD, JODHPUR-342 005

Mandate

- 1. To undertake and promote research on health problems specific to desert and pursue health systems research.*
- 2. To study changing pattern of health problems, specially in view of the various developmental activities.*
- 3. To transfer scientific and technical expertise to state/ local health agencies for their use.*

Current Thrust Areas

Malaria & Dengue

Tuberculosis

Hypertension

Nutrition

Disease burden & transition

Environmental impact on health

Preface

Desert Medicine Research centre has continued its endeavours of improvisation of research quality and on focusing at capability strengthening component of the Centre during current period.

Ongoing studies on Dengue have attained an authoritative lead especially in area of understanding of maintaining mechanism of virus in nature in Ae. albopictus-monkey cycle within outskirts of city. Conclusive studies on these leads are likely to add to understanding of the epidemiology of disease leading to impart a recognition to centre in Dengue research among contemporary workers/ institutes.

Studies pertaining to risk factors of desert malaria have reached to their conclusive phase. Based on the Health Management Information System project, Centre is likely to deliver long awaited contributions in desert specific malaria management strategy.

Some new areas of research have begun in centre viz; study of impact of environmental pollution on human health, longitudinal studies on disease burden estimation and on prevalence of Hypertension in desert population. Institute has gained an unprecedented leap in developing research academic activities such as Ph.D. programmes and national level training programmes.

In all, current year has been the phase of continuing the ongoing work and furtherance of developing focused research and reference and training for desert health problems.

*(Dr. R.C. Sharma)
Officer-in-charge*

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Studies on determination of possible role of *Aedes albopictus* mosquitoes in maintenance of urban cycle of dengue—Vinod Joshi and Manju Singhi

Date of Commencement: **November, 2001** Duration: **Two Years** Status: **Completed**

Objectives

1. To determine role of *Aedes albopictus* mosquitoes in maintenance of urban cycle of dengue virus through vertical transmission in nature.
2. To evaluate possible role of *Aedes albopictus*, *Aedes aegypti* and *Aedes vittatus* in maintenance of dengue virus through mosquito-monkey-mosquito cycle.
3. To compute quantum of virus getting exchanged from *albopictus*-monkey to *aegypti*-man cycle and vice-versa.
4. To study hot spots of urban *Aedes* breeding and sentinel points of mosquitoes and virus activity
5. Studies on associated breeding of *Ae. aegypti* and *An. stephensi*.

Rationale

Present status of knowledge about dengue viruses, of its incidence as a human disease and transmission dynamics in a particular region, is in the process of development and gaining reproducibility. Since the disease appears in the form of a seasonal phenomenon in a particular ecosystem, the silent phase of the disease needs to be probed for detection of reservoir foci of virus. Transovarial transmission of dengue is one such mechanism through which virus has shown to persist in nature, which DMRC has already reported. However, a possible alternate cycle of *Aedes albopictus*-monkey in zoos and parks and its possible mixing up with *Aedes aegypti* –man cycle may exist as maintenance of this pathogen under such set up.

Jodhpur is one of the places where number of natural habitats of monkeys as well as their man-made shelters in the form of zoos are available. A detailed study investigating tree hole breeding of *Aedes albopictus* and *Aedes aegypti* and presence of transovarial transmission of dengue virus through generations may furnish interesting observations to understand maintenance and transmission of dengue as existing under regional conditions of study area. In addition, a limited sero-survey of human fever cases for the study of incidence of dengue virus and its correlation with entomological observations may add to understanding of mechanism of dengue as regular and alternative cycles in a desert ecosystem.

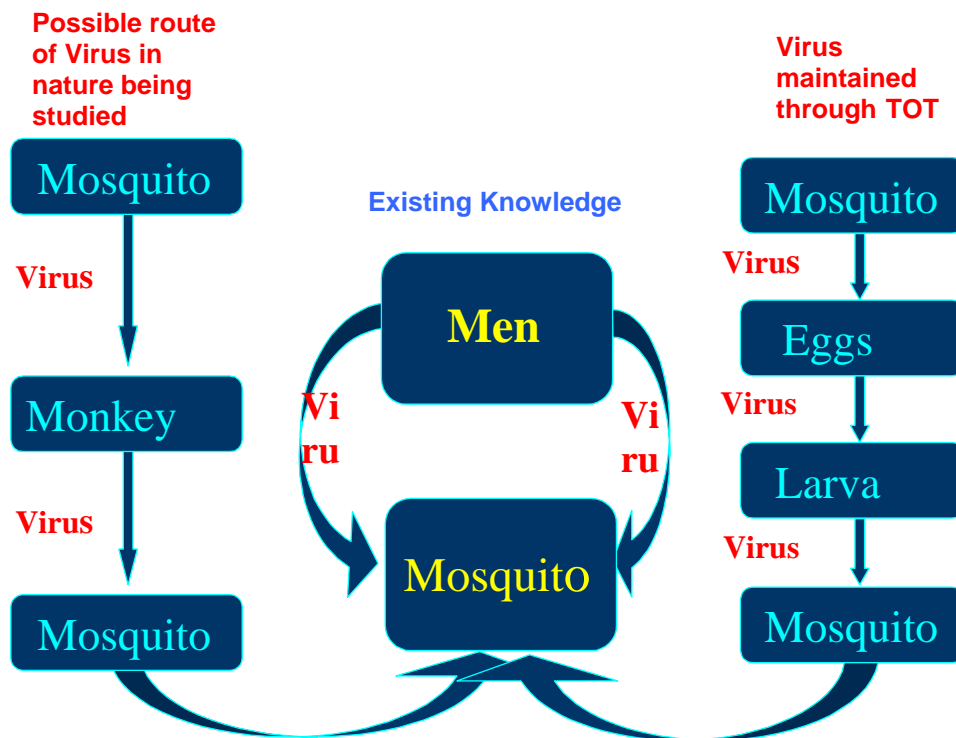


Figure-1. Ongoing and accomplished research in DMRC on maintenance mechanism of dengue virus

Progress of the work

Selection of Study areas: For tree hole breeding of dengue vectors

Based on the hypothesis that presence of *Aedes albopictus* and *Aedes aegypti* in the zoos/parks as tree hole breeders and their possible interaction with monkeys and humans, may maintain a virus activity cycle limited to few sentinel points around Jodhpur, and that these foci may disseminate infection to the urban set up during rainy season, following study areas were selected:

Table-1. Study areas and criteria of their selection for tree hole breeding of dengue vectors

S. No.	Area Code	Location characterization	Selection Criteria
1.	Fort (01)	Highest altitude in city	Top elevated area with frequent tourist visits.
2.	Vyas Park (02)	Located in interior old city	Interior city with Garden.
3.	Umaid Garden (03)	Outer city with zoo and garden	Garden with zoo having monkeys.
4.	Mandore Garden (04)	Garden away from city.	Garden with natural habitats of monkeys.

Selection of study areas: For urban breeding of dengue vectors

To study breeding profile of dengue vectors in urban set up of Jodhpur town, entire town was divided into different sub sets with the characteristics carrying relevance in epidemiology of dengue. Following study areas were selected for this study:

Table - 2. Study areas and criteria of selection for urban dengue vector breeding

S. No.	Area Code	Location characterization	Selection Criteria
1.	Juni Mandi (SA-I)	Inside city	Thickly populated, plain
2.	Bakra Mandi (SA-II)	Inside city	Thickly populated, low socioeconomic, elevated
3.	Milk Man colony (SA-III)	Outside city	Out side city with cattle
4.	Pratap Nagar (SA-IV)	Outside city	Outside city, without cattle

Periodicity of investigations:

All the study units covered in the present study were situated in a radius of about 10 km. The localities as described above were screened every month from November, 2001 through June, 2004. Breeding sites such as community water collection tanks, domestic containers, tree holes and tyre dumps etc. were searched for presence of breeding of *Aedes* for a longitudinal coverage of study areas each month during all the three prevailing seasons e.g., Post rainy, Winter and Summer seasons. The areas where extrinsic virus activities was observed in mosquitoes, a survey of suspected DF cases was also undertaken during the month of October, 2002.

Sero-surveillance:

Patients reporting in the Out Patient Department (OPD) of dispensaries covering human population from the areas where the mosquitoes were collected, were examined for clinical symptoms of viral fever. Wherever felt necessary by the treating physician, intra venous blood samples were taken for determining presence of antibodies to dengue.

Entomological studies:

The field collected larvae and pupae are reared in the laboratory in insectory maintaining ambient temperature of 25-30°C and relative humidity 60-70%. The sterilized dog-biscuits powder was provided as larval feed. Adults emerged from the pupae were fed on 4% glucose solution for 2-3 days in the Barraud Cages. The adults so developed were subjected to Indirect Fluorescence Antibody Test (IFA). To correlate extrinsic and intrinsic dengue virus activity at community level the human dwellings from where the viral fever cases were being reported, were screened for mosquitoes and for possible extrinsic dengue virus activity maintained by them.

Observations

Entomological observations: Tree hole breeding of dengue vectors

Two major vectors species of dengue virus viz; *Ae. aegypti* and *Ae. albopictus* were found breeding as tree hole breeders in the zoos and parks inside as well as outer city of Jodhpur. *Aedes aegypti* was observed frequently as tree hole breeder in all the four study settings during period of study. However, *Ae. vittatus* was found only during September, 2001 in areas SAI, SAII and SAIII. In area SAIV tree hole breeding of *Ae. vittatus* was not observed. The important species *Ae. albopictus* was observed breeding in tree holes only during months of September, 2001 in three study areas II, III & IV (Table 3). In month of August, 2003 *Ae. albopictus* was observed as tree hole breeder in study areas SAII.

Following observations were made:

- Tree hole breeding was more common in the zoos/parks which have monkeys. Since from the soil collection of tree holes viable eggs of *Aedes* species were collected, the observations indicate a continuous cycle of these vector species in the three study settings (SAII, SA-III and SA-IV).
- During winter months of December and January in the years 2001-2004, in SA-I and SA-II no tree hole breeding was observed. However during these months in other two study areas SA-III and SA-IV, tree hole breeding was reported consistently.
- The study area with larger park area and representing natural habitats of monkeys (SA-IV) observed to harbor tree hole breeding of *Aedes* species more consistently than other three areas.
- *Aedes albopictus* has not been found tree hole breeding in area of high altitude (SA-I).

Table-3. Monthly prevalence of tree hole breeding of *Aedes* species in study areas.

Month	SA-I			SA-II			SA-III			SA-IV		
	<i>aegypti</i>	<i>albopictus</i>	<i>vittatus</i>	<i>aegypti</i>	<i>albopictus</i>	<i>vittatus</i>	<i>aegypti</i>	<i>albopictus</i>	<i>vittatus</i>	<i>aegypti</i>	<i>albopictus</i>	<i>vittatus</i>
September , 01			+	+	+	+		+	+		+	
October	+			+						+		
November										+		
December										+		
January, 02	+											
March	+			+			+			+		
May				+						+		
June	+			+			+			+		
September	+											
October	+						+					
December							+					
January, 03							+			+		
March							+			+		
May				+								
July							+			+		
August							+			+	+	
September				+						+		
October										+		

SA-I = Top elevated area with frequent tourist visits; SA-II = Interior city with Garden.;

SA-III = Garden with zoo having monkeys; SA-IV = Garden with natural habitats of monkeys

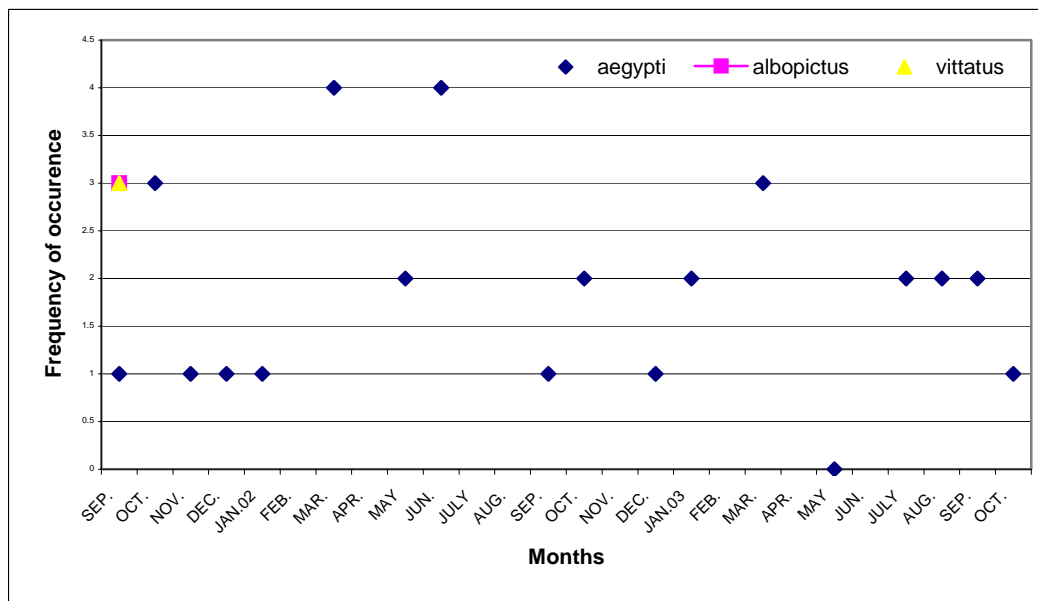


Figure -2. Monthly prevalence of tree hole breeding

Entomological observations: Urban breeding of dengue vectors

During course of present investigations simultaneous with tree hole breeding survey, breeding of *Aedes* fauna was also screened in community containers of different ecotypes of Jodhpur town. The observations made during 2001-2004 revealed following important points:

- It was observed that during almost all the months of study ie., from October, 2001 till June, 2004, in study area I (Juni Mandi) and study area IV (Pratap Nagar), most consistent and higher breeding of *Ae. aegypti* was observed as compared to other two study areas ie., study area II and III (Table 4).
- Characteristically, these two areas (SA-I and SA-IV) both represent a typical urban set up on plains, one being inside and other being outside city. It was obvious that a typical urban set up was most conducive ecotype for consistent and abundant breeding of dengue vectors.
- However, in area SA-III, where cattle and cattle tanks were in plenty, relatively less *Aedes* breeding is indicative of that breeding stages might have been ingested by cattle while consuming water from containers filled for providing drinking water to them.

Table-4. Breeding profile of *Ae. aegypti* in study areas of urban set up.

MON.	SA -I					SA -II					SA-III					SA -IV				
	Exa	+Ve	%	Tem	pH	Exa	+Ve	%	Tem	pH	Exa	+Ve	%	Tem	PH	Exa	+Ve	%	Tem	pH
SEP.01																				
OCT.											24	4	16	32	6	18	5	27	29	6
NOV.	6	1	16	21	6	25	-	-	-	-	26	4	15	25	6	20	3	15	25	6
DEC.	10	2	20	21	6	30	-	-	-	-	18	4	22	20.5	6	12	5	41.6	20.5	6
JAN.02	13	5	38	18.5	6	50	2	4	20	6	28	2	7	21	6	25	4	16	21	7
FEB.	13	2	15	19	6	40	-	-	-	-	25	2	8	19.5	6	20	-	-	-	-
MAR.	9	2	22	32	6	45	-	-	-	-	27	2	7	33	6	30	3	10	32.5	6
APR.	12	2	16	33	6	35	1	2	32	6	20	-	-	-	-	25	2	8	34	6
MAY	10	3	30	28	7	15	-	-	-	-	10	1	10	30	6	15	3	20	31	6
JUN.	12	2	17	30	6	15	2	13	32	7	15	1	.6	31	6	10	1	10	32	7
JULY	15	2	14	31	6	10	-	-	28	6	20	4	20	30	6	25	7	28	31	6
AUG.	15	1	6	30	6	15	-	-	30	6	15	1	8	32	7	20	4	20	30	7
SEP.	18	2	11	30	6	20	3	15	31	7	20	4	20	31	7	22	7	32	30	7
OCT.	10	1	10	27	7	15	2	13	29	6	15	-	-	-	-	20	-	-	-	-
NOV.	8	1	12.5	26.5	7	18	-	-	27	7	12	1	8.3	26	6.5	15	2	13.3	27	7
DEC.	9	2	22.2	25	7	16	-	-	26	7	16	-	-	-	-	22	3	13.6	25	7
JAN.03	10	2	20	22	7	22	3	3.6	19	6	14	1	7.1	23	7	15	2	13.3	25	6
FEB.	9	2	22.2	21	7	15	2	13	20	6	14	-	-	-	-	20	4	20	24	6
MAR.	10	3	30	23	7	18	3	16	21	6	14	-	-	-	-	22	5	22.7	24	6
APR.	10	2	20	29	6	20	3	15	29	6	12	2	16.6	28	7	25	5	20	25	6
MAY	5	2	40	28	6	20	3	15	27	7	15	2	13	27	7	16	3	19	26	7
JUN.	7	1	14.2	27	7	16	-	-	28	7	16	1	6.2	29	7	20	3	15	27	7
JULY	6	3	50	28	7	20	3	15	28	7	22	2	9.9	28	7	15	4	26.6	28	7
AUG.	10	10	100	28	7	25	6	24	28	7	30	16	53.3	27	7	18	7	38.8	27	7
SEP.	8	6	75	28	7	16	3	19	28	7	28	9	32	29	7	20	5	25	28	7
OCT.	7	1	14.2	27	7	12	-	-	-	-	14	3	21.4	27	7	15	2	13.3	28	7
NOV.	6	3	50	27	7	10	1	10	27	7	10	2	20	27	7	20	4	20	27	7
DEC.	6	2	33	26	7	10	-	-	26	7	10	1	10	25	7	15	1	6.6	26	7
JAN.04	7	-	-	25	7	4	-	-	24	7	9	-	-	24	7	15	-	-	24	7
FEB.	7	-	-	27	7	8	-	-	27	7	10	2	20	25	7	14	-	-	25	7
MAR.	6	3	50	27	7	12	2	16.6	27	7	10	2	20	28	7	15	1	7	27	7
APR.	7	3	42.6	28	7	10	-	-	28	7	10	1	10	29	7	12	-	-	28	7
MAY	7	2	29	28	7	12	-	-	28	7	10	-	-	28	7	12	1	8	28	7
June	7	2	29	28	7	10	-	-	28	7			-	-	-					

SA-I = City area with dense population; SA-II = City area with high altitude; SA-III = Semi urban area with cattle sheds; SA-IV = Semi urban area without cattle sheds.

