Study on Dengue and Dengue Haemorrhagic Fever in Rajasthan, India-

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Date of Commencement: **February, 2003** Duration: **Three Years** Status: **Ongoing**

Objectives (Research)

1. To undertake situation analysis with respect to entomological, virological, epidemiological and serological aspects of dengue/DHF in study areas. Establishment of inter-relation among pupal density of *Aedes* species, naturally infected adult mosquitoes and cases of dengue in a given setting, to develop entomological indicators of disease: Development of predictors and determinates of dengue in Rajasthan.

2. To study quantum of transovarial transmission of virus taking place in nature among generations of susceptible *Aedes* mosquitoes. Study of its epidemiological significance in retention of disease during inter epidemic periods.

3. To study mechanism of DHF in study areas in context to Halstead's hypothesis and role of cytotoxic factor and/or genomic changes: Determination of regional risk factors of DHF.

Objectives (Capacity Building)

1. Creation of a databank to provide knowledge of occurrence and distribution of *Aedes* species in representative paradigms (study areas) of Rajasthan. Development of an updating mechanism of above data base in existing computer soft wares to know status of entomological and virological parameters at a given time for a given setting. Computer simulations of expected dengue prone areas, validation of the simulated results and their ultimate utilization for developing early warning system.

2. Establishment of a Regional Dengue/DHF Reference Centre in the host institute. The proposed laboratory will have its own generated data in the demonstrable form, to guide in developing a suitable control programme. In addition, necessary reference facilities will be initiated in the host institute to help health implementing authorities in developing expertise of identifying vector species and their region specific habitats.

Rationale

To address the objectives 1-3 as stated above, present proposal is directed to answer following research questions:

Research question 1. Through study of dengue as a system consisting of *Aedes* vectors, dengue virus and affected human population, in association with regional ecological

condition of a given setting, can we develop predictors and determinants of dengue infection for different settings of Rajasthan?

Hypothesis to tested: It is hypothesized that in a given setting, dengue operates as definite relationship existing among vectors density (adults and immatures), number of naturally infected mosquitoes and person carrying active infection of dengue at a particular point of time. As a base line research, active surveillance of vector mosquitoes, their breeding and adult habitats and screening of dengue virus activity in humans and *Aedes* vectors is proposed to be taken up for determining the risk status of a particular settings due to dengue. The correlation of the observation emerging from these investigations and their reproducibility is likely to lead to development of standardized indicators of dengue virus activity in an area, as have been attempted for other regions in the world (Koopman *et al*., 1991)

Research question 2. Since dengue appears as a seasonal morbidity in community, during inter epidemic periods, where virus remains in nature?

Hypothesis to be tested: Studies undertaken by us in past have indicated that transovarial transmission of dengue virus persists in up to seven subsequent generations of *Ae. aegypti* and that this phenomenon could be the one way in which virus maintains itself in nature (Joshi et Al., 2002). The proposed study on host parasite interaction aspects such as number of mosquitoes infected through transovarial route of virus, may add to understanding that to what extent virus maintains itself in nature by this mechanism and that what could be the possible epidemiological significance of this phenomenon to retain the disease in a setting during inter epidemic periods.

Joshi, V., Mourya, D.T. and Sharma, R.C. 2002. Persistence of Dengue-3 virus through transovarial passage in successive generations of *Aedes aegypti* mosquitoes. *American Journal of Tropical Medicine & Hygiene* 67(2): 158-161

Research question 3. What are the risk factors of DHF in Rajasthan in context of Halstead's hypothesis, in context of concept of development of cytotoxic factor and/or in context of genomic genomic constitution of affected population?

Hypothesis to be tested: Due to increased movement of human population across the cities and states, risk of mixing of different types of dengue serotypes has increased substantially (Halstead, 2000). Moreover a particular human population group with its own genetic constitution may also contribute major or subsidiary role in making themselves vulnerable or resistant to DHF. Recent studies on DHF in Africa have revealed that there may be more than one reason responsible for making a particular human population to be vulnerable to DHF (Halstead, 2001). In this part of world too, the studies towards possible cause of DHF need to be determined to develop the regional risk factors of DHF in Rajasthan.