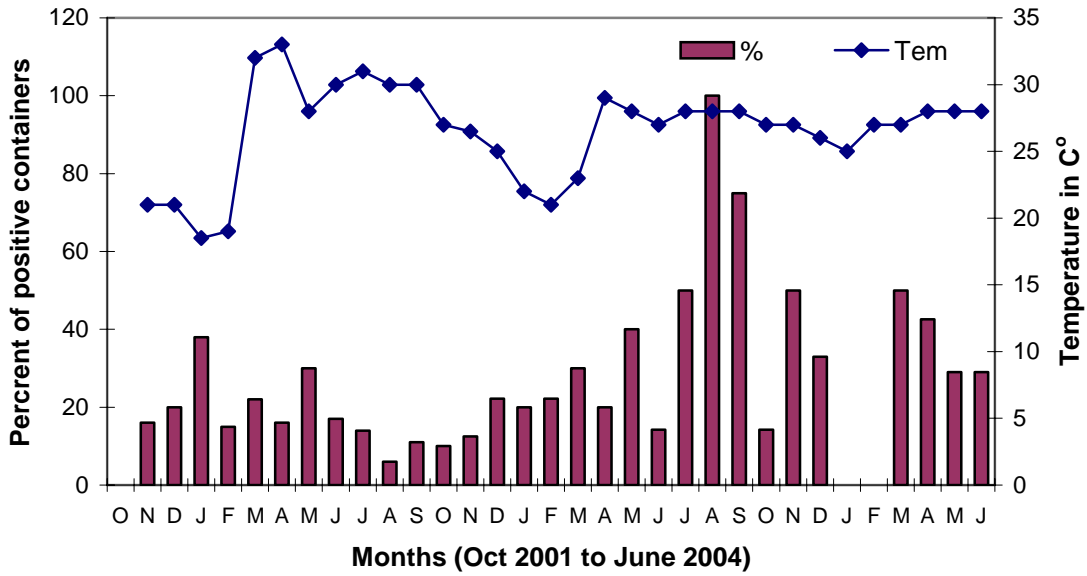


Figure-3. Breeding profile of breeding of dengue vectors in study area Juni Mandi (SA-I)

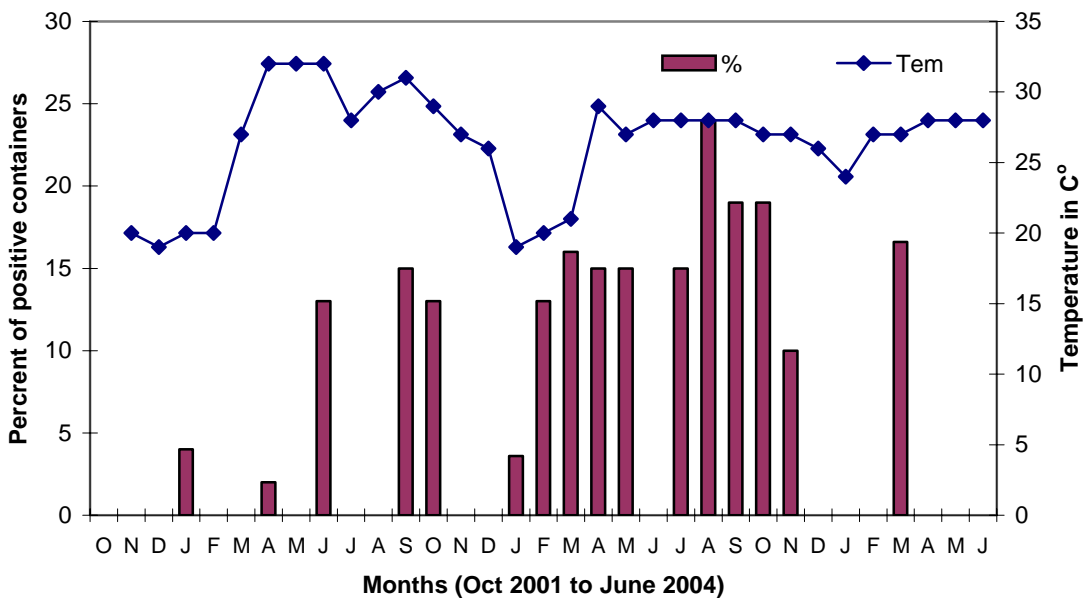


Figure-5. Breeding profile of breeding of dengue vectors in study area Bakra Mandi (SA-II)

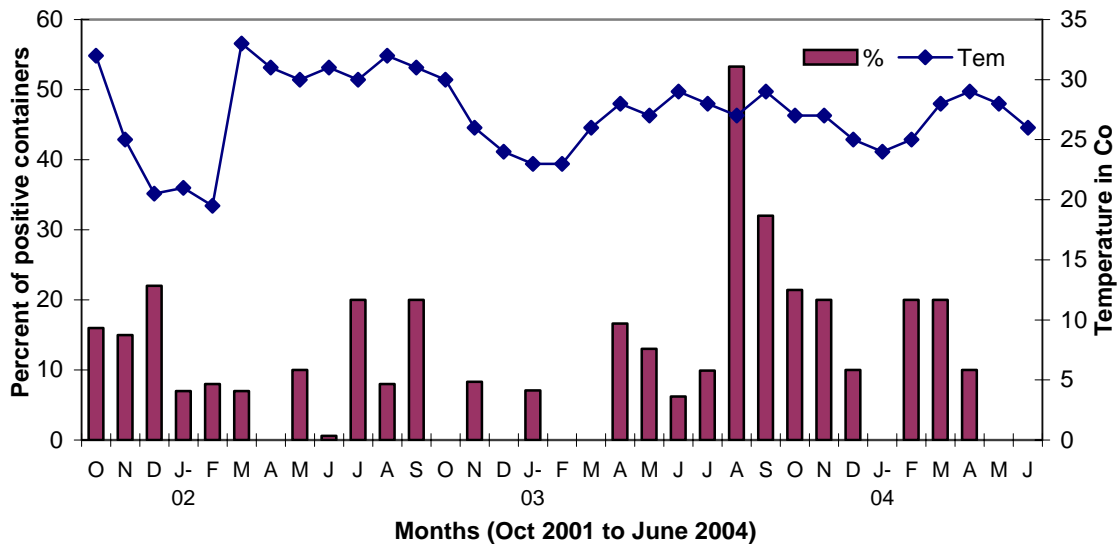


Figure -6. Breeding profile of breeding of dengue vectors in study area Milkman colony (SA-III)

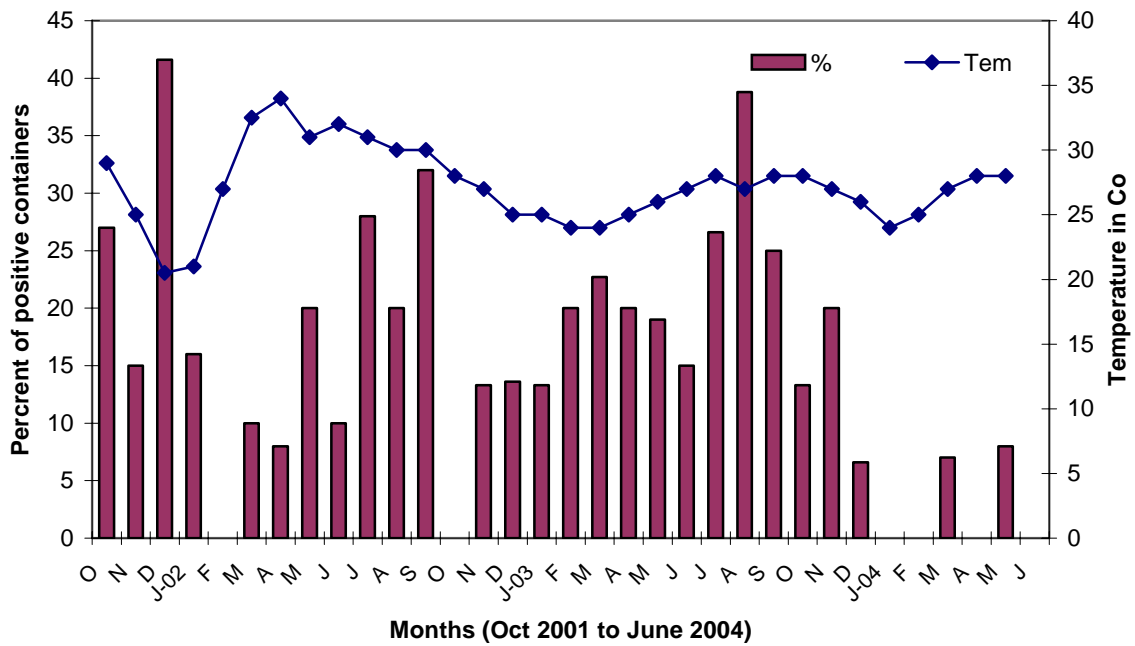


Figure -7. Breeding profile of breeding of dengue vectors in study area Pratap Nagar (SA-IV)

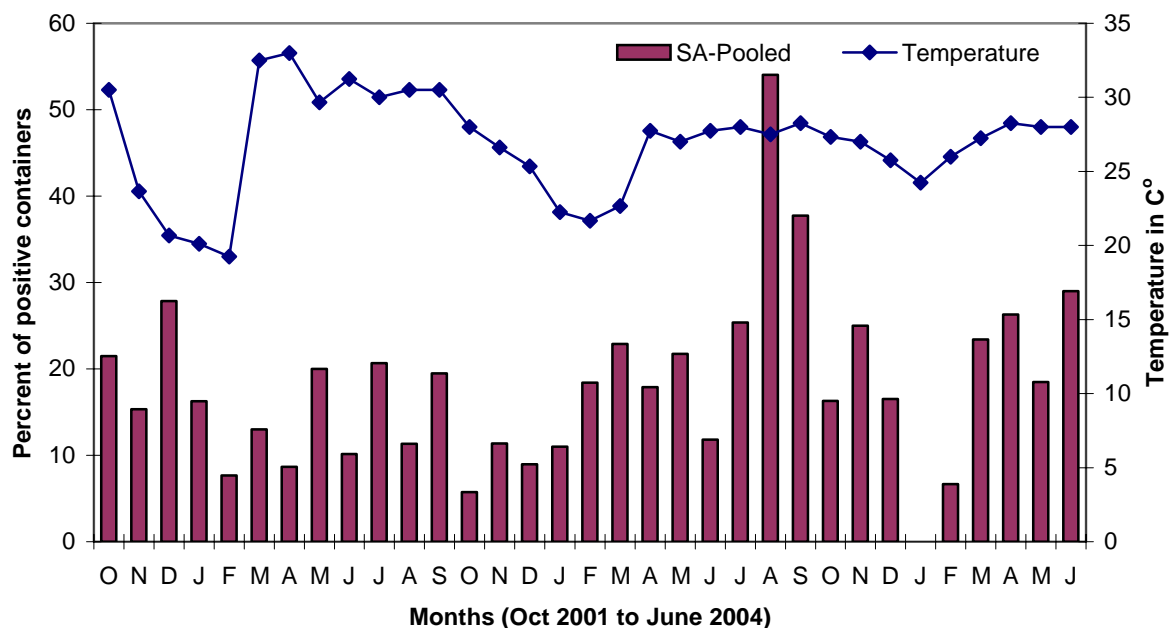


Figure -8. Pooled breeding profile of breeding of dengue vectors in all study areas

Entomological observations: Associated breeding of *Ae. aegypti* and *An. stephensi* in urban areas of Jodhpur

In all the four study areas, for studying breeding of dengue vectors in urban set up of Jodhpur, associated breeding of *Ae. aegypti* and *An. stephensi* was also studied as an additional exercise. Details of investigations are given in Table 5. Following observations were made:

- As was observed in the case of breeding of *Ae. aegypti*, for combined breeding of *stephensi* and *aegypti* also, study area I (Juni Mandi) was the most common locality for breeding of these two urban vectors.
- Highest percentage (50.0 %) of peri-domestic containers positive for combined breeding was observed in study area-I, representing inner city, in the month of March, 2004.
- During November to January, i.e., winter months of all the years of study viz; 2001, 2002 and 2003, no combined breeding or negligible percentage of containers +ve for breeding of these species was observed. However, during rainy and post rainy months of August to October, except study area III (area with cattle) some breeding was observed.
- Almost negligible combined breeding of *Ae. aegypti* and *An. stephensi* in study area III (with cattle) was an interesting observation.

Table- 5. Combined breeding of *Ae. aegypti* and *An. stephensi* during 2001 – 2004.

MON.	SA –I					SA –II					SA-III					SA –IV				
	Exa	+Ve	%	Tem	PH	Exa	+Ve	%	Tem	pH	Exa	+Ve	%	Tem	pH	Exa	+Ve	%	Tem	pH
OCT.											24	-	-	32	6	18	-	-	29	6
NOV.	6	-	-	21	6	25	-	-	-	-	26	-	-	25	6	20	-	-	25	6
DEC.	10	-	-	21	6	30	-	-	-	-	18	-	-	20.5	6	12	-	-	20.5	6
JAN.02	13	-	-	18.5	6	50	-	-	20	6	28	2	7	21	6	25	-	-	21	7
FEB.	13	-	-	19	6	40	-	-	-	-	25	-	-	19.5	6	20	-	-	-	-
MAR.	9	1	11	32	6	45	-	-	-	-	27	-	-	33	6	30	3	10	32.5	6
APR.	12	2	16	33	6	35	1	2	32	6	20	-	-	-	-	25	2	8	34	6
MAY	10	-	-	28	7	15	-	-	-	-	10	-	-	30	6	15	-	-	31	6
JUN.	12	2	16	30	6	15	2	13	32	7	15	-	-	31	6	10	-	-	32	7
JULY	15	1	7	31	6	10	-	-	28	6	20	-	-	30	6	25	5	20	31	6
AUG.	15	1	7	30	6	15	-	-	30	6	15	-	-	32	7	20	4	20	30	7
SEP.	18	2	5.5	30	6	20	2	10	31	7	20	-	-	31	7	22	6	27	30	7
OCT.	10	-	-	27	7	15	-	-	29	6	15	-	-	-	-	20	-	-	-	-
NOV.	8	1	12.5	26.5	7	18	-	-	27	7	12	-	-	26	6.5	15	-	-	27	7
DEC.	9	-	-	25	7	16	-	-	26	7	16	-	-	-	-	22	-	-	25	7
JAN.03	10	-	-	22	7	22	3	3.63	19	6	14	-	-	23	7	15	-	-	25	6
FEB.	9	-	-	21	7	15	2	13	20	6	14	-	-	-	-	20	2	10	24	6
MAR.	10	-	-	23	7	18	3	16.6	21	6	14	-	-	-	-	22	5	23	24	6
APR.	10	-	-	29	6	20	1	5	29	6	12	-	-	28	7	25	-	-	25	6
MAY	5	-	-	28	6	20	2	10	27	7	15	-	-	27	7	16	2	12.5	26	7
JUN.	7	-	-	27	7	16	-	-	28	7	16	-	-	29	7	20	1	5	27	7
JULY	6	-	-	28	7	20	-	-	28	7	22	-	-	28	7	15	1	6.5	28	7
AUG.	10	2	20	28	7	25	-	-	28	7	30	-	-	27	7	18	-	-	27	7
SEP.	8	3	37	28	7	16	-	-	28	7	28	3	10.7	29	7	20	2	10	28	7
OCT.	7	-	-	27	7	12	-	-	-	-	14	-	-	27	7	15	-	-	28	7
NOV.	6	-	-	27	7	10	-	-	27	7	10	-	-	27	7	20	2	10	27	7
DEC.	6	-	-	26	7	10	-	-	26	7	10	-	-	25	7	15	-	-	26	7
JAN.04	7	-	-	25	7	4	-	-	24	7	9	-	-	24	7	15	-	-	24	7
FEB.	7	-	-	27	7	8	-	-	27	7	10	-	-	25	7	14	-	-	25	7
MAR.	6	3	50	27	7	12	-	-	27	7	10	-	-	28	7	15	1	6.5	27	7
APR.	7	3	42.6	28	7	10	-	-	28	7	10	-	-	29	7	12	-	-	28	7
MAY	7	2	29	28	7	12	-	-	28	7	10	-	-	28	7	12	-	-	28	7
June	7	-	-	28	7	10	-	-	28	7	-	-	-	-	-	-	-	-	-	-

SA-I = City area with dense population; SA-II = City area with high altitude; SA-III = Semi urban area with cattle sheds; SA-IV = Semi urban area without cattle sheds.

Virological observations:

Soil samples collected from tree holes of all the study areas were immersed into water and larvae developed out of collected samples were reared into adults. Results of IFA showed following observations:

- Samples collected from study areas representing park of inside city, zoo/park of inside city and park out side city with monkeys, showed that in area where monkeys are present either in zoo or in free habitat, *Ae. albopictus* had shown dengue virus in IFA test. No other area showed any extrinsic virus activity in any of the *Aedes* species examined.
- Since the mosquitoes reared in laboratory showed presence of dengue antigen, it was obvious that the transovarial cycle of virus is going on among tree hole breeding *Ae. albopictus*, fauna.

Table -6. Extrinsic virus activity in sentinel points around Jodhpur.

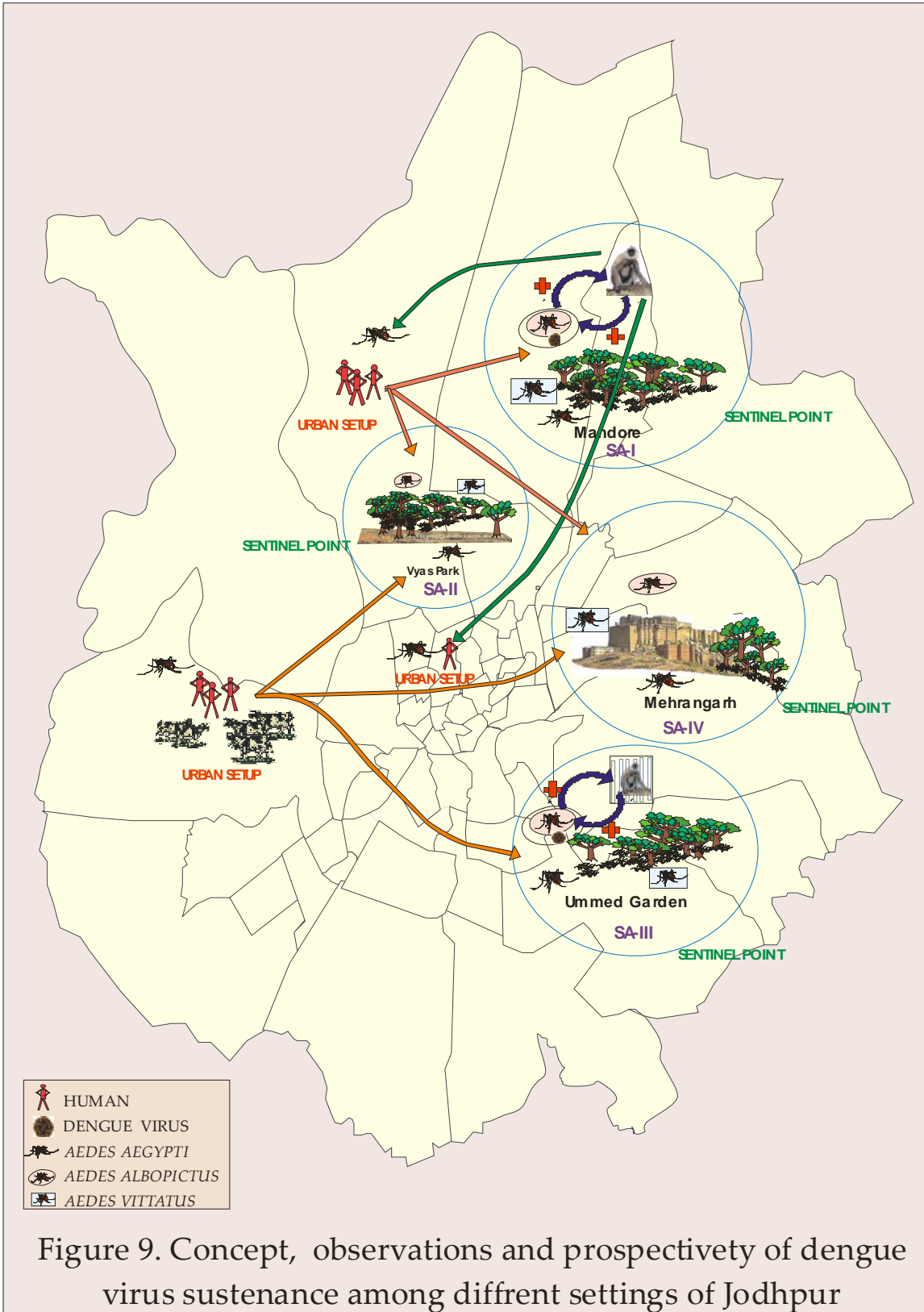
Study area	Tree hole breeding <i>Aedes</i> species			Extrinsic virus activity in <i>Aedes</i> species			Clinical cases of dengue	Sera +ve dengue Igm
	<i>aegypti</i>	<i>albopictus</i>	<i>vittatus</i>	<i>aegypti</i>	<i>albopictus</i>	<i>vittatus</i>		
SA-I	+		+				0	0
SA-II	+	+	+		+		20	0
SA-III		+	+		+		73	0
SA-IV							0	0

SA-I = City area with high altitude; SA-II = City area with park; SA-III = City area with zoo; SA-IV = Outer city with park and monkeys.

Important observations:

Based on the investigations undertaken for last three years following inferences can be drawn:

- The study undertaken on the basis of Geographical Reconnaissance (GR) and observations made on different parameters as detailed above, indicate that in urban set up para-domestic community containers serve as consistent sites of dengue vector breeding. Such vector reservoirs are more protected and conserved in inside city, urban set up.
- Semi-urban areas with cattle do not support breeding of dengue vectors to the extent it is supported in other areas..
- Sentinel points around city with trees and monkeys serve as protecting niche of relatively uncommon vectors species in the area viz; *Ae. albopictus*. This faunal stock of vectors maintain vertical transmission of dengue virus.
- Vector fauna of urban set up and that of sentinel points may exchange their extrinsic viral stock through movement of vertebrate host (monkey) of sentinel points to urban set up and those of urban set up (humans) to sentinel points. Through present studies made so far, these emerging points need to be confirmed by isolation and characterization of virus from monkeys and humans: However, up to mosquito level, the presence of virus has been shown. The concept lying, observations made so far and prospective work to be accomplished to prove the hypothesis has been shown in Figure 9.



Important Leads and work remains to be undertaken:

Addressing to the basic hypothesis behind present investigations that there may be an alternate cycle of dengue between tree hole breeding vectors and monkeys and this cycle may serve as maintenance cycle of virus in nature, the present observations seem to have proved a part at least that restricted foci in zoos/ parks have their own cycle of mosquitoes and virus since mosquitoes in tree holes are exhibiting vertically transmitted virus. However, to prove other components of present hypothesis that whether virus is being harbored by monkeys or not and whether the areas in which these monkeys move (areas of movement of monkeys are specific) have additional or more cycles of dengue than the places where these non human primates do not travel, remains to be worked out. Initial discussions with the local primate experts have been made and project needs to be extended for another one year to establish these components.

Rapid study of Dengue Fever in Jodhpur city: Situation analysis and risk predictions- *Vinod Joshi and R. C. Sharma*

Date of Commencement: **September, 2003** Duration: **Two Months** Status: **Completed**

Objectives

1. To undertake situation analysis of concentration and distribution of dengue fever and susceptible vector species of Jodhpur town.
2. To evaluate risk status of different setting and develop a predictive profile of susceptible areas in town.
3. To provide a prototype of developing dengue control plan for Jodhpur city.

Rationale

During the months of September and October, 2003 number of fever cases reporting to hospitals were diagnosed as dengue fever cases. During this period as per records of the chief Medical & health Officer, Jodhpur, 132 serologically confirmed cases of dengue were reported. It has realized that reporting examining and treating fever morbidities with active infection of dengue is not the enough anti-dengue measures to depend upon for meeting the future challenges of its risk in the area. It was therefore planned that entire Jodhpur town may be divided into different epidemiologically important ecotypes and vector profile (immature and adult) may be studied to develop hot spots of vectorial and viral concentrations in the town. A GR based study has been undertaken and associations have been depicted which may be very useful in taking future preventive measures against the infection and developing a prototype of anti-dengue operations in the town.

Progress of the work

Selection of Study areas:

Basis of selection of study areas was map of Jodhpur town obtained from the Municipal Corporation, Jodhpur (Fig.1). All the 60 wards of Jodhpur town were grouped into seven clusters each representing a relevant ecotype including number of identical wards. Following clusters of wards each representing a dengue sub-system within the town were chosen for study.

Table -1. Study areas and basis of their selection.

S. No.	Area	Location characterization	Selection Criteria
I	Paota and Mandore	Area with Orchard/Nursery Outside city	Higher humidity ambient and low human population
II	Soorsagar	Areas with Orchard/Nursery and Stone Quarries	Higher humidity ambient with additional breeding habitats as quarries
III	Chandna Bhakar	Low Socio-Economic/ Elevated areawith foot hills	Area with poor hygienic sense and unplanned water storage situated at a height
IV	Bamba Mohalla	Low Socio-Economic/ Plain Areas	Area with poor hygienic sense and unplanned water storage situated in plain
V	Milkman colony	Area with Cattle Shed's/Outside city	Areas with cattle providing additional bait for blood feed and breeding habitats
VI	Shastri Nagar	High Socio-Economic/ Outside City	Area with better hygienic sense and planned water storage situated outside city
VII	Navchowkiya	Inside City/ Plain Area	Area with better hygienic sense and planned water storage situated inside city

Sample Size:

A household with independent premises was taken as a unit of selected sample. Following systematic random selection procedure, 100 households were chosen from each of study areas. In all, 1052 households were surveyed for the present report.

Parameters of Study:

Following parameters of study were addressed during course of investigations:

1. Determination of Adult House Index of *Aedes* mosquitoes in study areas.
2. Determination of breeding profile of *Aedes* in study areas.
3. Evaluation of extrinsic dengue virus activity in different settings.
4. Current status of disease magnitude as per report of Medical college, Jodhpur.
5. Correlation of attributes of study areas with observations to study possible risk factors.

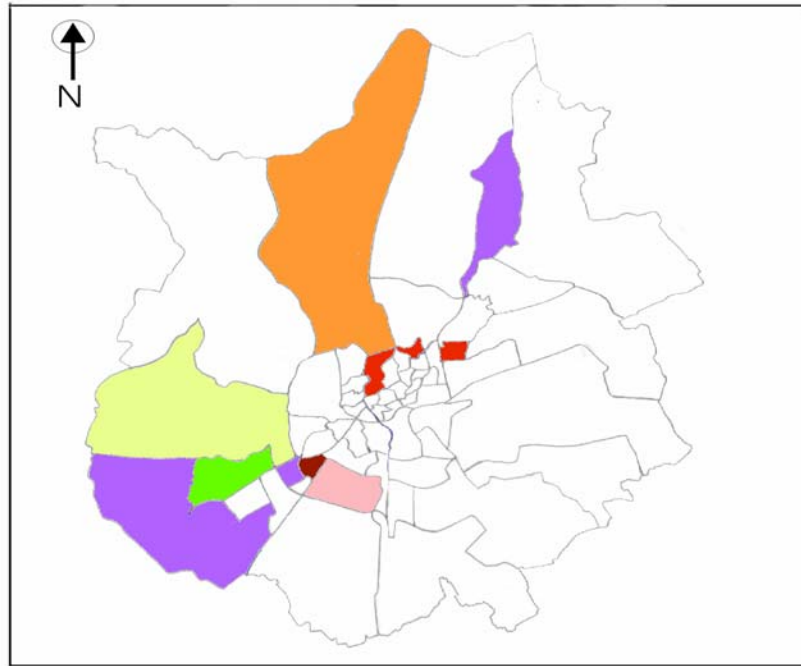
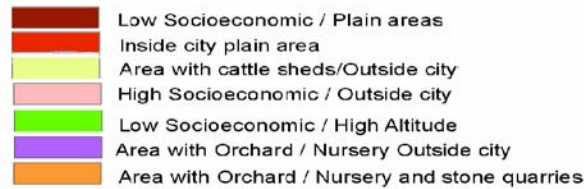


Fig 2: Map of Jodhpur city depicting GR based study areas for Dengue vector survey



Observations

The observations made during the period of two months (September & October, 2003), were focused to develop first a strategy of stratification of town as per epidemiologically important ecotypes and then gathering the information against the selected parameters. Following observations were made:

- The trend of observations suggested that all the 60 wards of Jodhpur city, from point of view of epidemiology of dengue, can be divided into 7 ecotypes. The investigations undertaken in these settings will represent entire city to plan and prioritize the preventive/control measures against dengue/DHF.
- The period of investigations represented post rainy period in the town and hence denote enhanced conditions of vector, virus and movement of man and materials within town. Data collected could form a baseline to plan anti-dengue measures.

Table-2. Adult house indices of *Ae. aegypti* in different study settings of Jodhpur town (September 2003).

Characteristics of Ward Surveyed	Ward Name	Adult House Hold Index		
		Number of House-Hold Examined	Positive	A.H.I
Area with Orchard/Nursery Outside city	-Chopasani-Village -C.H.B -Mandore	250	85	34%
Areas with Orchard/Nursery and Stone Quarries	Soorsagar	100	21	21%
Low Socio-Economic/ High Altitude	Chandana Bhakar	100	42	42%
Low Socio-Economic/ Plain Areas	Masuriya	100	54	54%
Area with Cattle Shed's/Outside city	Milk-Man Colony	100	21	21%
High Socio-Economic/ Outside City	Shastri Nagar	102	21	20.58%
Inside City/ Plain Area	-Juni Mandi -Bamba -Paota	300	79	26.33%
TOTAL	11	1052	323	30.7 %

Adult House Index (AHI):

- Of the total number of 1052 house holds or human dwellings surveyed in Jodhpur city, 323 (30.7 %) were positive for the presence of adult *Aedes* mosquitoes. Maximum AHI (54 %) was observed in the low socio-economic, plain areas (Masuriya) followed by another low socio-economic locality, Chandna Bhakar (42 %).
- Minimum AHI (26.3 %) was observed in the area characterized by high socio-economy and situated at outside city.
- Contrary to expected results, areas with orchard-nursery or those with stone quarries did not present higher concentration of adult *Aedes* mosquitoes.

Table- 3. Breeding details of *Aedes* mosquitoes in different study settings in Jodhpur town (September-2003).

Characteristics of Ward Surveyed	Ward Name	Breeding- Index											
		Ground			Under-Ground			Over-Head			Total		
		No. Ex.	+ve	%	No. Ex.	+ve	%	No. Ex.	+ve	%	No. Ex.	+ve	%
Area with Orchard/Nursery Outside city	-Chopasani-Village -C.H.B -Mandore	939	148	15.76	82	39	47.5	62	7	11.29	1083	194	17.91
Area with Orchard/Nursery and Stone Quarries	Soorsagar	451	139	30.82	1	1	100	-	-	-	452	140	30.97
Low Socio-Economic/ High Altitude	Chandana Bhakar	364	87	23.90	58	33	56.8	47	7	14.89	469	127	27.07
Low Socio-Economic/ Plain Areas	Masuriya	444	106	23.87	52	21	40.3	29	5	17.24	525	132	25.14
Area with Cattle Shed's/Outside city	Milk-Man Colony	456	54	11.84	51	18	35.2	15	3	20.0	522	75	14.36
High Socio-Economic/ Outside City	Shastri Nagar	330	59	17.87	52	5	9.61	36	12	33.33	418	76	18.18
Inside City/ Plain Area	-Juni Mandi -Bamba -Paota	1360	370	27.20	11	6	54.5	4	-	0.0	1375	376	27.34
TOTAL	11	4344	963	22.1	307	119	38.7	193	34	17.6	4844	1120	46.2

***Aedes aegypti* breeding Index:**

- Areas with orchard nursery and stone quarries revealed maximum breeding (30.9%) followed by inside city plain areas (27.3 %) and closely followed by low socio-economic, elevated areas (27.0 %) and low socio-economic plain areas (25.1%). Unlike adult profile of *Aedes* mosquitoes, urban set up has been found to favour more breeding of vectors, followed by low socio-economic areas.
- Among different types of containers examined for the breeding, underground water tanks had highest breeding positivity (38.7 %) followed by the tanks/utensils lying on the ground (22.1 %). Least breeding (17.6 %) was observed in overhead tanks.

Table- 4. Observations showing correlation of vector biological profile with the occurrence of dengue cases in the Jodhpur town (September, 2003).

Area	Characteristics	Adult House Index	Breeding Index	Cases of dengue*
-Chopasani-Village -C.H.B -Mandore	Area with Orchard/Nursery Outside city	34	17.91	5
Soorsagar	Area with Orchard/Nursery and Stone Quarries	21	30.97	2
Chandana Bhakar	Low Socio-Economic/ High Altitude	42	27.07	11
Masuriya	Low Socio-Economic/ Plain Areas	54	25.14	3
Milk-Man Colony	Area with Cattle Shed's/Outside city	21	14.36	4
Shastri Nagar	High Socio-Economic/ Outside City	20.58	18.18	12
-Juni Mandi -Bamba -Paota	Inside City/ Plain Area	26.33	27.34	20

* As per report of hospital records

Association of entomological indices and dengue cases

Maximum number of case serologically confirmed case of dengue have been reported from Inside city, plain area (Table-4). The study areas in which maximum dengue cases are reported also represent the area of maximum breeding of *Ae. aegypti* and in addition, the area of dense human population where maximum susceptible population (children) is expected (Table-3).

Conclusions

- The GR based classification of all the 60 wards of Jodhpur city on the basis of the characteristics relevant in the epidemiology of dengue, with minor modifications, appear to be necessary need to be developed as baseline of planning dengue prevention programme for Jodhpur. The approach used in the present study seems to be applicable in other parts too for the long-term anti-dengue activities.
- Socio-economic conditions and urban set up of locality have emerged as strong predictors of vector concentration. Results of present investigation may serve to prioritize the localities of the town and carry out control operations accordingly.
- Fairly high numbers of patients with confirmed serological presence of virus have been reported during the study period. The sample population need to be screened for presence of IgM antibodies to detect source maintaining and amplifying the viraemia.

Development of a computer based Health Management Information System (HMIS) in Rajasthan using Remote Sensing and Geographical Information System- *R. C. Sharma, Vinod Joshi and Manju Singhi*

Date of Commencement: **January, 2004** Duration: **One Year** Status: **Ongoing**

Objectives

1. To increase the efficiency and effectiveness of health management systems for improving the healthcare delivery and quality of health services through efficient and optimum utilization of available manpower and resources for sustainable results.
2. To reduce the disease load in the communities and to develop early warning systems for forecasting impending epidemic situations for undertaking timely preventive and control measures.
3. To identify problems in programme implementation requiring attention and intervention.

Rationale

In the state of Rajasthan, especially in its north-western desert part, malaria is the major cause of morbidity and mortality of inhabitants. The fact that the disease continues as one of the major public health problems in area, necessitates an approach to control the disease with the inclusion of some non-conventional management. The existing knowledge and investment in the management of malaria can be optimally used for its improvized control through re-modeling and managing the available information and resources. Application of modern tools such as GIS and RS can be used for evaluating their possible role in achieving the target.

Under extended objectives of Health Management Information System project, two sample PHCs suggested by the state health department have been selected viz; Tinwari PHC in Jodhpur district and Ramgarh PHC in Jaisalmer district. Current objectives to develop exemplary work in the project are to answer two specific questions:

1. Why malaria is persistent in these two PHC areas of Jaisalmer and Jodhpur districts
2. Prediction of malaria situation in selected villages of study PHCs.

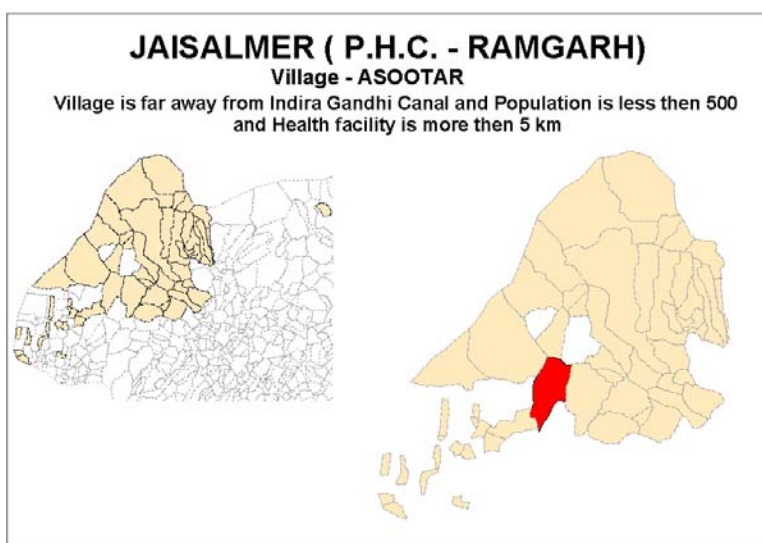
Progress of Work

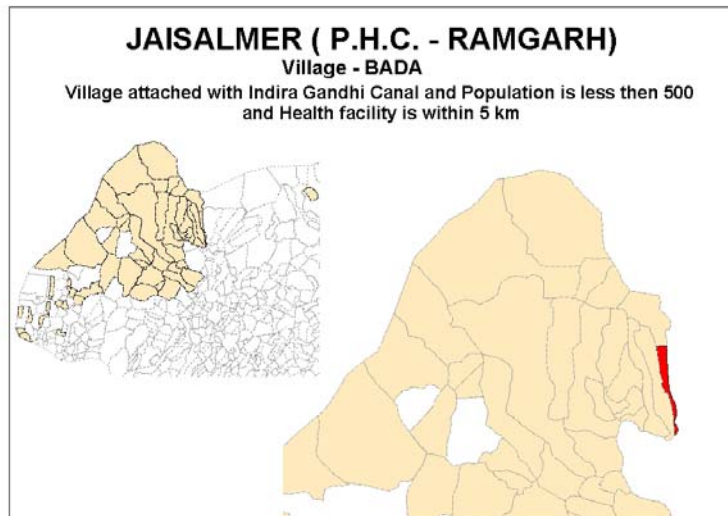
Perception of work:

Ongoing malaria monitoring and control activities in the state of Rajasthan are targeted to tackle the disease situation with two pronged approach; containment of parasite through anti malaria drug and insecticide spray for vector control. However, causes of malaria introduction and its prospective transmission mechanism can not be understood until a picture in totality is projected. Without understanding the problem in totality, epidemiological or peri-clinical solution to malaria can not be offered. Hence, at each PHC, sub centre and village level retrospective malaria profile needs to be consolidated, attributes to be correlated and determinants are to be segregated to use them as predictors and key factors of malaria control.

Selection of study areas and classification as per attributes:

All the 58 villages in Ramgarh PHC of Jaisalmer district have been digitized using GIS. For selection of study areas to attain the stated objectives, available data of state health department on malaria incidence are being used. However, in addition to magnitude of disease in a village, other characteristics viz; population of village, distance form health facility and location of villages from IG canal, have also been recorded and extrapolated over of villages having different magnitude of malaria. So far 9 representative groups of villages including 58 villages have been formed in Ramgarh PHC of Jaisalmer district. GIS digitized, polygonal presentation of two villages is shown in the figures below:





Work remains to be carried out:

It has been planned that during forthcoming year following activities will be performed to deliver the outputs of the HMIS project for the use by public health managers:

- Malaria magnitude data of individual villages of Ramgarh PHC will be collected and based on recent most disease burden, different clusters of villages will be formed.
- Inputs of important risk factor such as migration will be provided to the programme.
- Through investigations to be conducted on entomological, parasitological and epidemiological aspects in each study villages, corresponding values of vector presence and its preponderance will be accommodated in the programme.
- Predictive model will be prepared based on combinations of parameters shown above to forecast risk of prospective malaria in each village of the study PHC.

Studies on *Calotropis procera* as larvicide and repellent plant against vectors of Dengue and DHF in Rajasthan, India- *Manju Singhi, Vinod Joshi and P.K. Dam*

Date of commencement: **July 2003** Duration: **Two and half years** Status: **Ongoing**

Objectives

1. To study the efficacy of plant as larvicide and repellent against vectors of dengue.
2. To determine optimum dose of larvicide and study mode of action against vectors of dengue.
3. To study further role of latex of *Calotropis procera* as possible restricting agent for entry of dengue virus into cell line cultures of *Ae. aegypti* and *Ae. albopictus*.

Rationale

Dengue fever associated with Dengue Haemorrhagic Fever is emerging as one of the major infectious diseases in many parts of India including North -western state, Rajasthan. In the absence of any specific chemotherapy against this viral infection and with the confirmed reports of virus being maintained through transovarial transmission among vector fauna of dengue endemic localities, vector control attempting source reduction (larval control) through appropriate means is an effective methods of prevention of disease. *Calotropis procera* is a wildely grown plant of the desert available throughout the year. The plant may contain certain alkaloids which are responsible for the larvicidal efficacy. Preliminary results have shown that the latex avilable in *C. procera* has remarkable effect as larvicide. Through proposed project, the possibility of identification of active ingradient of *C. procera* latex against *Ae. aegypti* and *Ae. albopictus* will be explored for the formulation of a bio-larvicide. In addition, the optimum dose determination of larvicide will also be made to study feasibility of its use as handy and cost effective larvicide in vector control programmes. The preliminary work undertaken has shown that site of action of larvicidal latex is GI tract of mosquito larvae. Since in the adult mosquitoes this is the site of dengue virus development too, further studies will be made in experimental cell line cultures of vector species to study whether *C. procera* in addition to being larvicidal, may also act as incapacitating agent of virus into GI tract cells of larvicide exposed larvae.

Progress of the work

C. procera is the most abundant species available throughout the areas of desert ecosystem, during all the seasons of the year. The plant has been collected from DMRC campus during summer and rainy season. Latex was extracted manually and dissolved in water to prepare stock solution. Further dilutions were prepared from 0.1 to 5 % concentrations of latex in water. Larvae of mosquitoes were collected from the urban areas of Jodhpur city. Larvae were maintained in the laboratory at about 25 °C ambient temperature and at about 60-70 % relative humidity. Sterilized dog biscuit and yeast powder were provided as a larval food to experimental as well as control batches of immature of all the mosquito species. Control was kept in natural water to compare the results of experimental exposure. The experiments were repeated to observe consistency of results.