Halstead, S.B.2000.Global perspectives in Dengue Research. Dengue Bulletin24:17-21
Halstead et al. 2001. Haiti: Absence of dengue haemorrhagic fever despite hyper endemic dengue virus transmission. American Journal of Tropical Medicine & Hygiene 65(3): 180-183.

Progress of the work

As per the objectives stated in the project, progress attained so far , is summarized below:

1. **Research activities**
2. **Academic/training activities**
3. **Institutional Research Capacity building activities**

Research Activities

(Detailed Progress Report)

Summary of work undertaken

During reported period of 9 months, from February, 2004 till October, 2004 a comprehensive field work was planned and in part was executed in 25 study settings (20 villages and 5 urban towns) adopted for the present investigations. The selected areas are representative of all existing ecotypes, Socio-cultural setups and topographic variations existing in the state of Rajasthan, India.

Brief Description of study areas

1. **Desert Zone:** Desert region represents a plain, loose sandy, areas were no or thin vegetation is present. Human population is sparse and villages are far flung.

2. **Hilly terrain Zone:** This zone occupies southern part of state and represents hills lakes and relatively thickly vegetated area. Socio-culturally, it represents tribal populated area.

3. **Eastern foot hills zone:** This study setting represents foot hills zone with cosmopolitan Socio-cultural setup. The area includes population frequently mixing with other states in country.

4. **River, Forest and Irrigated zone:** This study areas presents a setting characterized by river, floods, thick forest and industrial setup in the towns.

5. **Desert with saline river zone:** This area represents desert with seasonal river containing saline nature. The area is culturally similar with Desert zone.

Table 1. Details of study settings and population covered in each village/town

Zone	Villages screened Pre-Monsoon	Popu. Examined	Villages screened Post-Monsoon	Popu. Examined	Total Population examined
Desert Zone	A Jaisalmer	510	A Jaisalmer	510	1020
	B Tejpala	481	B Tejpala	481	962
	C. Kanoi	501	C. Kanoi	501	1002
	D Lawah	117	D Lawah	586	703
	E Sakaria	ND	E Sakaria	423	423
	Sub Total	1609		2501	4110
Hilly terrain	A Udaipur	452	A Udaipur	469	921
	B Rishabdev	439	B Rishabdev	421	860
	C. Salera kalla	406	C. Salera kalla	458	864
	D Vana	ND	D Vana	951	951
	Sub Total	1297		2299	3596
Eastern foot hills	A Jaipur	664	A Jaipur	672	1336
	B Seodaspura	835	B Seodaspura	830	1665
	C. Samod	817	C. Samod	799	1616
	D Achrol	ND	D Achrol	688	688
	E Mahela	ND	E Mahela	597	597
	Sub Total	2316		3586	5902
River & forest irrigated zone	A Kota	526	A Kota	521	1047
	B Borabas	510	B Borabas	500	1010
	C. K . Patan	596	C. K . Patan	596	1192
	D Chandresar	ND	D Chandresar	637	637
	E Simliya	ND	E Simliya	497	497
	Sub Total	1632		2751	4383
Desert with saline river zone	A Jalore	469	A Jalore	470	939
	B Charli	428	B Charli	367	795
	C. Mandavla	455	C Mandavla	381	836
	D Daspa	ND	D Daspa	538	538
	E Sarnau	ND	E Sarnau	555	555
	Sub Total	1352		2311	3663
	Pooled	8206		13448	21654

Urban Areas Rural Areas, ND = Not Done

1. Situation Analysis with respect to dengue vectors, virus and disease status

1a. Vectors

Adult survey: A survey of adult *Aedes* mosquitoes was made in 1,588 households with population of 8,206 during pre-rain period and in 2,388 households with population of 13,448 during post rainy period in 20 villages and 5 urban towns across five study settings of Rajasthan, India. During pre-rains period Adult House Index (AHI) of *Aedes* mosquitoes in desert zone was 6.1%, 11% in hilly zone, 13.3% in Eastern foot hills zone, 13.3% in River forest zone and 8% in Desert saline river zone. The maximum overall *Aedes* positive houses were observed in areas characterized by river forest and foot hills (Table 2).