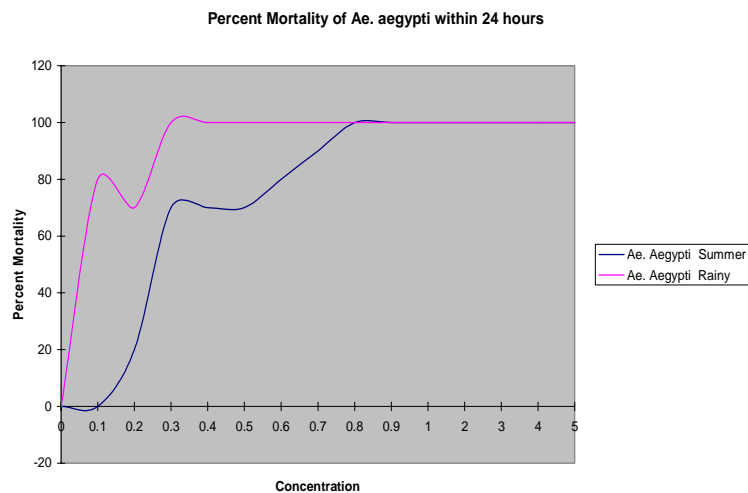
The susceptibility level of *Ae. aegypti* in the different concentrations of latex was determined. Table shows observations made to study the effect of different experimental concentrations of latex against the larvae of dengue vectors during summer and rainy season. It was interesting to note that a fairly low concentration 0.3% latex in water is effective during rainy season while during summer season 0.8 % latex in water shows 100% mortality against vector of dengue *Ae. aegypti* within 24 hrs . The corresponding observations made for controls showed no mortality of larvae under experimental conditions.

When examined microscopically the mode of action of latex was observed to cause extrudation of the organelles situated near the excretory pores of effected larvae. This indicated systemic action of larvicide failuring enzymatic / absorptive incapacitation of exposed larvae. Since the plant *C. procera* is an indigenous and widely grown plant species, its use by local village population through translating experimental lethal concentration into handy domestic measurements and then application to the mosquito breeding sites can bring larval control measures right at the level of the inhabitants of dengue endemic areas.

Table- 1. Larvicidal efficacy of *Calotropis procera* latex against *Aedes aegypti*.

S. No.	Concentration (%)	Percent Mortality after different time interval (Hrs.)											
		24		48		72		96		120		144	
		S	R	S	R	S	R	S	R	S	R	S	R
1.	Controls	Nil	NIL	Nil	NIL	Nil	NIL	Nil	NIL	Nil	NIL	Nil	NIL
2.	0.1	Nil	80	20	90	20	90	30	90	30	100	30	DS
3.	0.2	20	70	70	80	70	100	70	100	70	DS	80	DS
4.	0.3	70	100	90	DS	90	DS	90	DS	100	DS	100	DS
5.	0.4	70	DS	100	100	100	DS	100	DS	DS	DS	DS	DS
6.	0.5	70	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS
7.	0.6	80	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS
8.	0.7	90	DS	DS	100	DS	DS	90	DS	90	DS	100	DS
9.	0.8	100	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS
10.	0.9	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS
11.	1.0	DS	DS	DS	100	DS	DS	DS	DS	DS	DS	DS	DS
12.	2.0	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS
13.	3.0	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS
14.	4.0	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS
15.	5.0	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS

S = summer, R = rainy, DS = did not survive



Studies on the inheritance of synthetic pyrethroid resistance in *Anopheles stephensi* in view to know the speed and mechanism of resistance and the cross-resistance to other insecticides - Karam V. Singh and S. K. Bansal,

Date of Commencement: **January 2003** Duration: **Two Years** Status: **Ongoing**

Objectives

1. To study the knockdown resistance, if any,
2. To know the type and speed of the resistance, and
3. To study the cross-resistance spectrum

Rationale

The mosquito vector species have developed resistance to majority of the conventional insecticides, like DDT, BHC, malathion, etc., which have been used in vector control programmes. The studies have revealed that the synthetic pyrethroids are highly effective against those vector species, which have developed resistance to most of the organochlorines, organophosphates and carbamate compounds. Because of this property, the synthetic pyrethroids have been included in most of the vector control programmes recently. However, the precipitation of resistance against synthetic pyrethroids too has been recorded at some places among vector species. Keeping this aspect in view the present studies have been planned to study the speed, type and mechanism of resistance of synthetic pyrethroids in *An. stephensi*, an important malaria vector of desert. The information on the above aspects will be utilized for judicious use of these compounds to maintain their efficacy for a longer period. The information on the cross-resistance of synthetic pyrethroid to other compounds would suggest the inclusion of most appropriate compound(s) in future control strategies.

Progress of the work

To study the inheritance of synthetic pyrethroid resistance in anopheline species selection studies were undertaken and for the purpose *An. stephensi* strain, collected from peri-urban areas of Jodhpur, was considered. The base-line data on the susceptibility of this strain, which would represent the data of susceptible strain, was obtained through dose-mortality response against a synthetic pyrethroid - Cyfluthrin (Technical grade 95.5%), procured from M/S Bayer India Ltd.

A colony of *An. stephensi* was raised in the insectory of the centre. The standard procedure for rearing *anopheline* mosquitoes was followed. All life stages were reared in the insectory at temperature $28 \pm 2^\circ\text{C}$ and RH $70 \pm 5\%$. The adult mosquitoes were provided

with cotton soaked with a 10% glucose solution, besides, raisin and candy. The female mosquitoes were given blood feed on the third day post-emergence, and after 2-3 days oviposition-bowls were placed in the cages containing gravid females. The eggs were collected following day and kept outside cages for hatching. The larvae were given larval food prepared using dog biscuits and yeast powder (60:40). Pupae were collected daily and transferred to respective cages for emergence.

The susceptible strain of *An. stephensi* was placed under selection pressure with cyfluthrin at the concentration that caused 50% mortality. Due to the non-availability of cyfluthrin impregnated papers, the selection was given at larval stage instead at adult stage. The LC₅₀ of each subsequent generation was considered for the selection of next generation. The consideration of LC₅₀ was made taking into account the survivors for next generation. The survivors were raised as usual in the insectory. Approximately 1000 individuals were selected for each generation. The susceptibility level of cyfluthrin in successive generations was determined calculating LC₅₀ and LC₉₀ values. The susceptibility level of S-4 generation was found 2.9 times reduced in comparison to normal generation at LC₅₀ level (Table 1).

Table- 1. Data on the susceptibility of normal and S-4 generations of *Anopheles stephensi* against cyfluthrin.

S. No.	Generations Tested	Regression Coefficient	Regression Equation	Chi-Square (df)	LC ₅₀ (Fiducial limits)	LC ₉₀ (Fiducial limits)
1.	Normal	1.54	Y=2.03+1.54x	5.6 (3)	0.0085 (0.006-0.013)	0.0578 (0.012-0.277)
2.	S-4	1.49	Y=2.91+1.49x	6.4 (3)	0.0253 (0.014-0.040)	0.1833 (0.043-0.779)

All values of LC₅₀ and LC₉₀ are in mg/l.

During the studies, tests were also conducted to determine the knockdown time of the selected generations to know whether the knockdown resistance is also developing during the selection process in the subsequent generations. It was observed that the knockdown time at 50% level (KD₅₀) was found higher in S-4 in comparison to normal generation (Table 2).

Table- 2. Data on the development of knockdown resistance in normal and S-4 generations of *Anopheles stephensi* against cyfluthrin.

S. No.	Generations Tested	Regression Coefficient	Regression Equation	Chi-Square (df)	KD₅₀ (Fiducial limits)	KD₉₀ (Fiducial limits)
1.	Normal	7.68	$Y = -11.8 + 7.68x$	1.31 (3)	15.35 (12.51-18.82)	22.54 (12.31-41.23)
2.	S-4	9.67	$Y = -16.5 + 9.67x$	1.56 (3)	16.72 (14.28-19.57)	22.68 (15.28-33.65)

All values of KD₅₀ and KD₉₀ are in minutes.

Comparative efficacy of different synthetic pyrethroid compounds to major mosquito vectors in the Thar desert - S.K. Bansal and Karam V. Singh

Date of Commencement: **April, 2001** Duration: **Three Years** Status: **Concluded**

Objectives

1. To determine the larval and adult susceptibility of *An. stephensi*, *Aedes aegypti* and *Culex quinquefasciatus* towards different synthetic pyrethroids (SP) like Fenvalerate, deltamethrin, cypermethrin, cyfluthrin and lambda cyhalothrin.
2. To determine the effect of synergists on the efficacy of these compounds in the arid conditions.

Rationale

Vector control, which includes both anti-larval and anti-adult measures, constitutes an important aspect of mosquito control programmes. The different larval and adult stages of mosquitoes have different susceptibility status in different geographical areas. Therefore, resistance status of each species in each area should be determined well before the anti-vector programmes are initiated. Such studies would help as an aid in selecting the most appropriate adulticide or larvicide for the inclusion in control operations and in understanding a possible mechanism of inheritance of insecticide resistance.

Progress of the work

Experiments on the comparative efficacy of synthetic pyrethroids under the above project were carried out in different areas of Jodhpur city. Susceptibility tests were carried out with larvae of three major mosquito species viz. *Anopheles stephensi*, *Aedes aegypti* and *Culex quinquefasciatus*. Fenvalerate (20% E.C) and Deltamethrin (2.8% E.C) were selected as the candidate compounds to test the larvae of above three mosquito species. Third or early fourth instar larvae of these mosquito vectors were tested as per standard WHO method for determining the baseline data on their susceptibility status. Stock solutions of fenvalerate and deltamethrin were prepared in ethyl alcohol and different concentrations of the above pyrethroid compounds were added in 249 ml of water to obtain required concentrations. 20-25 larvae of each mosquito species were released in each concentration. Mortality was noted after 24 hr and corrected by using Abbott's formula. Average of four observations was taken and data was subjected to probit analysis.

Observations on the larval susceptibility to fenvalerate have been given in Table 1. With all the mosquito species mortality was found dose dependent. LC_{50} and LC_{90} values along with their fiducial limits, regression equation and chi-square were calculated. LC_{50}

values as observed for *An. stephensi*, *Ae. aegypti* and *Cx. quinquefasciatus* were 0.1006, 0.0046 and 0.0112 mg/l respectively which showed that larvae of *Aedes* were 21.9 and of *Culex* 9.0 times more susceptible than *Anopheles* to fanvalerate.

Table- 1. Larvicidal efficacy of Fanvalerate to the larvae of three major mosquito vectors.

Mosquito species/ Concentrations (mg/l)	No. Exposed	No. Dead	Percent Experimental Mortality	Percent Corrected Mortality
<i>An. stephensi</i>				
Control	104	6	5.8	–
0.01	104	25	24.0	19.3
0.05	101	42	41.6	38.0
0.10	101	53	52.5	49.6
0.50	100	71	71.0	69.2
1.00	100	97	97.0	96.8
<i>Ae. aegypti</i>				
Control	89	5	5.6	–
0.0010	88	11	12.5	07.3
0.0025	90	28	31.1	27.0
0.0050	84	47	56.0	53.4
0.0100	83	69	83.1	82.1
0.0500	88	86	97.7	97.6
<i>Cx. quinquefasciatus</i>				
Control	140	4	2.9	–
0.0025	145	15	10.3	10.3
0.0050	137	27	19.7	19.7
0.0100	143	63	44.1	44.1
0.0250	146	117	80.1	80.1
0.0500	149	140	94.0	94.0

Larval susceptibility tests with *An. stephensi*, *Ae. aegypti* and *Cx. quinquefasciatus* were also carried out with deltamethrin and the results have been given in Table 2. The concentrations used in the experiments were from 0.00001 to 0.1mg/l. The LC₅₀ and LC₉₀ values along with their fiducial limits, regression equation and chi-square were calculated. The LC₅₀ values as determined for *An. stephensi*, *Ae. aegypti* and *Cx. quinquefasciatus* were 0.0092, 0.00004 and 0.00073 mg/l respectively which revealed that the *Ae. aegypti* is much more susceptible than the rest of the two species. *Aedes* was found 230 times more susceptible than *Anopheles*, while *Culex* only 12.6

times. Results of the log probit regression analysis of the data of all the three mosquito species have been given in Table 3.

Table- 2. Larvicidal efficacy of Deltamethrin to the larvae of three major mosquito vectors.

Mosquito species/ Concentrations (mg/l)	No. Exposed	No. Dead	Percent Experimental Mortality	Percent Corrected Mortality
<i>An. stephensi</i>				
Control	114	5	4.4	—
0.001	113	20	17.7	17.7
0.005	109	35	32.1	32.1
0.010	110	54	49.1	49.1
0.050	112	94	83.9	83.9
0.100	112	110	98.2	98.2
<i>Ae. aegypti</i>				
Control	91	6	6.6	—
0.000010	90	17	18.9	13.2
0.000025	90	31	34.4	29.8
0.000050	90	59	65.6	63.2
0.000100	93	75	80.6	79.2
0.000500	92	89	96.7	96.5
<i>Cx. quinquefasciatus</i>				
Control	140	5	3.6	—
0.0001	139	24	17.3	17.3
0.0005	136	50	36.8	36.8
0.0010	134	70	52.2	52.2
0.0025	137	114	83.2	83.2
0.0050	140	130	92.9	92.9

Table- 3. Log probit analysis of the mortality data of larvae of different mosquito species to Fanvalerate and Deltamethrin.

Mosquito species	Regression Equation	Chi-Square (DF)	LC₅₀ (Fiducial Limits)	LC₉₀ (Fiducial Limits)
Fanvalerate				
<i>Anopheles stephensi</i>	Y=0.90x+4.09	2.49(3)	0.1006 (0.0564-0.1794)	2.6218 (0.5063-13.5738)
<i>Aedes aegypti</i>	Y=2.24x+3.53	0.23(3)	0.0046 (0.0034-0.0061)	0.0169 (0.0091-0.0315)
<i>Culex quinquefasciatus</i>	Y=2.17x+2.72	0.83(3)	0.0112 (0.0089-0.0142)	0.00436 (0.0255-0.0746)
Deltamethrin				
<i>Anopheles stephensi</i>	Y=1.18x+3.86	3.25(3)	0.0092 (0.0058-0.0145)	0.1118 (0.0340-0.3675)
<i>Aedes aegypti</i>	Y=1.93x+3.83	0.77(3)	0.00004 (0.00003-0.0006)	0.0002 (0.0001-0.0004)
<i>Culex quinquefasciatus</i>	Y=1.27x+3.90	2.83(3)	0.00073 (0.00051-0.0011)	0.0075 (0.0030-0.0107)

Role of Fluoride in Urolithogenesis in Desert Population of Rajasthan- *K.R. Haldiya, Raman Sachdev and M.L. Mathur*

Date of commencement: **January, 2004.** Duration: **2 Years** Status: **Ongoing**

Objectives

Phase I:

1. To find out prevalence of urolithiasis in endemic and nonendemic fluoride areas of Rajasthan.

Phase II:

1. To find out association of fluoride with urolithiasis, if any, by comparing the stone formers and nonstone formers for the following:
 - Serum fluoride level
 - Total intake of fluoride, and
 - Dietary profile
2. To study metabolic effects, if any, by high fluoride intake in stone formers.
3. Estimation of fluoride content in urine and calculi

Progress of the Work

During this period a rapid survey was carried out to confirm the finding of preliminary survey that urolithiasis is more prevalent in fluoride endemic areas than non-endemic.

The survey was carried in rural and urban areas of Jodhpur (medium) and Nagaur (Highly affected) districts. The area was selected on the basis of fluoride content in the drinking water based on WHO/ ICMR criteria.

A total of 2560 households were covered. The head of household or any other adult member of family was interviewed and enquired about cases of urolithiasis in the family and confirmed on the basis of following criteria- i) X-ray diagnosis of urinary calculus, ii) History of operation of urinary calculus, and iii) History of passing stone in urine. The total members aged 15 years and above were 9487.

172 cases of urolithiasis of 15 years of age and above were recorded on the basis of above mentioned criteria. The over all prevalence of urolithiasis was 1.8 percent. The prevalence of urolithiasis in endemic areas was 2.2 percent while in non-endemic areas, it was 1.3 percent, which is statistically significant ($p < 0.0038$). The majority of the cases observed were in the age group of 40 years and above. The duration of urinary calculus was taken when patient first came to know about it. The maximum duration was 1-4 years (41.9%), followed by less than one year (37.2%) and remaining varied from 5-20⁺ years (21.9%). The prevalence of urolithiasis in males was 2.3 percent while in females, it was 1.2

percent ($p < 0.0001$). The prevalence of urolithiasis in known hypertensive was 3.8 percent while in non-hypertensive, it was 1.7 percent ($p < 0.025$).

Table-1. Percent prevalence of urolithiasis according to surveyed villages.

Name of Villages/city	Urolithiasis		Prevalence (%)
	Surveyed Population	Cases	
Jodhpur (Urban)	2649	40	1.5
Borunda	1639	73	4.5
Chaba	990	2	0.2
Balesar	1681	27	1.6
Bap	1015	9	0.9
Gachipura	682	10	1.5
Ramsiya	307	4	1.3
Jasvantpura	187	2	1.1
Kakel	337	5	1.5
Total	9487	172	1.8

Table-2. Sex-wise prevalence of urolithiasis in surveyed populations according to fluoride status.

Renal calculus	Males		Females		Total**	
	Endemic	Non Endemic	Endemic	Non Endemic	Endemic	Non Endemic
Present	79(2.7) *	39(1.8)	39(1.5) *	15(0.8)	118 (2.2)	54 (1.3)
Absent	2871(97.3)	2187(98.2)	2497(98.5)	1799(99.2)	5486(97.8)	4001(98.7)
Total	2950	2187	2536	1814	5604	4055

Values in Parentheses shows percentage

* $p < 0.03$ $p < 0.03$, ** $p < 0.003$

Work remaining to be carried out

The study will be carried out in remaining selected areas and fluoride content of water and stone analysis will be done.

Possible outcome and Utilization

The study will help in understanding the formation of urinary calculus in endemic fluoride areas and its prevention.

Epidemiology of Essential Hypertension in Arid Population of Rajasthan- *K.R. Haldiya, Raman Sachdev and M.L. Mathur*

Date of commencement: **January, 2004.** Duration: **2 Years** Status: **Ongoing**

Objectives

1. To determine prevalence of hypertension in desert population and confirm high prevalence of hypertension in Gachipura village of Rajasthan.
2. To identify the risk factors for hypertension in desert population.
3. To determine the awareness and its impact on control of hypertension.
4. To determine the magnitude of secondary complications due to hypertension.

Progress of the Work

The project was revised as per suggestions of experts and proforma along with the protocol was prepared. The project was submitted for WHO grant for 2004-2005. The preliminary visits were made in the selected area of survey. The detail analysis of data for blood pressure of previous surveys was carried out. The analysis of data of Nawa city showed that prevalence of hypertension was 15.7%. The visit to Makarana and Kuchaman city was also done and it was observed that hypertension is one of the major non-communicable disease in Nagaur district. The schedules were finalized after taking into consideration the schedules of WHO stepwise NCD Risk Factor Surveillance.

Work remaining to be carried out

The detailed survey work will be started from April 2004.

Possible outcome and Utilization

The study will identify the risk factors of high prevalence of hypertension in Nagaur district and will provide estimates of prevalence, awareness, treatment and control of hypertension in the desert population which will assist in planning of intervention programme and database for hypertension in desert population.

Study of Silica Induced Renal Damage – *Murli L. Mathur and K. R. Haldiya*

Date of commencement: Jan 2004 **Duration:** Two Years **Status:** Ongoing

Objectives

1. To find out if sandstone quarry workers are at a greater risk of developing renal disorders.
2. To examine association between duration of exposure to silica dust and renal disorders.

Rationale

There are many case-reports of glomerulonephritis in cases of silicosis. Some studies using analysis of records and registries, showed comparatively higher risk of End Stage Renal Disease (ESRD) in silica-exposed workers, while others refuted this hypothesis. Analysis of records and registries, have also revealed slightly excess mortality due to chronic renal diseases in silica-exposed workers. Relation of renal damage to duration and dose of exposure to silica is still not established. Case-control studies have shown increased microproteinuria and enzymeuria in silica-exposed workers, both of which are known early indicators of renal damage. Among different studies about renal diseases in silica-exposed workers, none has been carried out on sandstone workers; any such report is not from Indian subcontinent. It is therefore proposed to carry out this study to find out if sandstone quarry workers of western Rajasthan are at a greater risk of developing renal diseases and if there is any dose response relationship.

Progress of the work

A total of 101 sandstone quarry workers and 27 controls were studied. Mean age of these 101 workers was 29.89 ± 8.15 years. Only one of them had their serum beta microglobulin less than 3.0, while all others had it more than 3.0. Serum beta microglobulin of workers had no association with their duration of working in quarries, as given in Table 1.

Table- 1. Mean serum beta microglobulin of quarry workers according to their duration of working in quarries.

Duration of working in quarries (Years)	No. of workers (N)	Mean serum beta - microglobulin
<6	20	4.38 ± 0.66
6-10	40	4.70 ± 1.43
11-15	20	4.82 ± 1.82
16-20	11	4.75 ± 0.91
>20	10	5.61 ± 1.62
Total	101	4.75 ± 1.40

Serum creatinine was 1.0 in 16 1.1 in 9 and, 1.2 in other 2 workers; however, in all other 74 workers serum creatinine was less than 1.0. In one of the workers serum urea was 48 while in all others it was below 45.0. In these 101 workers linear regression between serum creatinine and serum beta microglobulin showed very poor correlation ($R^2=0.05$)

Mean age of 27 non-workers was 30.9 ± 11.54 years whose mean serum beta-microglobulin was 2.02 ± 0.52. In only two cases serum beta-microglobulin was more than 3.0 and serum creatinine was 1.2 and 1.3 respectively, while their serum urea was 35.7 and 37.2 respectively.

Effect of high fluoride contents of drinking water on lungs of exposed human beings- *Raman Sachdev, M. L. Mathur, K. R. Haldiya and J. Lakshminarayana*

Objectives

1. To find out if long exposure to drinking water with high fluoride contents damages the lung parenchyma to the extent that it is reflected in x-ray chest or results of spirometry.

Progress of Work

During this period, a house-to-house survey was carried out in 100 households of Ramsiya village of Makrana tehsil of Nagaur district and Netra village of Bhopalgarh tehsil of Jodhpur district. Detailed clinical examination was done in 50 individuals. Eleven chest x-rays (PA View) were taken. Twelve urine samples and drinking water samples from two different sources of Ramsiya were collected for estimation of fluoride. Two samples of drinking water from different sources of Netra village were also taken. The data of endemic fluoride area were compared with non-endemic area of village Kakelao of Jodhpur district and it was found that non-skeletal symptoms of fluorosis in endemic area were three times higher than those of non endemic area. Out of 11 chest x-rays chest (PA View) taken in the PHC Makrana, four were repeat x-rays of the persons of whom, chest x-rays were taken one year back and they were read and compared by the experts. Three x-rays showed definitive fluorotic changes in left apical/middle regions of the lungs which required further detailed investigation. The individuals did not give h/o pulmonary tuberculosis or antituberculous treatment.

The average urinary fluoride excretion was 10.1 ± 4.1 ppm while average fluoride content of drinking water in endemic fluoride area was 5.6 ± 1.1 ppm and in non-endemic area, it was < 1.0 ppm.

Important leads/outcome from the study and possible utilization

After having studied and confirming the pulmonary changes in endemic fluorosis area due to high fluoride content in drinking water the study will be able to help in differential diagnosis of pulmonary tuberculosis and avoid unnecessary treatment of tuberculosis in those patients who are actually not suffering from it.

Morbidity pattern and Nutrition among the workers engaged in Textile industry of Pali and Jodhpur districts of Rajasthan – Madhu B. Singh, Ranjana Fotedar and J. Lakshminarayana

Date of commencement: **August, 2001**. Duration: **2 yrs & 6 months** Status: **Concluded**

Objectives

1. To find out the pattern of diseases prevalent in the workers engaged in the textile industry.
2. To find out the extent and type of malnutrition existing among the textile workers.
3. To find out socio demographic profile of the workers engaged in the textile industry.

Progress of the work

Project prelude activities included the field visits to thirty three textile industries selected randomly from Jodhpur district and Pali district. A total of 1240 workers have been examined out of which 845 were textile workers. Data on 395 comparative group workers of same age groups and smoking habits who were not being involved in the textile work have also been collected from eight colonies of Pali and Jodhpur district which were around the textile industries. From each worker, information on Socio-demographic/ economic aspects, duration of exposure and smoking habits were recorded in pre-structured schedules by means of Interview Technique. Workers who worked in the textile industry at least for one year and more were considered for the present study. Each worker was examined for present and past illnesses, anthropometry, dietary intake (24 hours recall method) and clinical examination of nutritional deficiency signs. Routine urine investigations for RBC, albumin, sugar, and ketone (multiple strip method) and haemoglobin estimation by Cymmethaemoglobin technique (Filter paper method) was done.

Analysis of 1240 workers has been done out of which 845 were textile workers and 395 comparative group workers. Table 1 and 2 showed the age- and sex-wise distribution of the workers. Textile hand processors work has been categorized into four groups i.e. Causticizing & Bleaching, Dyeing, Printing and Finishing (Stentering i.e. sizing of cloth, Felt finishing and packing). In the present study 96.9 percent male and 3.0 percent were female workers. Majority of the workers (55.3 %) belonged to 18 to 30 years age group. Present survey showed child labour in the textile industry to be 4.7 percent. 21 percent workers were illiterate. Maximum textile workers were Hindu (92.6 %), followed by Muslim (7.3%) and Sikh (0.1%). Regarding their smoking habits (Table 5), 51.4 percent were smoking various types such as Gutka (30.1 %), Zarda (37.7 %) and Beerli (25.0 %)

Table- 1. Age wise distribution of workers and Comparative group.

Age Group	Textile workers		Comparative group	
	Number	%	Number	%
<18	40	4.7	22	5.6
18-30	467	55.3	188	47.6
30-40	221	26.2	102	25.8
40-50	92	10.8	63	15.9
>50	25	3.0	20	5.1
Total	845	100.0	395	100.0

Table- 2. Age and sex -wise distribution of workers and Comparative group according to type of textile work (N = 845 & Comparative group = 395).

Age Group	Caust.& Bleaching		Dyeing		Printing		Finishing		Total		Comparative group	
	M	F	M	F	M	F	M	F	M	F	M	F
<18	0	0	11	0	14	0	14	1	39	1	20	2
18-30	39	0	67	4	186	0	171	0	463	4	173	15
30-40	30	0	53	10	54	0	70	4	207	14	95	7
40-50	7	0	21	5	22	0	36	1	86	6	58	5
>50	1	0	8	1	2	0	13	0	24	1	19	1
Total	77	0	160	20	278	0	304	6	819	26	365	30

Table- 3. Percent distribution of workers and Comparative group according to education (N= 845 & Comparative group = 395).

Education Level	Total	Comparative group
Illiterate	18.5	4.1
Primary	31.4	23.3
Middle	26.4	25.6
Second.	15.1	23.3
S. Second.	5.7	5.6
College	2.8	18.2

Table- 4. Percent distribution of workers and Comparative group according to religion (N= 845 & Comparative group = 395).

Religion	Caust & Bleaching	Dyeing	Printing	Finishing	Total	Comparative group
Hindu	100.0	90.6	92.4	91.9	92.6	95.7
Muslim	0.0	9.4	7.2	8.1	7.3	4.3
Sikh	0.0	0.0	0.4	0.0	0.1	0.0

Table- 5. Percent distribution of workers and Comparative group according to type of smoking (N= 845 & Comparative group = 395).

Smokers			Type	Caust. & Bleach.	Dyeing	Print-ing	Finish-ing	Total	Compara-tive group
Yes	435	51.4	Beeri	28.2	36.0	18.7	23.3	25.0	16.7
			Cigarette	2.6	4.0	2.0	2.8	2.7	5.9
			Gutka	20.5	35.0	24.0	35.6	30.1	24.8
			Afeem	2.6	5.0	1.3	7.5	4.5	0.5
			Zarda	46.1	20.0	54.0	30.8	37.7	50.8
No	410	48.6	Non Smoker	9.2	19.7	30.9	39.9	48.6	53.2

Sickness at the time of survey was 52.9 percent in the textile workers (Table 6) which was high than comparative group workers i.e. 46.3 percent. Main morbidities reported at the time of survey in textile workers were aches (body ache, backache and headache) i.e. 19.4 percent, respiratory (12.1 %) and gastric complaints mainly abdominal pain (8.2 %) were higher than the comparative group i.e. 11.6 percent, 7.8 percent and 8.1 percent respectively. Fever in 7.7 % and skin morbidity in 4.1 % and general weakness along with loss of appetite and giddiness observed among 3.6 % in textile workers. Among the textile workers, gastric problems, respiratory, fever and general weakness were higher in printing group followed by bleaching, finishing and dyeing group workers whereas aches and skin problems were higher in dyeing group.

Table- 6. Morbidity profile of textile workers in different types of work.

Total workers: 845

Sick: 447 (52.9 %)

Comparative group: 395

Sick: 183 (46.3 %)

Type of Morbidity	Caust & Bleaching		Dyeing		Printing		Finishing		Total		Comparative group	
	No	%	No.	%	No.	%	No.	%	No.	%	No.	%
Aches	12	15.6	46	25.5	52	18.7	54	17.4	164	19.4	46	11.6
Respiratory	11	14.3	21	11.7	44	15.8	26	8.4	102	12.1	31	7.8
Gastric Problem	6	7.8	11	6.1	30	10.8	22	7.1	69	8.2	32	8.1
Fever	7	9.1	12	6.7	25	8.9	21	6.8	65	7.7	19	4.8
Skin	3	3.9	11	6.1	7	2.5	14	4.5	35	4.1	19	4.8
G.weakness	2	2.6	4	2.2	13	4.7	11	3.5	30	3.6	13	3.3
Eye	2	2.6	3	1.7	2	0.7	6	1.9	13	1.5	11	2.8
U.T.I	1	1.3	5	2.8	3	1.1	2	0.6	11	1.3	5	1.3
Ear	-	-	3	1.7	1	0.3	-	-	4	0.5	4	1.0
Others	3	3.9	9	1.1	3	3.9	18	2.1	33	3.9	20	5.1

Percent prevalence of morbidity in relation to housing conditions revealed that in textile workers, overall morbidity was lower (15.0 %) in good housing conditions than poor and fair conditions (85.0 %), whereas, in comparative group, only 56.7 % morbidities were observed in poor and fair housing conditions.

Percent prevalence of morbidity in relation to personal cleanliness revealed that in textile workers, overall morbidity was lower (4.5 %) in good cleanliness than poor and fair conditions (95.5 %), whereas, in comparative group, only 98.5 % morbidities were observed in poor and fair housing cleanliness. Percent prevalence of morbidity in relation to education revealed that in textile workers, overall morbidity was higher (79.6 %) in low education (Primary) than high education (Secondary & above - 5.7 %), whereas, in comparative group only 60.2 % morbidities were observed in low education and 18.4 % in high education.

Percent prevalence of morbidity in relation to anemia (Hb estimation) revealed that morbidities such as aches, gastric problems, general weakness, respiratory problems and fever were higher in textile workers suffering from anemia (71.3%) as compare to non anemic workers (28.7%), whereas, in comparative group, morbidity in anemic was 69.2% and in non anemic it was 30.8%.

Regarding anemia (cynmethaemoglobin technique) 66% textile workers were found to be anemic. Percentage of textile workers belonging to severe anemia category (below 7 gm/ dl) was 3.5 percent which was higher than comparative group workers(1.1%). Textile workers falling in the moderate category (7-10 gm/dl) was 21.2% which was again higher than comparative group workers (16.6%). Among the textile workers, percentage of moderate and severe anemia was observed to be maximum in the Dyeing group workers and least in the Printing, Caustisizing & Bleaching work

Regarding their nutritional deficiency signs, the relative percentage prevalence of the various signs related to protein calorie malnutrition in textile workers were discoloration (1.2%) and dryness of hair (0.4%). Regarding Vitamin A and B complex deficiency, Bitot spots were observed in 2.0 percent workers and angular stomatitis in 1.3 percent and cheilosis in 2.0 percent. Vitamin C deficiency (Bleeding of gums) was 15.4 percent. Teeth problems were observed to be high (41.8%). Percentage of textile workers having caries and mottled enamel in their teeth were 24.4 and 11.0 percent. Textile workers having both the problems i.e. caries and mottled enamel were 6.4 percent. Vitamin A, B complex & C deficiencies were higher in textile workers (2.1, 4.0 & 16.1%) than comparative group workers (0.2, 1.5 & 12.1%).

Dietary analysis (24 hours recall method) revealed that calorie deficit was 20.5 percent in male textile workers but their diet was rich in proteins in comparison to RDA, ICMR but due to calorie deficiency in their diet, proteins were being used in providing calories to the body which leads to protein energy malnutrition. Vitamin A deficiency was 42.9 percent in comparison to RDA, ICMR which may be responsible for vitamin A deficiency.

Anthropometrically, body mass index was calculated in order to observe the extent of malnutrition as per WHO categorization. Textile workers suffered from chronic energy malnutrition significantly higher (43.5%) than comparative group (38.2 %). Marginal and moderate thinness was higher in the workers engaged in the Dyeing work followed by Finishing and Printing work and least in the Caustisizing and Bleaching work.

Urine analysis revealed that 1.8 percent and 2.6 % workers were found positive for albumin and RBC respectively. Glucose and ketone were observed in 1.2 and 0.9% workers, whereas, in comparative group no positive case of RBC, ketone, albumin and sugar was observed in urine. Microscopic examination of some of the urine (114) and sputum (14) samples was done at Microbiology department, S.N.Medical college, Jodhpur. Microscopic examination of urine was done for pus cells, epithelial cells, cast, crystals and bacteria. Results revealed that 4.4 percent workers had significant pus cells in urine (pyuria) and bacteria indicating urinary tract infection. Only 2.6 percent textile workers showed significant presence of epithelial cells in urine suggesting mild inflammation in urinary tract. Cast was not observed in any case. Microscopic examination of sputum (only those cases who had chronic cough) showed insignificant

presence of pus cells, epithelial cells, bacteria, fungus and foreign material in textile workers. No positive case of AFB was observed.

Important leads/ outcomes from the study

Nutrition plays a vital role in the health of a community especially malnutrition. Results of the present study showed that sickness at the time of survey was higher in textile workers (52.9%) than the comparative group workers (46.3%). Main morbidities reported at the time of survey in textile workers were aches, respiratory and gastric complaints mainly abdominal pain and fever (8-20%) were higher than the comparative group i.e. (5-12%). Chronic energy malnutrition was significantly higher in textile workers (43.5%) than comparative group (38.2%). In textile workers, 66 % were anemic. Protein calorie malnutrition, Vitamin A, B complex and C deficiencies were higher in textile workers (1.8, 2.1, 4.0 & 16.1%) than comparative group workers (0.9, 0.2, 1.5 & 12.1%). Morbidity showed negative association with housing conditions, personal cleanliness and education but positive association with anemia. Dietary analysis revealed that their diet was deficient in calories (20.5 %) and Vitamin-A (42.9%) but rich in proteins in comparison to RDA, ICMR which led to protein energy malnutrition and vitamin-A deficiency which was responsible for higher morbidity among textile workers. Thus there is need to plan and formulate preventive measures including health education and welfare programs for the textile workers.

Nutrition Monitoring Survey on NNMB pattern in Jodhpur district of Rajasthan - *Madhu B. Singh, J. Lakshminarayana, Ranjana Fotedar and R. K. Kalundha*

Date of commencement: **January, 2004** Duration: **Long Term** Status: **Ongoing**

Objectives

1. To develop continuous monitoring service to study the nutritional status, dietary habits, food availability and the effect of changing social and environmental factors on the health status of the population.
2. Aim at doing comparisons with other states data so as to assess the percentage of variation among the states.

Progress of the work

During the report period, Survey work on NNMB pattern has been initiated in Jodhpur district. Sampling plan has been worked out in detail in order to start survey work. The similar sampling design and protocol was adopted for the Nutrition Monitoring type of survey to be carried out in Rajasthan, as it is being done in other states where NNMB is in operation. The sampling adopted here was two stage stratified random sampling method in which the villages in selected district, formed the first stage units (FSU's), while in the village households (HH's) formed the second stage units. For the study purpose the district has been divided in to different strata in rural areas as per the tehsils with agro-economic regions and based on the population size of the village i.e. <2000 and >=2000 populated villages. In the urban area three wards were selected as per the census classification.

Keeping in view the manpower and resources available at the centre, it has been decided to cover only Jodhpur district in the first phase and later on this will be expanded horizontally in other districts of the state in the similar pattern.

Selection of villages: From each stratum i.e. Tehsil, five villages were chosen randomly for the purpose of the survey in different direction one each from north, south, east, west and central part, to have proper representation of the tehsils in the district.

Selection of Households: The households in each village have been selected by adopting cluster sampling procedure for the purpose of the survey. A total of five clusters of four households each will be selected from each village. Generally the households in a village can be divided into natural 'groups/areas' by geographical location such as streets/mohalla/areas. The SC/ST population often live in a separate group/area in the villages. One cluster will be selected from SC/ST group/area while the remaining 4 clusters have been selected by systematic random sampling procedure, probability

proportion to size of the group. In each cluster, by selecting a random start, 4 contiguous households will be covered.

Selection of a random start in a cluster: In a given group/area, to start with, the total number of households have been assessed. Then a random number is chosen using random number tables, which forms the random start. From any one corner of the area starting on the left hand side of the street/road, the households were counted in a serpentine order till the random number is reached. This household will form the first HH of that cluster, while remaining three HHs are covered contiguously. In case a particular house is found locked, the next adjacent HH will be covered for the survey. Similar procedure is repeated for other clusters. If in an area/group the number household is large, say >30, the same is divided into two or more sub-groups. From these, one sub-group is selected randomly and above procedure will be adopted to cover a cluster. Thus a total of 20 households will be covered from each selected village. Taking total number of households divided by number clusters required identifies the sampling interval.

Selection of area/groups for covering clusters: One three digit random number is selected from Random Number Table (Tippets Random Numbers Table). If, the random number selected is 'X' , since it falls in any one of the area, then that cluster is selected. To this random number add the sampling interval 'Y' i.e. (X+Y) to select cluster number 2. Similarly, areas under which cluster numbers 3 and 4 falls are identified by adding sampling interval to the preceding number.

Selection of HHs in an area – I: There are A number households in an area. Hence a random number is selected depending upon the digits one or two then that particular house hold has been selected to make a random start. If the random number is higher than A then subtract the random digit from A and make less than or equal to that of A, if it is B then random start is B, then continuously four consecutive households will be covered for demography and nutrition assessment. For diet survey alternate households selected randomly are covered. Similar pattern will adopted for other selected areas to cover the sample.

All the selected household will be examined for socio-demographic and socio-economic aspects. All the members in the household have been examined for nutritional deficiency signs, anthropometric measurements (height, weight, arm circumference and FFT), Dietary intake (24 hours recall method) and examination of nutritional morbidities in last 15 days. Dietary intakes of the individuals information were recorded in alternate houses i.e.10 households from each village are covered. Training at divisional level has been conducted for standardization of anthropometric technique, dietary intakes and examination of nutritional deficiency signs in order to minimize the interpersonal variations and errors. A total of 7 villages were covered from Jodhpur and Osian tehsils of Jodhpur district covering 140 households. Project work is being continued and detailed analysis will be reported later on.

Table-1. List of selected villages in Jodhpur district.

S. No.	Tehsils	Villages	Code no.	House Holds	Population of Villages
1.	Phalodi	Malamsingh-ki-seer	14/1/27	105	785
		Modkiya	14/1/44	99	704
		Phalodi (proper)	14/1/84	144	847
		Ridmal sar	14/1/126	511	3773
		Jalora	14/1/155	442	3135
2.	Osian	Bhim sagar	14/2/3	457	3165
		Jakhan	14/2/19	452	2952
		Newra road	14/2/74	317	2436
		Gagari	14/2/82	437	2968
		Chindri	14/2/108	114	764
3.	Bhopalgarh	Gajsinghpura	14/3/11	519	3370
		Basni patan	14/3/28	101	592
		Ustara	14/3/47	425	2647
		Khariyakhangar	14/3/80	513	2480
		Godawas	14/3/104	103	640
4.	Sher garh	Lawaran	14/4/22	220	1335
		Somesar	14/4/31	444	2350
		Chaba	14/4/54	677	4305
		Ghudiyala	14/4/82	146	928
		Tena	14/4/99	732	4494
5.	Jodhpur	Karwar	14/5/21	190	1217
		Khatiya sani	14/5/73	207	1295
		Boranada	14/5/121	327	2032
		Janadesar	14/5/140	171	1254
		Peeparli	14/5/180	355	2353
6.	Bilara	Ransi gaon	14/6/15	895	5293
		Chandelao	14/6/32	218	1378
		Ghanamagra	14/6/39	298	1593
		Ramasani	14/6/58	253	1612
		Malkosni	14/6/70	356	1889

460 households from 23 villages belonging to Osian, Bilara, Shergarh, Phalodi and Bhopalgarh tehsils have to be covered.

Table-2. Age and sex wise distribution of population covered.