Larval survey: Detailed investigations with respect to larval densities and their preference towards breeding containers, in different settings has been undertaken in all the study villages. The observations have been made in pre-rains (April-June' 04) as well as in post-rain (August–October' 04) period. In all, 1588 house holds including population of 8206 were screened in pre-rains and 2500 house holds including population of 13,448 were screened as follow up studies during post-rainy period. In all 16,694 domestic containers examined of which 632 (3.8%) were positive for *Aedes* breeding. In desert zone cement tank

(12.3% pre-rains; 5.1% post-rains); in Eastern foothills zones unclassified containers and cement tanks (46.2%; 20.0%) in forest and river zone coolers and cement tanks (16.7; 18.3%); in desert with saline zone cement tanks and coolers (5.7; 91.7%) and in hilly terrains zone cement tanks (16.1%) were preferred breeding habitats (Table 5).

Table 2. Observations of Entomological Investigations on dengue Vector: Adult & Larval Survey

Zone	Villages /Town	Pre-rains					Post-rains				
		House Exam.	+Ve for Aedes	AHI	Cont +Ve	BI	House Exam.	+Ve for Aedes	AHI	Cont. +Ve	BI
Desert Zone	A Jaisalmer	100	24	24	37	37	100	20	20	9	5
	B Tejpala	88	0	0	29	33.0	88	0	0	1	0.56
	C. Kanoi	100	0	0	25	25.0	100	0	0	2	1
	D Lawah	100	0	0	2	2	100	1	1	0	0
	E Sakaria	ND	0	0	ND	ND	100	0	0	2	1
	Sub-Total	388	24	6.1	93	24.0	488	21	4.3	14	2.8
Hilly terrain	A Udaipur	100	13	13	3	3	100	6	6	16	16
	B Rishabdev	100	9	9	2	2	100	10	10	13	13
	C. Salera kalla	100	11	11	7	7	100	13	13	27	27
	D Vana	ND	ND	ND	ND	ND	100	8	8	23	23
	Sub-Total	300	33	11	12	4.0	400	37	9.3	79	19.7
Eastern foot hills	A Jaipur	100	15	15	15	15	100	3	3	14	14
	B Seodaspura	100	11	11	34	34	100	14	14	48	48
	C. Samod	100	14	14	60	60	100	7	7	27	27
	D Achrol	ND	ND	ND	ND	ND	100	32	32	43	43
	E Mahela	ND	ND	ND	ND	ND	100	5	5	5	5
	Sub-Total	300	40	13.3	109	36.3	500	61	12.2	137	27.4
River & forest irrigated zone	A Kota	100	3	3	5	5	3	5	5	16	16
	B Borabas	100	18	18	20	20	18	13	13	24	24
	C. K . Patan	100	19	19	24	24	19	20	20	44	44
	D Chandresar	ND	ND	ND	ND	ND	ND	1	1	1	1
	E Simliya	ND	ND	ND	ND	ND	ND	7	7	16	16
	Sub-Total	300	40	13.3	49	16.3	500	46	9.2	101	20.2
Desert with saline river zone	A Jalore	100	6	6	5	5	100	1	1	4	4
	B Charli	100	9	9	2	2	100	4	4	3	3
	C Mandavla	100	9	9	17	17	100	6	6	12	12
	D Daspa	ND	ND	ND	ND	ND	100	10	10	14	14
	E Sarnau	ND	ND	ND	ND	ND	100	2	2	68	68
	Sub-Total	300	24	8	24	8.0	500	23	4.6	101	20.2
	Pooled Total	1588	133	8.3	287	18.0	2388	167	7.00	432	18.1

Urban Areas Rural Areas ND = Not Done

1b. Natural infectivity of dengue in field collected mosquitoes: During pre-rains period 304 *Aedes aegypti* and 4 *Aedes vittatus* and during post rain period 353 *Aedes aegypti* and 10 *Aedes vittatus* were subjected to IFA Test for detection of natural infection of dengue virus in field caught mosquitoes. In pre-rains period in desert zone and hill terrain zone no mosquito was detected infected while maximum (2.3%) extrinsic presence of virus was observed in desert with saline river zone . During post rainy season while majority of areas did not show any infected mosquitoes in forest and river zone, 6.7% *Aedes aegypti* were infected (Table 3).

Table 3. Observation on natural infection of mosquitoes by dengue virus

Zone	Villages /Town	Pre-rains				Post-rains			
		Aedes aegypti	Aedes vittatus	+Ve for Dengue Virus	% +ve	Aedes aegypti	Aedes vittatus	+Ve for Dengue Virus	% +ve
Desert Zone	A Jaisalmer	50	0	0	0	45	0	0	0
	B Tejpala	0	0	0	0	0	0	0	0
	C. Kanoi	0	0	0	0	0	0	0	0
	D Lawah	0	0	0	0	1	0	0	0
	E Sakaria	0	0	0	0	0	0	0	0
	Sub-Total	**50**	**0**	**0**	**0**	**46**	**0**	**0**	**0**
Hilly terrain	A Udaipur	24	0	0	0	8	2	0	0
	B Rishabdev	15	0	0	0	19	1	0	0
	C. Salera kalla	25	0	0	0	21	2	0	0
	D Vana	ND	ND			26	0	0	
	Sub-Total	**64**	**0**	**0**	**0**	**74**	**0**	**0**	**0**
Eastern foot hills	A Jaipur	26	0	0	0	3	1	0	0
	B Seodaspura	15	0	0	0	24	0	0	0
	C. Samod	20	4	1	5	16	0	0	0
	D Achrol	ND	ND			70	1	0	0
	E Mahela	ND	ND			9	0	0	0
	Sub-Total	**61**	**4**	**1**	**1.6**	**122**	**0**	**0**	**0**
River & forest irrigated zone	A Kota	7	0	0	0	10	3	0	0
	B Borabas	36	0	1	2.7	31	2	0	0
	C K . Patan	36	0	0	0	31	4	6	19.3
	D Chandresar	ND	ND		0	1	0	0	0
	E Simliya	ND	ND			16	2	0	0
	Sub-Total	**79**	**0**	**1**	**1.2**	**89**	**11**	**6**	**6.7**
Desert with saline river zone	A Jalore	7	0	0	0	1	0	0	0
	B Charli	14	0	1	7.1	4	0	0	0
	C Mandavla	21	0	0	0	11	0	0	0
	D Daspa	ND	ND			21	0	0	0
	E Sarnau	ND	ND			5	0	0	0
	Sub-Total	**42**	**0**	**1**	**2.3**	**42**	**0**	**0**	**0**
	Pooled Total	**304**	**4**	**3**	**1.3**	**353**	**10**	**6**	**1.6**

Urban Areas Rural Areas ND = Not Done

1c. Serological surveillance: Demographic details of each house hold surveyed were recorded and from each study family surveyed, it was also enquired if any suspected case of DF/DHF in them (as per hospitals diagnosis) was present. Wherever, presence of a suspected DF case was reported, blood sample (2 ml) was taken with help of treating physician following laid down ethical protocol of the project. In all, 1588 house holds including population of 8206 were screened in pre-rains and 2388 house holds including population of 13448 was studied during post-rain period. Of the total 47clinically suspected cases of DF in 8206 persons examined during pre-rains, 22 (2.6 cases per thousand) were positive for IgM antibodies against dengue when tested for Mac-ELISA. Highest incidence of DF during pre-rains was observed in Desert zone (7.4 per thousand), followed by Hilly terrain zone (5.3 per thousand). In zones such as River & Forest zone, Saline river zone and Foot hills zones only sporadic cases or no case of DF was observed during pre-rains period. However, during post rains, more DF/DHF cases were observed in River & Forest (2.5 per thousand) and in Saline river zone (2.5 per thousand) as compared to Desert (0.0),Hilly terrain zone (0.0) and Foot hills zone (0.2 per thousand).