No	0 – 5 years	5-15 years	15-45 years	45 years & above	Total
Male	61	124	184	52	421
Females	60	99	195	54	408
Total	121	223	379	106	829

Important leads/ outcomes

The results of such a study carried out on representative segment of the population in desert areas as well as non desert areas would provide information and useful guidelines not only for food policies but also to assess the impact of the nutritional programs currently in progress and for future planning in the state of Rajasthan.

Assessment of Nutritional status of rural population of Drought affected areas of Jodhpur district of Western Rajasthan - Madhu B. Singh, Ranjana Fotedar, J. Lakshminarayana, P.K. Anand and R. K. Kalundha

Date of commencement: **April, 2003** Duration: **5 months** Status: **Concluded**

Objectives

1. To assess the nutritional status of rural population of drought affected areas of Western Rajasthan by means of anthropometry, dietary intake as well as through clinical examination.
2. To study the time trend analysis so as to determine the causes of malnourishments, if any and to suggest possible redressal mechanism.

Progress of the work

In Rajasthan, drought conditions occur periodically. Desert districts of Western Rajasthan had been the worst affected area. During last century, the arid region experienced 47-62 percent droughts of varying intensities. This periodic cycle of scarcity conditions attributable to geomorphology and climatic characteristics of that desert invariably affects the agricultural population residing in the desert by influencing their food intake. The cereals and millets contribute the maximum proportion of calories and protein intakes of the rural residents and nearly 85 percent calories of the total daily calorie intake of the rural population of India is consumed from the cereals and millets. In desert residents this proportion is more than 85 percent. This proportion increases further during the outbreak of drought. DMRC in 1987 conducted health and nutrition survey of drought affected parts of Rajasthan and revealed grade III malnutrition, assessed on the basis of weight for age. In preschool children it was reported to an extent of 2.9 to 17.3 percent. Male and females were equally affected. Calorie intake was significantly reduced in all age groups in all districts in comparison to RDA of ICMR. Clinical cases of PEM (3-17.8%) were frequently seen in all six desert districts. Incidence of Vitamin A deficiency was widely prevalent in Barmer, Jodhpur, Jalore and Jaisalmer in all age groups. In the year 2000 DMRC again conducted a rapid health survey in Barmer district of Rajasthan and found that the consumption of calorie and protein intakes along with green leafy vegetables in all age groups were less in comparison to earlier drought survey (DMRC 1987).

With this backdrop a two point survey first in June and second in the normal situation without drought conditions was planned to study the impact of drought on nutrition and morbidity profile of rural population in desert area facing the drought

conditions very frequently along with the harsh conditions of the desert. The results of the study will help in assessing the magnitude and extent of malnutrition in desert area. The results of this study will be compared with the findings of 1987 drought survey and baseline health survey to assess the impact of drought on nutrition which is further responsible for enhancing the higher prevalence of various morbidities.

The sampling design for assessment of health and nutritional status, a three stage sampling technique was adopted. In the first stage the worst affected district was selected from the earlier drought studies conducted by DMRC. Barmer and Jodhpur districts were found affected with nutritional deficiencies, Calorie deficits and Protein Energy Malnutrition (PEM). At the second stage of sampling the tehsils were selected. In this study all the tehsils were taken into consideration to overcome the intra district variation. The tehsils of the district are treated as homogeneous among themselves for the sampling purpose. In the third stage the villages were selected randomly. From each tehsil four villages were selected in different direction by simple random sampling criteria using random number tables available. This sampling would give complete picture of the tehsil and by combining the result, complete profile of the district. In the selected villages, 40 preschool children, 60 school age children and 60 adult population (15-45 years age group) were covered.

The sample size has been calculated, based on the prevalence rates, as more than 1% prevalence was taken as the public health problem. During drought situation all the nutritional deficiencies, clinical morbidities and protein, calorie deficit will show distinct changes among all the age groups and the prevalence will be more than 1%. Considering this and using the standard procedure for determining the sample size (n) by the formula, with 20% error and 10% non response, 95% Confidence Interval (C.I) using ± 2 S.D. limits a sample of 4000 was calculated to be covered from Jodhpur district.

Data have been collected on a total of 3951 individuals covering 24 villages belonging to 6 tehsils of Jodhpur district from 12th May to 31st May, 2003. A total of 914 preschool children, 1497 school age children and 1540 adult population were examined (Table 1). Children and adults were examined at household level or at relief work spot as per their availability. At each individual level, information for demography and socio-economic aspects had been collected by means of interview technique using pre tested schedules. Each individual was examined for anthropometry, dietary intake (Calories from cereals & Millet intake) and clinical examination of nutritional deficiency signs in order to assess their nutritional status.

The results of the present study were compared with the earlier surveys of Jodhpur district conducted by DMRC i.e. drought survey (1987) and Base Line Survey (1986-87). The comparisons were made between male and female for different age groups by applying Proportion Test. In dietary analysis the mean calorie and protein intakes were also compared with above surveys by applying t-test for difference of means.

The analysis of the data collected on 3951 individuals revealed that 96.3 percent of covered population were Hindu and 3.6 percent muslim. 85.7 percent belong to lower

and middle income groups mainly involved in labour and famine work on relief work spots, followed by agriculture. 57.8 percent females and 33 percent males were illiterate. 35.1 percent of total population belong to SC and 31 percent to OBC.

Table-1. Age and sex wise distribution of population in six tehsils of Jodhpur district.

Tehsil	0-5 years		5-15 years		15-45 years		Total		G . Total
	M	F	M	F	M	F	M	F	
Phalodi	73	74	137	123	129	125	339	322	661
Osiya	99	76	130	114	122	138	351	328	679
Bhopalgarh	85	79	140	115	131	126	356	320	676
Shergarh	84	85	115	131	132	121	331	337	668
Jodhpur	64	63	135	115	130	135	329	313	642
Bilara	65	67	137	105	122	129	324	301	625
Total	470	444	794	703	766	774	2030	1921	3951

Anthropometrically growth retardation was observed in children. Recent and long term malnutrition was calculated in reference to NCHS standards

Recent malnutrition: In children recent malnutrition (weight for age) was observed to be 38.3 percent in less than 5 years age group and 50.6 percent in 5-15 years age group. Recent malnutrition was highest in Shergarh and Bhopalgarh tehsils. In less than 5 years age groups, highest malnutrition was observed in 1-2 years age group. In 5-15 years age groups, malnutrition was more in adolescent girls (9-13 years) as well as in boys (12-15 years). Girls were suffering more from recent malnutrition in comparison to boys.

Long term malnutrition: Overall 24 to 26 percent children (up to 15 years age group) were suffering from chronic malnutrition. Chronic malnutrition was higher in girls than boys, in both less than 5 and 5-15 years age groups. Tehsil-wise, Shergarh and Phalodi showed highest percent prevalence of chronic malnutrition. Malnutrition according to age and sex revealed that in children less than 5 years age group, 1 to 2 years age group children suffered more from chronic malnutrition. In 5-15 years age group, boys (12-15 years) and girls (9-14 years) in adolescent period suffered more from chronic malnutrition. It was observed higher in girls (26.1 %) than boys (23.6 %).

Fat fold at triceps: Reduction in calorie consumption is likely to affect the fat deposits. In preschool children, 36.4 percent suffered from mild to moderate and 36.9 percent from severe deficit in FFT, which was high. Fat deficit was found maximum in Phalodi and Osiya tehsils. In 5-15 years age group, overall nearly 89.0 percent

children suffered from fat deficit which was too high. Fat deficit was observed significantly high in girls (69.8 %) than boys (59.4 %).

Body mass Index: In adults BMI is used to assess the chronic energy deficiency (cut off values are according to WHO classification). It was observed that 45.8 percent males and 39.5 percent females showed chronic energy deficiency which was high and needs attention. 12.7 percent males and 8.7 percent females suffered from severe chronic energy deficiency. Overall adults of Bhopalgarh and Phalodi tehsils were suffering more from chronic energy deficiency than other tehsils. Cumulative percentage distribution of FFT in adults revealed that overall 16 to 66 percent adults had nearly 50 percent reduced fat deposits in comparison to standards.

Analysis of nutritional deficiency signs showed that overall 33.7 percent rural population was found to be anemic (diagnosed on the basis of conjunctival pallor and platynichia and Koilonichia). In adults prevalence of anemia was significantly high in females (43.9 %) than males (27.4 %). Children and adults of Osiya, Jodhpur and Bilara tehsils were suffering more from anemia.

Prevalence of various signs related to Protein calorie malnutrition were observed to be high i.e. Dispigmentation and dryness of hair were 32.3 percent. Overall prevalence of Marasmus was 0.6 percent but it was observed higher in preschool children i.e. 2.3 percent in boys and 1.1 percent in girls and almost negligible in adults. PCM was observed to be higher in pre school children followed by school age children. Phalodi, Bhopalgarh and Osiya tehsils were suffering more from associated signs of PCM.

Regarding Vitamin A deficiency, overall prevalence of Bitot spot was 1.2 percent and night blindness was 0.2 percent. Vitamin A deficiency was found higher in females than males. This was observed more in Osiya and Bilara tehsils.

Regarding vitamin B complex deficiency, overall prevalence of Angular stomatitis was 0.9 percent, cheilosis 1.6 percent and glossitis 2.7 percent. This deficiency was higher in adults (4.4 % - Glossitis) and school age children (1.0%). Osiya tehsil was suffering most from this deficiency. Vitamin C deficiency was 1.5 percent (Gums bleeding) and 0.4 percent suffered from swollen red papillae. Teeth caries and mottling of enamel were observed to be 5.8 and 23.2 percent respectively.

Results of the present study when compared with earlier drought survey of Jodhpur district, it was observed that prevalence of various signs related to Protein calorie malnutrition was observed higher in the present study (32.3%) in comparison to earlier drought study (17.8%). Vitamin A deficiency and B complex deficiencies were highly reduced from 1987 study i.e. Bitot spot from 28.3 to 1.2% and Vitamin B complex deficiency from 83.7 to 5.2 %. Overall prevalence of anemia was also reduced to 33.7 percent in comparison to drought study, 1987 (74.1%).

Nearly 85 percent calories of the total daily calorie intake of the rural population of India is consumed from the cereals and millets and in desert residents this proportion has been found more than 85 percent. Therefore, instead of carrying conventional diet survey to assess individuals calories and protein intake it was decided to carry out only cereal and millets consumption survey. Analysis showed that mean calorie intake was very poor in comparison to RDA, ICMR in all age groups i.e. 339.6 to 343.6 calories in 0-5 years, 862 to 845.6 calories in 5-15 years and 1447.7 to 1168.9 calories in 15-45 years in males and females respectively. Children were suffering more from calorie deficit in comparison to adults. Calorie deficit was observed higher in preschool children (76%), followed by school age children (61%) and adults (38%). Overall calorie deficit was found maximum in Osiya tehsil.

In the present study, mean calorie intake in all age groups (339-1815 calories) was observed to be very low in comparison to earlier study, 1987 (982-2466 calories), which may be responsible for higher prevalence of PCM in the present study.

Mean Protein intake was also showing deficit. Overall protein intake was 11.9 and 12.1 gm in 0-5 years, 30.3 and 29.7 gm in 5-15 years and 50.9 and 41.1 gm in 15-45 years age groups in males and females respectively, which were low in comparison to RDA, ICMR. Overall protein intake was lowest in children of Osiya tehsil. Overall mean protein intake deficit was 53.8 percent in preschool children, 42.3 percent in school age children and 16.4 percent in adult population.

In the present study, mean protein intake in all age groups (11- 64 gm) was observed to be low in comparison to earlier study, 1987 (32 - 83 gm), which was also contributing to increase the prevalence of PCM in the present study.

Table- 2. Comparative table of mean calorie intakes in different surveys according to age and gender.

Tehsils	< 5 Years		5 – 15 Years		15 – 45 Years	
	Males	Females	Males	Females	Males	Females
Base line 1986-87	800 (39)	953 (37)	1795 (138)	1412 (114)	1586 (107)	1825 (131)
RDS 1987	982±464.9 (136)	870±436.1 (93)	1588±526.4 (376)	1567±478.3 (147)	2466±896.4 (571)	2258±856.6 (583)
DROUGHT 2003	339.6*± 311.23 (381)	343.6*± 383.86 (365)	862.2*± 400.42 (774)	845.6*± 645.82 (703)	1447.7*± 624.24 (745)	1168.9*± 614.13 (774)
RDA	1460	1460	2450	2060	2425	1875

*(P<0.01)

Values in parenthesis () are numbers covered.

The mean calories intakes of present study were compared with previous drought survey, 1987 and baseline survey, 1986-87 (conducted by DMRC) and were found to be significantly lower than the previous drought, 1987 and baseline survey, 1986-87 (P<0.01)

Table- 3. Comparative table of mean protein intakes in different surveys according age and gender.

Tehsils	< 5 Years		5 – 15 Years		15 – 45 Years	
	Males	Females	Males	Females	Males	Females
Base line 1986-87	25.3 (39)	29.4 (37)	58.9 (138)	47.3 (114)	46.6 (107)	58.0 (131)
RDS 1987	32.3± 14.90 (136)	29.0± 14.53 (93)	52.9± 17.54 (376)	52.2± 16.61 (147)	82.6± 29.88 (571)	76.3± 28.55 (583)
DROUGHT 2003	11.9*± 10.94 (381)	12.1*± 13.49 (365)	30.3*± 14.08 (774)	29.7*± 22.70 (703)	50.9*± 21.95 (745)	41.1*± 21.59 (774)
RDA	22.3	22.3	53.0	51.0	60.0	50.0

* (P<0.01) Values in parenthesis () are numbers covered.

The mean protein intake has been compared with previous drought and baseline survey (conducted by DMRC) and were found to be statistically significant and the protein intakes were very low in comparison to earlier drought and baseline surveys, 1986-87 (P<0.01).

Frequency distribution of protein intake in children and adults of six tehsils of Jodhpur district reveals that 44 to 83 percent preschoolers had protein intake less than 15 gm which was nearly half of the RDA, ICMR i.e. 26 gm. In school age children, 6 to 50 percent population had protein intake less than 22.5 gm, again low in comparison to the RDA, ICMR i.e. 52 gm. Percentage of protein deficit was highest in preschoolers, followed by children and adults. Osiya tehsil population was suffering maximum from protein intake deficit.

Analysis revealed that 27.8 percent population was sick at the time of survey. Main morbidities reported at the time of survey were Gastroenterological (9.4 %), Respiratory (3.6 %) and fever (2.9 %). Gastroenterological problems were existing in children as well as in adults, but other morbidities such as respiratory, fever and ear diseases were higher in preschool children, followed by school age children and adults. Population of Shergarh, Phalodi and Bhopalgarh tehsils were suffering more from Gastroenterological, Fever, UIT and Respiratory morbidities.

Important leads/ outcomes from the study

- Results of the present study when compared with earlier drought survey of Jodhpur district conducted by DMRC in 1987 on health and nutrition survey of drought affected parts of Rajasthan revealed that prevalence of various signs related to protein calorie malnutrition were high in the present study (33.2%) in comparison to earlier drought study, 1987 (17.8%). Vitamin A deficiency and B complex deficiencies were highly reduced from 1987 drought study i.e. Bitot spot from 28.3 to 1.2% and Vitamin B complex deficiency from 83.7 to 5.2%. Overall prevalence of anemia was also reduced to 33.7 percent in comparison to 1987 drought study i.e. 74.1 percent.
- In the present study, mean calorie intake in all age groups (339-1448 calories) was observed significantly low in comparison to earlier drought study, 1987 (870- 2466 calories) and baseline survey, 1986-87 (800- 1825 calories), which may be responsible for higher prevalence of PCM in the present study. Mean protein intake in all age groups (12-51 gm) in studied population was also observed significantly low in comparison to earlier drought study, 1987 (29 - 83 gm) and baseline survey, 1986-87 (25-59 gm), which was also contributing to increase the prevalence of PCM in the present study. Overall calorie deficit was observed high in preschool children (76.0%), followed by school age children (61.0%) and adults (38.0%). Overall mean protein intake deficit was high in preschooler (53.8%), followed by school age children (42.3%) and adults (16.4 %).
- Anthropometrically growth retardation was observed in children and adults. In children recent malnutrition (weight for age) was observed 39 to 50 percent and long term malnutrition 24 to 26 percent. Long term malnutrition (Height for age) was higher in females than males. Extant of malnutrition in preschoolers was highest in 1-2 years age group. In school age children, malnutrition was higher during adolescent period in boys (12-15 years) and girls (9-14 years). In adults, BMI is used to assess the chronic energy deficiency. Males (45.8%) and females (39.5%) showed chronic energy deficiency, which was high and needed attention. 12.7 percent males and 8.7 percent females suffered from severe chronic energy deficiency. In adults, 16 to 66 percent population had fat deposits reduced to 50 percent in comparison to NCHS standards.
- Overall adults of Bhopalgarh and Phalodi tehsils were suffering more from chronic energy deficiency than other tehsils. Overall children of Shergarh, Bhopalgarh, Phalodi and Osiya tehsils were suffering more from recent and long term malnutrition, which in turn was responsible for higher prevalence of PCM in Phalodi, Bhopalgarh and Osiya tehsils and leading to higher prevalence of gastroenterological morbidities, respiratory and fever in Bhopalgarh, Phalodi and Shergarh tehsil.

Recommendation

- i. Results of the present study revealed that prevalence of Vitamin A deficiency and B complex deficiencies was highly reduced from 1987 drought study results, but the prevalence of various signs related to protein calorie malnutrition were higher in the present study (32.3%) in comparison to earlier drought study (DMRC), 1987 (17.8%). It indicated that supply of Vitamin A and Iron by state government has reduced vitamin A & B complex deficiency to certain extent but due to inadequate consumption of daily food, which is deficient in calories along with proteins, as mentioned earlier, they were suffering from protein calorie malnutrition.

- ii. Attempts should be made in the ongoing relief measures to incorporate the measures such as ensuring the supply of adequate calories and proteins to all age groups, especially to preschool children, adolescent period in school age children and pregnant and lactating women.

- iii. There is strong need of developing nutritional packages based on the local diet which will give adequate calories, proteins and nutrients to all the age groups.

- iv. There is a need to carry out a follow up of one of the above six tehsils with a view to monitor nutritional status.

A preliminary survey of Nutritional status of adult population of Raika community in Jodhpur district, Rajasthan - *Madhu B. Singh, Ranjana Fotedar, J. Lakshminarayana and R. K. Kalundha*

Date of commencement: April, 2003. **Duration:** 3 months **Status:** Concluded

Objectives

1. To assess the nutritional status of adult population of Raika community in Jodhpur district, Rajasthan by means of anthropometry, dietary intake as well as through clinical examination.
2. To study the time trend analysis so as to determine the causes of malnourishments, if any.
3. To study the association between the nutrition and morbidity, if any.

Progress of the work

Raika community in Jodhpur district commonly consume camel milk in their diet. There are reports that camel milk consumption reduces the occurrence of diabetes in the community. Camel milk consumption may also be helpful in reducing the nutritional deficiencies and morbidities in adult community. Study was undertaken to know the dietary pattern. Their anthropometric measurements were taken to assess the degree and type of malnutrition and to know the prevalence of PCM and prevalence of various morbidities are comparable with the desert population.

Data had been collected on a total of 203 adults using camp approach in three villages i.e. Bhatinda, Salawas and Mogra in the month of March, 2003. At each individual level, information for demography and socio-economic aspects had been collected by means of interview technique in pre tested schedules. Each individual was examined for their anthropometry, dietary intake (24 hours recall method) and clinical examination of nutritional deficiency signs in order to assess their nutritional status. The results of the present study were compared with the earlier surveys in Jodhpur district i.e. textile workers project conducted by DMRC (2003). The comparisons were made between male and female for different age groups by applying proportion test. In dietary analysis the mean calorie and protein intakes were compared with ICMR recommended dietary allowances by applying t-test for difference of means.

Adult population i.e. 18-45⁺ years age group were examined at camps organized at their Samaj Bhawan (Community Hall) for Raika population. Analysis revealed that 62.1

percent belong to lower and middle income group mainly involved in labour work and agriculture. 98.2 percent women and 74.9 percent males were illiterate.

Table-1. Age and sex wise distribution of adult population.

Age structure (years)	Population		Total
	Male	Female	
18-25	14	36	50
26-35	19	36	55
36-45	23	20	43
45+	28	27	55
	84	119	203

Anthropometrically growth retardation has been observed

Body mass Index: In adults BMI was used to assess the chronic energy deficiency using cut off values of WHO classification (Table 2). It was observed that 51.2 percent males and 37.0 percent females showed chronic energy deficiency. 15.5 percent males and 10.9 percent females suffered from severe chronic energy deficiency.