Table 4. Sero-surveillance of DF/ DHF in study areas

Zone	Villages screened Pre-Monsoon	No of serum sample Examined	No of serum +ve	% +Ve cases / 1000 population	Villages screened Post-Monsoon	No of serum sample Examined	No of serum samples+ ve	% +Ve cases / 1000 population
Desert Zone	A Jaisalmer	22	11	21.5	A Jaisalmer			
	B Tejpala	4	1	2.07	B Tejpala			
	C. Kanoi	0	0		C. Kanoi	4		
	D Lawah	0	0		D Lawah			
	E Sakaria	0	0		E Sakaria			
	Sub Total	**26**	**12**	**7.4**		**4**	**0**	**0**
Hilly terrain	A Udaipur	13	7	15.5	A Udaipur			
	B Rishabdev	0	0		B Rishabdev			
	C. Salera kalla	0	0		C. Salera kalla			
	D Vana	ND	ND		D Vana			
	Sub Total	**13**	**7**	**5.3**		**0**	**0**	**0**
Eastern foot hills	A Jaipur	7	2	3.01	A Jaipur	6	1	1.5
	B Seodaspura	0	0		B Seodaspura	3	0	0
	C. Samod	0	0		C. Samod	3	0	0
	D Achrol	ND	ND		D Achrol			
	E Mahela	ND	ND		E Mahela			
	Sub Total	**7**	**2**	**0.8**		**12**	**1**	**0.2**
River & forest irrigated zone	A Kota	0	0		A Kota	0	7*	13.4
	B Borabas	0	0		B Borabas			
	C. K . Patan	0	0		C. K . Patan			
	D Chandresar	ND	ND		D Chandresar			
	E Simliya	ND	ND		E Simliya			
	Sub Total	**0**	**0**			**0**	**7**	**2.5**
Desert with saline river zone	A Jalore	1	1	2.1	A Jalore	13	6	12.7
	B Charli	0	0		B Charli			
	C. Mandavla	0	0		C Mandavla			
	D Daspa	ND	ND		D Daspa			
	E Sarnau	ND	ND		E Sarnau			
	Sub Total	**1**	**1**	**0.7**		**13**	**6**	**2.5**
	Pooled Total	**47**	**22**	**2.68**		**29**	**14**	**1.04**

Urban Areas Rural Areas ND = Not Done

2. Study of Regional risk factors of DHF

In the study area named as River & Forest zone, 7 cases of DHF (diagnosed by the hospital) were reported from the indoor wards of hospital of urban area (Kota) in the setting. The mosquito fauna collected from the household from where the cases belonged, when tested for IFA, were positive for dengue antigen (Table 4). The detailed history of the patients has been recorded to undertake contact tracing / follow up studies to determine possible causes of DHF. Following additional investigations were undertaken in this study area:

- Surveillance of tree hole breeding of mosquitoes was undertaken to examine whether extrinsic virus strain of such restricted mosquito fauna is different than circulating virus strain among DF cases. Further work is in progress.
- The studies to characterize extrinsic and intrinsic strains are to be undertaken in forthcoming time. It is presumed that cross strain infection of dengue sero types may be due to mixing of strain and its antibodies circulating regularly in urban population and its occasional crossing by a different strain being retained vertically by tree hole breeding fauna.
- *Aedes albopictus* and *Ae. thomsoni* were observed breeding in tree holes. Further studies are in progress. *Ae. thomsoni* has not been reported earlier from this area and its role in virus transmission or sustenance will be studied.

Highlights of Research

- Observations on entomological parameters of dengue vectors show that among all study settings, except, during pre-rain period urban house index of *Ae. aegypti* was observed higher than in post-rain periods. The risk factor associated with such observation is supply of domestic water in the areas. During pre-rain or summer season in most of the arid or semi-arid areas of the state, water supply get irregular and people tend to store more and more water which pronounces vector prominence in the human habitations. Such observations are important as arid ecology of a setting will indirectly influence the etiology of dengue through irregular water supply in the town.
- Pronounced vector density in Desert zone and Hilly terrain zone and more number of DF cases (7.4 and 5.3 per thousand respectively) during pre-rains period indicate a different time of peak of disease endemicity in these settings as compared to settings such as Forest & River zone and Saline river zone where more DF activities (2.5 and 2.5 per thousand) have been observed in post-rains period. Another important observation is that in Desert zone and Hilly terrain zone while more pronounced vectors and disease was observed, infected mosquitoes were not detected in pre-rains period. It appears that disease pathogen in Desert and Hilly terrain may be of less sustenance type in nature and occurrence of disease during pre-rains in these settings may be an imported infection, to be confirmed and studied further.
- It appears from the points mentioned above and from overall trends of the observations that a detailed situation analysis of the state as per the parameters being studied, is likely to lead to a reproducible knowledge of risk factors of DF across all the ecotypes of Rajasthan. An overall dengue surveillance and monitoring design based on the results of the project should be possible.
- The observations made on frequency of DHF cases in Forest & Hilly zone (in Kota town) alarms the role of DHF supporting factors in the region owing to different ecology of this area which is favoring tree hole breeding of un reported *Aedes* species. Role of tree hole breeders in carrying a different strain of DEN than one circulating regularly, is a unique research point being pursued by the group of PI, and it may add a newer dimension to our understanding of etiology of DHF in general and as a specific risk factor in study setting.

2. Academic and training activities

Ph. D. Programmes:

Through ongoing project two students have started their Ph.D. programmes on Dengue. Details of Ph. D. topics are mentioned below:

1. Entomological and virological studies of *Aedes* mosquitoes with reference to their role in dengue transmission in different ecotypes of Rajasthan.(working for last one year)

2. Molecular characterization of dengue vectors (yet to be registered)

Short term Training courses:

Following students of Bachelor of Engineering (Bio technology) have been trained in various entomological virological and serological techniques being used in present project. Details of students are given below:

Trainee	Institution
1. Aman Anand	Jaipur Engineering college and Research centre, Jaipur
2. Ritesh Gupta	Jaipur Engineering college and Research centre, Jaipur
3. Pradeep Ashani	Jaipur Engineering college and Research centre, Jaipur

Three months small project /dissertations training courses:
Following students were delivered three months training project as working towards sylvatic cycle of dengue around Jodhpur and investigating into its different aspects.

Trainee	Institution
1. Ms. Jullie vergeese	Mahatma Jyoti Rao Phule Mahila Mahavidhyala, Jaipur
2. Ms. Sunita Rana	Mahatma Jyoti Rao Phule Mahila Mahavidhyala, Jaipur

3. Institutional Research Capacity building activities:
The project has strengthened institute's capacity to undertake extensive field & laboratory work, infrastructure and trained manpower availability in the institute and also opportunities of interaction for the PI and his group, with the National experts. During reported period following conspicuous progress has been made in this direction.

1a. Generating observations pertaining to situation analysis:

- A comprehensive surveillance of *Aedes* mosquitoes in 5 physiographic regions of Rajasthan state has been started. Collection of adult mosquitoes from domestic, peri-domestic and tree holes are being identified and processed further, larvae and pupae being collected are reared in laboratory. Mosquitoes collected from the field and reared in laboratory, have been subjected to IFAT (Indirect Fluorescence antibody Test) for detecting natural infectivity of dengue virus.

- During reported period (March to October' 04) field investigations have been undertaken in two phases; Phase I- Pre-rain period (April-July) and Phase II- Post rain period (August-October).

- Blood samples of suspected DF cases were collected and tested for Mac-ELISA for presence of Igm antibodies, against dengue.

- Investigations have been undertaken in 20 villages and 5 urban towns spread in 5 physiographic regions of state of Rajasthan. These 25 study settings have been surveyed two times, once in pre-rain and other in post-rain season during reported period.

- The observations are analyzed using GIS based computer programme. It is expected that at the end of two years investigations, a comprehensive data base pertaining to vectors, extrinsic virus activity, circulating antibodies in suspected cases and associated ecological attributes, will be developed as a baseline and exemplary database for planning an anti-dengue programme in the state.