FFT: Cumulative percentage distribution of FFT in adults showed that 62 to 79 percent adults have nearly 50 percent reduced fat deposits (FFT < 6 mm) in comparison to standards.

Table-2. BMI in adult population of Raika community of Jodhpur district.

BMI	Male		Female		Total	
	No.	Percent	No.	Percent	No.	Percent
Normal	41	48.8	75	63.0	116	57.1
Mild	21	25.0	24	20.2	45	22.2
Moderate	9	10.7	7	5.9	16	7.9
Severe	13	15.5	13	10.9	26	12.8
Total	84	100.0	119	100.0	203	100.0

**P < 0.01 between M & F

Analysis of nutritional deficiency signs showed that overall 61.0 percent rural population was found to be anemic (diagnosed on the basis of conjunctival pallor and platynichia and koilonichia). Prevalence of anemia was slightly higher in males (61.9%) than females (60.5%).

Prevalence of various signs related to protein calorie malnutrition were observed to be low i.e. 2.9 percent (dispigmentation and dryness of hair). Signs of protein calorie malnutrition were observed only in women. Overall prevalence of Bitot spot was 3.4 percent suggesting Vitamin A deficiency which was found to be higher in males (4.7 %) than females (2.5 %). Vitamin B complex deficiency prevalence (cheliosis) was 2.4 percent. The deficiency of Vitamin C (gums bleeding) was in 0.8 percent population. Teeth complaints were observed to be high i.e. 46.3% (teeth caries-18.7 % & mottled enamel - 8.9% & teeth caries along with mottled enamel -18.7%).

Results of the present study when compared with textile worker's comparative group in Jodhpur and Pali district showed that overall prevalence of Vitamin A (Bitot spot) and B complex deficiencies (Cheliosis) were higher in Raika adults (3.4 % & 2.4%)) than textile worker's comparative group where no deficiency of vitamin A was observed and B complex deficiencies (Cheliosis) was 1.4 percent.

Regarding anemia (cymmethaemoglobin technique), 87.7 percent Raika adults were found to be anemic which is significantly higher in comparison to textile worker's comparative group i.e. 48.8 percent (Table 3). Percentage of Raika adults belonging to moderate and severe anemia category (below 7 gm./ dl) was observed to be higher in females (41.2 %) than males (22.6 %).

Table- 3. Distribution of Raika Adults according to Anemia.

Hb. Grades	Male		Female		Total		Comparative group (125)	
	No.	%	No.	%	No.	%	No.	%
Normal	9	10.7	16	13.4	25	12.3**	64	51.2
Mild	56	66.7	54	43.4	110	54.2**	40	32.0
Moderate	19	22.6	42	35.3	61	30.1**	20	16.0
Severe	0	0.0	7	5.9	7	3.4	1	0.8

** P<0.01 Total vs Comparative group

Sickness at the time of survey was 75.3 percent which is significantly higher in females (79.8%) than males (69.0%). Main morbidities reported at the time of survey were aches (body ache, backache and headache) i.e. 56.6 percent, gastric complaints mainly abdominal pain (26.1%) and respiratory (8.8 %) were significantly higher than the comparative group i.e. 5.6, 6.9, 5.6 and 4.8 percent respectively. General weakness were observed among 19.2 percent adults. Fever was in 12.3 percent and eye morbidity was 0.9 percent. Aches, gastric problems and general weakness were significantly higher in female than males.

Table-4. Morbidity profile in adult population of Raika community.

Raika adults: 203 Sick: 153 (75.3 %) Comparative group: 125 Sick: 48 (33.3%)

Type of Morbidity	Male (N=84)		Female (N=119)		Total (N=203)		Comparative group (N=125)	
	No	%	No.	%	No.	%	No.	%
Aches	21	25.0	94	78.9*	115	56.6*	10	6.9
Gastric Problem	14	16.6	39	32.7*	53	26.1*	8	5.6
G. weakness	13	15.4	26	21.8*	39	19.2*	7	4.9
Respiratory	11	13.0	7	5.8*	18	8.8**	7	4.8
Skin	1	1.2	3	2.5	4	1.9	8	5.6
Eye	1	1.2	1	0.8	2	0.9	-	-
Fever	17	20.2	8	6.7	25	12.3	3	2.1
U.R.I	2	2.3	0	0.0	2	0.9	2	1.4
Ear	2	2.4	0	0.0	2	1.0	2	1.4
Others	5	5.9	8	6.7	13	6.4	4	2.8

* P<0.05 M vs F

Total vs Comparative group * P<0.05 ** P<0.01

Percent prevalence of morbidity in relation to housing conditions revealed that overall morbidity was lower (3.9%) in good housing conditions than poor and fair conditions (96.1%), whereas, in controls only 34.8 percent morbidities were observed in poor and fair housing conditions. Morbidity in relation to personal cleanliness revealed that overall morbidity was lower (40.6%) in adults who had good personal cleanliness than adults who had poor and fair (59.4%). Morbidity was found to be decreasing as education level increased. Total morbidities were 90.9 percent in illiterate education group and 5.9 percent in college level educated group.

Morbidity in relation to anemia (Haemoglobin estimation) revealed that percent prevalence of overall morbidities were higher in adults suffering from mild to moderate anemia (57.5% & 26.8%) in comparison to non-anemic adults (12.4%).

Dietary analysis (24 hours recall method) revealed that calorie deficit was 20.5 percent in males and 80.6 percent in females. Males diet was rich in proteins in comparison to ICMR recommended dietary allowances but due to calorie deficit in their diet, proteins were being used in providing calories to the body which led to protein energy malnutrition.

Important Leads/ Outcome of the study

The results of the present study revealed that Raika adults suffered from Chronic Energy Deficiency (44.1 %), Vitamin A and B complex deficiencies (3.4 % & 2.4 %) along with anemia (87.7 %). Main morbidities reported at the time of survey were aches (56.6 %), gastric complaints mainly abdominal pain (26.1%) and respiratory (8.8%). Morbidity showed negative association with personal cleanliness, housing conditions, education and haemoglobin estimation. Diet analysis also revealed that Raika adults suffered from the calorie deficit (50.5 %), but their intake of proteins met the allowances recommended by ICMR indicating proteins are being used for the purpose of providing energy in face of calorie inadequacy leading to malnutrition. Thus there is strong need of planning nutrition education program for this community so as to reduce the extent of malnutrition along with morbidity in this area.

4. Infrastructure Development

During this period due importance was given to the various infrastructure developmental activities for the smooth functioning of the research activities. ***'Enhancement and extension of library'*** was one of these activities. The air-conditioned library has a well-developed books and journals section with a attached reading room. The library has been provided with a ***'computer for the updating'*** of all the recent arrivals and easy access to the old and new books. The library has been provided with a photocopier for the on spot availability of the research articles. ***'Online library records'*** have been made available to for easy accessibility to each scientist through the ***'Networking'***. ***'ISDN line'*** has been laid to provide ***'Internet facility'*** in the centre to each computer. Computers with printing facility have been provided to each scientist with an easy access to all the project staff. ***'Electricity and water line'*** throughout the office is being ensured through the maintenance section of the centre. ***'Security'*** of the office during office and after office hours was also provided by giving a contract to a government agency- Home Guards Security Organization.

Various developmental activities related to scientific interest have also been organized throughout the year. ***'Journal club'*** is being held on every Saturday where scientists can present their work or any scientific article relevant to their work for mutual discussion among themselves. A ***'In-house Screening Committee'*** scrutinizes the research proposals and other research work accomplished by the scientists for its quality improvement. A ***'policy planning group'*** consisting of all the scientists and heads of administration and accounts divisions under the chairmanship of the officer-in-charge also meets every Monday to take a review of the work done during the week. The major aim of the meeting is to meet the requirements of the scientists and the administrative staff from time to time. During this period four new vehicles including one AC and a staff car has been added which has given ***'A new dimension in the transport'*** requirement of the centre. A due emphasis has also been given to the ***'Development of greenery and plantation work'*** throughout the office campus. In all increased scientific along with the overall developmental activities of the centre remained the main focus during the year.

5. Capacity Strengthening Activities

A. Seminars Organized

- One day seminar on 'Researchable issues in bio-medical research', on 27th June, 2003, on the occasion of Annual Day of the Centre and experts of malaria, dengue, fluorosis, HIV and tuberculosis delivered lectures in the seminar.

B. Training Course Conducted

- A pre-conference training course on 'Research Methodology' during 21st Annual Conference of ISMS, Jodhpur, on 27th November, 2003. The deliberations on Basics in research methodology, ranking and selection pressure, multiple classification analysis, non-parametric statistical methods and research methodologies were made during the training.

C. Conferences Organized

- 21st Annual Conference of Indian Society for Medical Statistics on National Health Policy: Opportunity and Challenges for Statisticians, from 28th to 30th November, 2003 at Jodhpur. Over 200 scientists attended conference. 92 research papers were read. The bio-statisticians of the centre got the opportunity to interact with their peers in the field of their specialization and along with other scientists benefited themselves by participating in organizational activities.

D. Workshops Organized

- Workshop on 'Epidemic preparedness for prevention and control of malaria', at Jodhpur from 10-12th March, 2004. The workshop was sponsored by 'National Vector borne Diseases Control Programme', Ministry of Health & FW, Govt. of India, New Delhi. The workshop provided opportunity to medical/malaria officers from different states of the country *viz*; Maharashtra, Gujarat, Punjab, Haryana, Uttar Pradesh and Rajasthan including DMRC scientists, to learn the fundamentals of dynamics of malaria and plan control strategy accordingly.
- ICMR-WHO sponsored workshop on 'Competence building for writing up Research Proposals for international funding', at DMRC, Jodhpur from 18-20th March, 2004. Young scientists aspiring to pursue bio-medical research from various medical colleges of Union territory of Delhi, Rajasthan,

Himachal Pradesh, Punjab, Haryana and Uttar Pradesh, including DMRC scientists, participated in the training.

E. Invited Lectures

- *'Dengue/DHF in India: Research Gaps'*, was delivered by Dr. N. L. Kalra, WHO Consultant, New Delhi, on June 27, 2003.
- *'Hepatocyte dysfunction in Plasmodium falciparum malaria'*, was delivered by Dr. D. K. Kochar, Professor, S. P. Medical College & Associated Group of Hospitals, Bikaner, on June 27, 2003.
- *'HIV and TB - A Double Trouble'*, by Dr. S. D. Purohit, Former Principal, S.N. Medical College, Jodhpur and Director Clinical Programmes, FXB Rajasthan Society, Jodhpur, on June 27, 2003.
- *'Fluorosis Control Mission - Present and Future'*, by Dr. Ram Gopal, Former Director Defence Laboratory Jodhpur & Professor Emeritus, Department of Chemistry, JNVU, Jodhpur, on June 27, 2003.
- *'Importance of Traditional Desert Medicines'*, by Dr. Ram Harsh Singh, Vice Chancellor, Rajasthan Ayurved University, Jodhpur, on November 15, 2003.
- *'Half a Century of Mosquito Genetics - Past Progress, Future Prospects and the Paradox'*, by Dr. K. S. Rai, Professor Emeritus University of Notre Dame, Notre Dame, Indiana, USA, on November 24, 2003.

6. Papers published/accepted

A. Published/ Accepted:

1. Bansal, S.K. and Singh, Karam V. (2004). Efficacy of different organophosphate and synthetic pyrethroid insecticides to the larvae of malaria vector *Anopheles stephensi*, Liston. *Journal of Environmental Biology*, 25(4): (Accepted)
2. Haldiya, K.R., Dixit A.K and Sachdev R. (2003). Letter to Editor on an article “Is the rule of halves in Hypertension still valid? Evidence from the Chennai Urban Population study” *Journal of Association Physicians India*, 51: 931.
3. Mathur ML and Yadav SP. (2003) “Wet Drilling as a measure of dust control in quarrying of sandstone”. Proceedings of National Seminar on Recent Development in Machinery and Equipment for Dimensional Stone Mining Organised at Dept. of Mining, College of Technology and Engineering, Maharana Pratap Agriculture University, Udaipur on 13 and 14th December, p. 183-189.
4. Dewan A, Bhatnagar VK, Kashyap R, Sadhu HG, Mathur ML, Chakma T, Saiyed HN. (2004). Repeated Episodes of Endosulfan Poisoning. *Journal of Toxicology - Clinical toxicology*.(Accepted)
5. Singh, Madhu B. (2004). Anthropometric assessment of the nutrition in female children of Thar desert of Rajasthan. *Annals of Arid Zone*. (Accepted)

7. Workshops/Conferences/Symposia/Scientific meetings attended by scientists

Dr. R. C. Sharma, Deputy Director & Officer-in-Charge

Organized:

- One day seminar on 'Researchable issues in bio-medical research', on 27th June, 2003, on the occasion of Annual Day of the Centre.
- Pre-conference course on 'Research Methodology' during 21st Annual Conference of ISMS, Jodhpur, on 27th November, 2003.
- 21st Annual Conference of Indian Society for Medical Statistics on National Health Policy: Opportunity and Challenges for Statisticians, from 28th to 30th November, 2003 at Jodhpur.
- Workshop on 'Epidemic preparedness for prevention and control of malaria', at Jodhpur from 10-12th March, 2004.
- ICMR-WHO workshop on 'Competence building for writing up Research Proposals', at Jodhpur from 18-20th March, 2004.

Attended

- SAG meeting held on 3rd & 4th April, 2003 at ICMR, New Delhi and presented work of DMRC carried out during 2002-03. Various research projects pursued at centre were presented and an over view of the progress made during reported period was provided for further strengthening of the ongoing programme.
- Training Course to use the GIS software Arc GIS View 8.2, from 2 to 6th June, 2003 at NIIT, New Delhi. The working pattern of software was learnt and its application to existing projects of DMRC was explored.
- Task force meeting on 'Roll of camel milk in diabetes' on 18th August, 2003 at ICMR, New Delhi.
- 'Indo-French workshop on Dengue' at Pune on 18th & 19th December, 2003, and submitted a tentative project proposal to be taken up at DMRC on the subject.
- 3rd Global meets on Parasitic Diseases held from 12 to 16th January, 2004, at Bangalore and delivered an invited lecture on 'Emerging problem of dengue in India', in the plenary session of the meet.

- Meeting on preparation of 'EFC' document of DMRC at ICMR, New Delhi on 2nd & 3rd July, 2003.
- Meeting held at Ministry of Defence on 3rd & 4th September, 2003 at Delhi, regarding NOC for construction of DMRC building.
- 'Second meeting of the ICMR forum for epidemiology', at NIE, Chennai on 12th & 13th October, 2003.
- Building committee meetings held from 27 to 29th October, 2003 and 4th February, 2004.
- E-databases meeting on 4th December, 2004 at ICMR, New Delhi.
- Meeting on Collaborative Studies with NAMP and Environment and Human Health Cell, GOI at Delhi from 9 - 12th January, 2004.
- Scientific Advisory Committee meeting at RMRC, Port Blair held on 30th & 31st January, 2004.
- Director's/OIC's meeting at Central JALMA Institute of Leprosy, Agra on 6th & 7th February, 2004

Dr. K. R. Haldiya, Deputy Director

- Attended a one day seminar on 'Researchable issues in bio-medical research', organized by DMRC, on 27th June, 2003, on the occasion of Annual Day of the Centre.
- Attended CME International Conference on Hypertension, Diabetes, Lipids and Preventive Cardiology at Bangalore 1st Aug.-3rd Aug., 2003, and presented a paper entitled 'Salt in environment: impact of some interventional measures on blood pressure among the salt workers in desert region of Rajasthan'.
- Participated in Expert Working Group on "National Programme for Control and Treatment of Occupational Diseases (Ninth Five year Plan) - Third Meeting on 9th September 2003 at NIOH, Ahmedabad.
- Participated in the ICMR Forum for Epidemiology on the 12th & 13th October 2003 at National Institute of Epidemiology, Chennai.

- Attended National Conference of Hypertension Society of India from 18th –19th Oct., 2003 at Madurai, and presented papers entitled 'Rule of halves in hypertension: some observations from rural community of desert part of Rajasthan' and 'Risk of high blood pressure due to inhalation of salt among salt workers of desert region of Rajasthan'. The paper entitled "Risk of high blood pressure due to inhalation of salt among salt workers of desert region of Rajasthan" was adjudged for 'Best Paper Award' of the conference.
- Pre-conference Workshop on 'Research Methodology' on 27th November 2003 at Desert Medicine Research Centre, Jodhpur and 21st National conference of ISMS held at Hotel Sri Ram International and DMRC, Jodhpur from 27 – 30th November, 2003.
- Attended 'Mid Term National Conference of Geriatric Society of India', from 31st Jan –1st Feb 2004 at Jodhpur, Rajasthan.
- Participated in '*Swasthya Mela*', organized by State Health Department at S.N. Medical College, Jodhpur, from 11th to 13th February, 2004, and highlighted the work of DMRC.
- Attended the ICMR-WHO workshop on 'Competence building for writing up Research Proposals', organized by DMRC, Jodhpur from 18-20th March, 2004.
- Attended a meeting on "Science Awareness 2004", at local unit of State DST, on

Dr. Vinod Joshi, Deputy Director

- Delivered an expert lecture on “Dynamics of desert Malaria” and a practical demonstration of different mosquito species in the refresher course organized by the department of Zoology, JNV University, in February, 2004.
- Delivered expert lecture on “Control aspects of malaria” to the medical officers of state health department organized by the Joint Director Jodhpur zone, department of Health and FW, at Dr. S.N. Medical College Jodhpur in January, 2004.
- Delivered expert in the workshop on “Epidemic Preparedness for control of Malaria” sponsored by the National Vector-Borne Disease Control Programme (VBDCP), Delhi, on 10-12th March, 2004.
- Participated as faculty in the ICMR-WHO workshop on “Competence building for writing up research proposal for international funding” March 18-20th, 2004.

Dr. M. L. Mathur, Deputy Director

- Attended a one day seminar on 'Researchable issues in bio-medical research', organized by DMRC, on 27th June, 2003, on the occasion of Annual Day of the Centre.
- Attended National Seminar on Recent Development in Machinery and Equipment for Dimensional Stone Mining Organized at Dept. of Mining, College of Technology and Engineering, Maharana Pratap Agriculture University, Udaipur on 13 and 14th December 2003, and presented paper entitled "Wet Drilling as a measure of dust control in quarrying of sandstone".
- Attended 21st Annual Conference of Indian Society of Medical Statistics, November 28-30, 2003, Organized by Desert Medicine Research Centre, Jodhpur - 342005 and presented paper entitled "Opium Addicts have High Risk of Tuberculosis of Lungs."
- Participated in the Workshop on "Aravalies Mining and Forests" on 11th October 2003 Organized by National Law University, Jodhpur at Educational Media Research Centre, Jai Narayan Vyas University, Jodhpur-342011 and discussed problem of silicosis in sandstone quarries in the region. I presented work of study of silicosis in Karauli District over there.
- Participated in Expert Working Group on "National Programme for Control and Treatment of Occupational Diseases (Ninth Five year Plan) - Third Meeting on 9th September 2003 at NIOH, Ahmedabad and presented my work on measures of prevention of silicosis in sandstone quarry workers of Jodhpur, in the meeting, which was appreciated. Dr. Sisodiya, Deputy Director at Office of Director General of Mines Safety (DGMS) told that DGMS is aware of this work of DMRC. We are trying our best to implement wet drilling in place of dry drilling in stone quarries. He informed that labour secretary has written a letter to Chief secretary of Rajasthan about it.
- Participated in 'Swasthya Mela', organized by State Health Department at S.N. Medical College, Jodhpur, from 11th to 13th February, 2004, and highlighted the work of DMRC.
- Attended the ICMR-WHO workshop on 'Competence building for writing up Research Proposals', organized by DMRC, Jodhpur from 18-20th March, 2004.

Dr. Raman Sachdev, Deputy Director

- Attended a one day seminar on 'Researchable issues in bio-medical research', organized by DMRC, on 27th June, 2003, on the occasion of Annual Day of the Centre.

- Attended a Pre-conference Workshop on “Research Methodology” on 27th November 2003 at Desert Medicine Research Centre, Jodhpur and 21st National conference of ISMS held at Hotel Sri Ram International and DMRC, Jodhpur from 27th – 30th November, 2003.
- Attended Mid Term National Conference of Geriatric Society of India from 31st Jan –1st Feb 2004 at Jodhpur and presented a paper on Health Problems of Elderly Population of Desert region of Rajasthan.
- Participated in '*Swasthya Mela*', organized by State Health Department at S.N. Medical College, Jodhpur, from 11th to 13th February, 2004, and highlighted the work of DMRC.
- Attended the ICMR-WHO workshop on ‘Competence building for writing up Research Proposals’, organized by DMRC, Jodhpur from 18-20th March, 2004.

Dr. Karam V. Singh, Assistant Director

- Attended a one day seminar on 'Researchable issues in bio-medical research', organized by DMRC, on 27th June, 2003, on the occasion of Annual Day of the Centre.
- Attended a pre-conference course on ‘Research Methodology’ during 21st Annual Conference of ISMS, organized by DMRC, Jodhpur, on 27th November, 2003.
- Attended the 21st Annual Conference of Indian Society for Medical Statistics from 28-30th November, 2003 at DMRC, Jodhpur.
- Attended the National Symposium on ‘Management of aquatic resources for biodiversity maintenance and conservation’ from 2-4th February, 2004 at JNV University, Jodhpur.
- Attended Global Meet of Parasitic Diseases, from 12-16th January, 2004, and presented a paper on 'Effect of temperature and water quality on the efficacy of microbial agents against some important mosquito vectors., at Bangalore University, Bangalore.
- Participated in '*Swasthya Mela*', organized by State Health Department at S.N. Medical College, Jodhpur, from 11th to 13th February, 2004, and highlighted the work of DMRC.
- Attended the workshop on ‘Epidemic preparedness for prevention and control of malaria’, organized by DMRC, Jodhpur from 10-12th March, 2004.

- Attended the ICMR-WHO workshop on ‘Competence building for writing up Research Proposals’, organized by DMRC, Jodhpur from 18-20th March, 2004.

Dr. S.K. Bansal, Assistant Director

- Attended a one day seminar on 'Researchable issues in bio-medical research', organized by DMRC, on 27th June, 2003, on the occasion of Annual Day of the Centre.
- Attended a pre-conference course on ‘Research Methodology’ during 21st Annual Conference of ISMS, organized by DMRC, Jodhpur, on 27th November, 2003.
- Attended the 21st Annual Conference of Indian Society for Medical Statistics from 28-30th November, 2003 at DMRC, Jodhpur.
- Attended the National Symposium on ‘Management of aquatic resources for biodiversity maintenance & conservation’ from 2-4th February, 2004 at JNV University, Jodhpur.
- Participated in '*Swasthya Mela*', organized by State Health Department at S.N. Medical College, Jodhpur, from 11th to 13th February, 2004, and highlighted the work of DMRC.
- Attended the workshop on ‘Epidemic preparedness for prevention and control of malaria’, organized by DMRC, Jodhpur from 10-12th March, 2004.
- Attended the ICMR-WHO workshop on ‘Competence building for writing up Research Proposals’, organized by DMRC, Jodhpur from 18-20th March, 2004.

Dr. S. P. Yadav, Assistant Director

- Attended a one day seminar on 'Researchable issues in bio-medical research', organized by DMRC, on 27th June, 2003, on the occasion of Annual Day of the Centre.
- Attended a pre-conference course on ‘Research Methodology’ during 21st Annual Conference of ISMS, organized by DMRC, Jodhpur, on 27th November, 2003.
- Attended the 21st Annual Conference of Indian Society for Medical Statistics from 28-30th November, 2003 at DMRC, Jodhpur, and presented a paper entitled 'The impact of maternal education on live birth, childhood mortality and their inter-relationship in the desert part of Rajasthan.

- Attended the ICMR-WHO workshop on ‘Competence building for writing up Research Proposals’, organized by DMRC, Jodhpur from 18-20th March, 2004.

Dr. Madhu B. Singh, Assistant Director

- Attended a one day seminar on 'Researchable issues in bio-medical research', organized by DMRC, on 27th June, 2003, on the occasion of Annual Day of the Centre.
- Attended a pre-conference course on ‘Research Methodology’ during 21st Annual Conference of ISMS, organized by DMRC, Jodhpur, on 27th November, 2003.
- Attended the 21st Annual Conference of Indian Society for Medical Statistics from 28-30th November, 2003 at DMRC, Jodhpur, and presented a paper entitled 'Assessment of Nutritional status of adult population of drought affected areas of Jodhpur district of western Rajasthan'.
- Attended Mid Term National Conference – Jodhpur Gericon-2004 held at Dr. S. N. Medical college, Jodhpur from 31st January to 1st, February, 2004 and presented a paper entitled 'Nutritional status of adult population of Raika community of Jodhpur district, Rajasthan'.
- Participated in 'Swasthya Mela', organized by State Health Department at S.N. Medical College, Jodhpur, from 11th to 13th February, 2004, and highlighted the work of DMRC.
- Attended the ICMR-WHO workshop on ‘Competence building for writing up Research Proposals’, organized by DMRC, Jodhpur from 18-20th March, 2004.

Dr. J. Lakshminarayana, Assistant Director

- Attended a one day seminar on 'Researchable issues in bio-medical research', organized by DMRC, on 27th June, 2003, on the occasion of Annual Day of the Centre.
- Participated in the ICMR Forum for Epidemiology on the 12th & 13th October 2003 at National Institute of Epidemiology, Chennai.
- Attended a pre-conference course on ‘Research Methodology’ during 21st Annual Conference of ISMS, organized by DMRC, Jodhpur, on 27th November, 2003.
- Attended the 21st Annual Conference of Indian Society for Medical Statistics from 28-30th November, 2003 at DMRC, Jodhpur, and presented papers entitled 'Opium

use and Socio-cultural factors associated in consumption pattern in three districts of Rajasthan' and ' Association of camel milk with diabetes in western parts of Rajasthan: A community-based study'.

- Attended Mid Term National Conference – Jodhpur Gericon-2004 held at Dr. S. N. Medical college, Jodhpur from 31st January to 1st, February, 2004.
- Participated in '*Swasthya Mela*', organized by State Health Department at S.N. Medical College, Jodhpur, from 11th to 13th February, 2004, and highlighted the work of DMRC.
- Attended the ICMR-WHO workshop on 'Competence building for writing up Research Proposals', organized by DMRC, Jodhpur from 18-20th March, 2004.

Dr. A. K. Dixit, Assistant Director

- Attended a one day seminar on 'Researchable issues in bio-medical research', organized by DMRC, on 27th June, 2003, on the occasion of Annual Day of the Centre.
- Attended a pre-conference course on 'Research Methodology' during 21st Annual Conference of ISMS, organized by DMRC, Jodhpur, on 27th November, 2003.
- Attended the 21st Annual Conference of Indian Society for Medical Statistics from 28-30th November, 2003 at DMRC, Jodhpur, and presented a paper entitled 'Simultaneous comparison of mean, variance and higher order movements of the two distributions'.
- Attended the workshop on 'Epidemic preparedness for prevention and control of malaria', organized by DMRC, Jodhpur from 10-12th March, 2004.
- Attended the ICMR-WHO workshop on 'Competence building for writing up Research Proposals', organized by DMRC, Jodhpur from 18-20th March, 2004.

Dr. Ranjan Fotedar, SRO

- Attended a one day seminar on 'Researchable issues in bio-medical research', organized by DMRC, on 27th June, 2003, on the occasion of Annual Day of the Centre.

- Attended a pre-conference course on ‘Research Methodology’ during 21st Annual Conference of ISMS, organized by DMRC, Jodhpur, on 27th November, 2003.
- Attended the 21st Annual Conference of Indian Society for Medical Statistics from 28-30th November, 2003 at DMRC, Jodhpur.
- Participated in ‘*Swasthya Mela*’, organized by State Health Department at S.N. Medical College, Jodhpur, from 11th to 13th February, 2004, and highlighted the work of DMRC.
- Attended the ICMR-WHO workshop on ‘Competence building for writing up Research Proposals’, organized by DMRC, Jodhpur from 18-20th March, 2004.

Dr. Manju Singhi , Research Officer

- Delivered a talk on Medicinal plants : “Scope for research documentation and patenting” in one- day seminar on intellectual property Rights & patents with special reference to Rajasthan, organized by faculty of Engineering, JNV University, Jodhpur 2nd September, 2003.
- Attended a training programme on “medicinal plants of desert “Organized by National Beuro of Plant Genetics research, Regional station, Jodhpur September 19 , 2003.
- Attended state conference of IDVAL organized by Dept. of skin, V D and Leprosy, Dr.S N Medical college Jodhpur , October, 2003.
- Attended a pre-conference course on ‘Research Methodology’ during 21st Annual Conference of ISMS, organized by DMRC, Jodhpur, on 27th November, 2003.
- Attended ISMS National Conference organized by DMRC, Jodhpur November 28-30, 2003, at DMRC, Jodhpur.
- Participated in panel discussion on “Traditional medicine” Organized by D MRC, November 11, 2003.
- Participated in ‘*Swasthya Mela*’, organized by State Health Department at S.N. Medical College, Jodhpur, from 11th to 13th February, 2004, and highlighted the work of DMRC.
- Participated as faculty in the workshop on “Epidemic Preparedness for control of Malaria”. Sponsored by Directorate of National vector borne diseases control programme, Delhi. Ministry of Health & Family Welfare Govt. of India , March 10-12, 2004.

- Participated as faculty in the workshop sponsored by ICMR- WHO on 'Competence building for writing up research proposals for funding' March 18-20, 2004 .

Dr. Praveen K. Anand, Research Officer

- Attended the 21st Annual Conference of Indian Society for Medical Statistics from 28-30th November, 2003 at DMRC, Jodhpur.
- Participated in WHO-ICMR Workshop on IPR & WTO issues from 16-17th February, 2004 at Regional Medical Research Centre for Tribals, Jabalpur, .
- Attended the ICMR-WHO workshop on 'Competence building for writing up Research Proposals', organized by DMRC, Jodhpur from 18-20th March, 2004.

Dr. H. R. Balotia, Research Officer

- Participated in '*Swasthya Mela*', organized by State Health Department at S.N. Medical College, Jodhpur, form 11th to 13th February, 2004, and highlighted the work of DMRC.
- Attended the workshop on 'Epidemic preparedness for prevention and control of malaria', organized by DMRC, Jodhpur from 10-12th March, 2004.
- Attended the ICMR-WHO workshop on 'Competence building for writing up Research Proposals', organized by DMRC, Jodhpur from 18-20th March, 2004.

Mr. P. K. Dam, Technical Officer

- Attended a pre-conference course on 'Research Methodology' during 21st Annual Conference of ISMS, organized by DMRC, Jodhpur, on 27th November, 2003.
- Attended I S M S National Conference organized by DMRC, Jodhpur November 28-30, 2003.
- Participated in '*Swasthya Mela*', organized by State Health Department at S.N. Medical College, Jodhpur, form 11th to 13th February, 2004 and highlighted the work of DMRC.
- Participated as faculty in the workshop on ""Epidemic Preparedness for control of Malaria"" sponsored by the National Vector Born Disease Control Programme (VBDCP), Delhi, on 10-12th March, 2004.

- Participated as faculty in the ICMR-WHO workshop on “Competence building for writing up research proposal for international funding” March 18-20th, 2004.

Mr. R. K. Kalundha, Technical Officer

- Attended the 21st Annual Conference of Indian Society for Medical Statistics from 28-30th November, 2003 at DMRC, Jodhpur, and presented papers entitled 'Association of camel milk with diabetes in western part of Rajasthan: A community based study'.

8. Scientific Advisory Committee 2003-04

Chairman

1. Dr. S. D. Gupta
Director
Indian Institute of Health
Management & Research
Prabhu Dayal Marg
Sanganer Air Port, Jaipur – 302 011

Ex-Officio Members

2. Dr. Padam Singh
Additional Director-General
Indian Council of Medical Research
Ansari Nagar, New Delhi – 110 029
3. Dr. Bela Shah
Sr. D.D.G. & Chief, Division of NCD
Indian Council of Medical Research
Ansari Nagar, New Delhi – 110 029
4. Director
Malaria Research Centre
22, Sham Nath Marg, Delhi – 110 054
5. Director (PH)
Directorate of Medical & Health Services
Swasthaya Bhawan, Jaipur – 302 005
6. Director (FW)
Directorate of Medical & Health Services
Swasthaya Bhawan, Jaipur – 302 005
7. Principal
Dr. S. N. Medical College
Jodhpur – 342 003
8. Secretary
Health & Family Welfare
Govt. of Rajasthan, Secretariat
Jaipur – 302 005

9. Divisional Commissioner
Jodhpur – 342 006

Member

10. Professor R. C. Mahajan
SN Bose INSA Research Professor &
Emeritus Professor
Department of Parasitology
PGI, Chandigarh – 160 012

11. Dr. N. L. Kalra
Consultant WHO & MRC
A-38, Swasthya Vihar
Vikas Marg, New Delhi – 110 092

12. Dr. Umesh Kapil
Additional Professor
Deptt. of Gastroenterology &
Human Nutrition Unit
All India Institute of Medical Sciences
Ansari Nagar, New Delhi – 110 029

13. Dr. M. Bhandari
Vice Chancellor
King George Medical University
Chauk, Lucknow – 226 001

14. Dr. S. K. Sharma
Professor of Medicine
All India Institute of Medical Sciences
Ansari Nagar, New Delhi – 110 029

15. Dr. Alok Kalla
Prof. of Physical Anthropology
University of Delhi, Delhi – 110 007

16. Dr. A. K. Khokkar
Dy. Medical Commissioner
ESIC, Panchdeep Bhawan
Kotla Road, New Delhi - 110 002

17. Dr. Arvind Pandey
Director
Institute for Research in Medical Statistics
Ansari Nagar, New Delhi – 110 029

18. Dr. V. M. Katoch
Director
Central Jalma Institute for Leprosy
Tajganj, Agra – 282 001
19. Dr. A. C. Mishra
Director
National Institute of Virology
20-A, Ambedkar Road
Pune – 411 001
20. Dr. S. D. Purohit
Former Principal
Dr. S. N. Medical College
FXB Organization
543, Defence Colony
Jodhpur – 342 003
21. Dr. M. M. Bhandari
Professor Emeritus
Former Head Department of Botany
J.N.V. University, Jodhpur 342 001

Special Invitee

22. Dr. S. D. Sharma
Emeritus Professor
Institute of Human Behaviour and
Allied Sciences (IHBAS)
Dilshad Garden, New Delhi – 110 095

Member Secretary

23. Dr. R. C. Sharma
Officer-in-Charge
Desert Medicine Research Centre
New Pali Road, Jodhpur –342 005

9. Ethical Committee

1. Dr. S.D. Purohit
Former Principal
Dr . S.N. Medical College
FXB Organization
543, Defence Colony
Jodhpur
Chairman
2. Dr. Alok Gupta
Associate Professor
Department of Medicine
Dr. S. N. Medical College
Jodhpur
Clinician
3. Dr. D.R. Mathur
Professor & Head
Department of Pathology
Dr. S. N. Medical College
Jodhpur
Basic Medical Science
4. Dr. C.S. Bais
Professor & Head
Department of Microbiology
Dr. S. N. Medical College
Jodhpur
Basic Medical Science
5. Dr. M. M. Vyas
Joint Director
Medical & Health Services
Zone Jodhpur
Jodhpur
State Health representative
6. Shri Vinit Kumar Mathur
Addl. Central Government
Standing Council
784, 5th Chopasani Road
Jodhpur
Legal Expert
7. Shri R. Tater
Secretary
Thar Voluntry Health Society
E-22, Bhagvan Mahaveer Nagar
Pal Link Road
Jodhpur
NGO representative

- | | |
|---|---------------------|
| 8. Dr. C. L. Mathur
Former Deputy Director
2/356, Kudi Bhagtasani Housing
Board Colony
Jodhpur | Veterinarian |
| 9. Prof. R. S. Srivastava
Former Prof. & Head
Department of Sociology
JNV University
10, Central School Scheme
Jodhpur | Sociologist |
| 10. Dr. Kishor Choudhary
Dy. Director-General (SG)
Indian Council of Medical Research
V. Ramalingaswami Bhawan
New Delhi | ICMR representative |
| 11. Dr. R. C. Sharma
Officer-in-Charge
DMRC | Member Secretary |

10. Divisions/Functional Groups

Officer-in-Charge

Dr. R. C. Sharma, M. Sc., D. Sc.

A. SCIENTIFIC

Division of Parasitology & Medical Entomology

Dr. Vinod Joshi, M.Sc., Ph.D., Deputy Director
Dr. Karam V. Singh, M.Sc., Ph.D., Assistant Director
Dr. S.K. Bansal, M.Sc., Ph.D., Assistant Director
Dr. Manju Singhi, M.Sc., Ph. D., Research Officer
Dr. H. R. Balotia, M.B.B.S., Research Officer
Shri P.K. Dam, M. Sc., Technical Officer
Dr. Himmat Singh, M.Sc., Ph.D., Research Assistant
Shri Anil Purohit, M.A., Research Assistant

Division of Clinical Epidemiology

Dr. K. R. Haldiya, M.D., Deputy Director
Dr. M.L. Mathur, M.D., Deputy Director
Dr. Raman Sachdev, M.D., Deputy Director

Division of Nutrition

Dr. Madhu B. Singh, M.Sc., Ph. D., Assistant Director
Dr. J. Laxminarayana, M.Sc., Ph. D., Assistant Director
Dr. Ranjana Fotedar, M.B.B.S., Senior Research Officer

Division of Bio-statistics

Dr. A. K. Dixit, M.Sc., Ph.D., Assistant Director
Dr. Praveen Kumar Anand, M.B.B.S., Research Officer

Division of Social Sciences

Dr. S.P. Yadav, M.A., Ph.D., Assistant Director
Shri Raj Kumar Kalundha, M.A., Technical Officer

B. TECHNICAL STAFF

Shri Manjeet Singh Chalga, Technical Officer (Joined 17.11.2003)
Shri M.S. Khan, Laboratory Technician
Shri Rajneesh Kumar, Laboratory Technician
Shri Pooran Mal Meena, Laboratory Technician
Shri Ramesh Chandra Sisodiya, Laboratory Technician
Shri Colvin Sunil Singh, Laboratory Technician
Shri Santosh Kumar Dhawal, Laboratory Technician
Shri Rohit Prasad Joshi, Laboratory Assistant
Shri Rajendra Kumar Chouhan, Laboratory Assistant

C. ADMINISTRATION

Shri S. K. Gautam, Section Officer (Up to 25.02.2004)
Shri Narender Bajaj, Assistant
Smt. Neelam Devi, Assistant
Shri Joginder Singh, Stenographer
Smt. Kanchan Bala, Junior Hindi Translator on Ad-hoc (Joined on 24.11.2003)
Smt. Lajwanti, Upper Division Clerk (Up to 07.11.2003)
Shri Ram Nivas, Lower Division Clerk
Shri Nand Kishore, Lower Division Clerk

MAINTENANCE, LIBRARY & TRANSPORT

Shri S. K. Lotan, Section Officer
Shri Shamshad Ali, Upper Division Clerk
Shri M.C. Pargi, Upper Division Clerk

ACCOUNTS

Shri Anup Sarin, Accounts Officer (Joined 03.03.2004)
Shri D. V. Rao, Accounts Officer (Up to 17.06.2003)
Shri Dharam Pal Belani, Assistant
Shri Rajinder Singh, Assistant
Smt. Chandra Kala, Upper Division Clerk
Shri Yash Pal Singh, Upper Division Clerk

D. SUPPORTING STAFF

Drivers

Shri Babu Lal
Shri Raghu Nath Singh
Shri Ishwar Khetani
Shri Dalpat Singh

Shri Mangu Singh
Shri Mohd. Gaffar
Shri Manohar Singh

Laboratory Attendants

Shri Banwari Lal
Shri Lal Chand Bandra

Shri Sridhar Bohra

Animal Attendants

Shri Raghu Nath Singh Bisht
Shri Mahaveer Prasad

Shri Babu Lal Bunker
Shri Satya Prakash

Attendants (A)/ Peons (P)/ Sweepers (S)

Shri Mahesh Chand Sharma (A)
Smt. Laxmi Kanta (A)
Shri Ram Lal, (P)
Shri Ladhu Ram (P)

Shri Jodha Ram (A)
Shri Khushal Singh (A)
Smt. Sohani Devi (P)
Smt. Sua Devi, (S)

PROJECT STAFF - WHO (Dengue)

Dr. Yogesh Kumar, Research Associate
Shri Sandeep Adha , Senior Research Fellow
Miss Keerti Sharma, Junior Research Fellow
Shri Narender Sharma, Laboratory Technician
Shri Sonu Sharma, Driver