Ib. Progress towards establishment of a regional reference services Centre on Dengue:
Available status of knowledge about etiology of dengue/DHF and technical capacity to deal with entomological, virological and serological aspects of DF is quite meager among medical and paramedical staff of state health department, Rajasthan. To enhance the specific knowledge and provide technical guidance to the health implementing authorities/personnels, host institute has made an early mark of being specialized regional laboratory on Dengue, through ongoing work of the project. Following progress has been made:

- Two batches of medical officers each consisting of about 25 medical doctors, have been trained for etiology of dengue demonstrating, to them, morphological characteristics of different vector species, their breeding and adult habitats and mechanism of DHF as per existing theories.

- Blood samples received from the Government hospital are being tested for the presence of Igm antibodies against dengue and results have been communicated to the concerned. The authorities have been offered to take guidance of groups of PI for launching investigations in areas affected by DHF to take preventive measures against further expansion of problem in areas.

- Director, Health services, Government of Rajasthan has been intimated about ongoing activities of the project and observations generated on different aspects.

Salient observations and Early Leads

The studies towards stated research objectives in the project are in progressing phase. Before any inference or conclusion is made, confirmation need to be made. However, as an interim report following points are stated:

- Observations on entomological parameters of dengue vectors show that among all study settings, except, during pre-rain period urban house index of *Ae. aegypti* was observed higher than in post-rain periods. The risk factor associated with such observation is supply of domestic water in the areas. During pre-rain season in most of the arid or semi-arid areas of the state, water supply get irregular and people tend to store more and more water which pronounces vector prominence in the human habitations. Such observations are important as arid ecology of a setting will indirectly influence the etiology of dengue through irregular water supply being made available in the towns.

- Pronounced vector density in Desert zone and Hilly terrain zone and more number of DF cases (7.4 and 5.3 per thousand respectively) during pre-rains period indicate a different time of peak of disease endemicity in these settings as compared to seasonality of disease in settings such as Forest & River zone and Saline river zone

where more DF activities (2.5 and 2.5 per thousand) have been observed in post-rains period. Another important observation is that in Desert zone and Hilly terrain zone while more pronounced vectors and disease was observed, infected mosquitoes were not detected in pre-rains period. It appears that disease pathogen in Desert and Hilly terrain may be of less sustenance type in nature and occurrence of disease during pre-rains in these settings may be an imported infection, to be confirmed and studied further.

- It appears that a detailed situation analysis of the state as per the parameters being studied, is likely to lead to a reproducible knowledge of risk factors of DF across all the ecotypes of Rajasthan. An overall dengue surveillance and monitoring design based on the results of the project should be possible in time to come.

- The observations made on frequency of DHF cases in Forest & Hilly zone (in Kota town) alarms the role of DHF supporting factors in the region owing to different ecology of this area which is favoring tree hole breeding of un reported *Aedes* species. Role of tree hole breeders in carrying a different strain of DEN than one circulating regularly, is a unique research point being pursued by the group of PI (Unpublished data), and it may add a newer dimension to our understanding of etiology of DHF in general and as a specific risk factor in study setting.

- An interesting trend is emerging that while etiology of DF is governed more by socio-cultural habits of the inhabitants in water scarce areas of Rajasthan, DHF seems to be the outcome of ecological set up of area where restricted ecological niche such as tree holes sustaining their own viral strain, may serve as determinant or regional risk factor of DHF.

Coming activities and Expected duration

Activity	Duration
• Surveillance of vector, virus and sero prevalence investigations in 25 study settings for winter season.	March, 2005
• Laboratory investigation of field collected mosquitoes and serums samples	March to May, 2005
• Marking the "hot spots" of vector abundance and disease occurrence and their correlation with ecology of the study settings in GIS. Launching follow up studies in houses/localities of high vector and disease occurrence to establish relationship of vector-infected vector and disease load. Development of entomological and physio-demographic markers of disease and surveillance design development studies. Identification of DHF cases in study settings.	June- July, 2005
• Follow up of DHF cases to record their history of migration, earlier exposure to dengue and about familial history of DHF.	August-December, 2005
• Surveillance of tree hole breeding of mosquitoes in representative areas of 5 study settings. Study of their natural infectivity by dengue virus (horizontal & vertical studies). Role of tree hole breeding vectors in maintaining virus through transovarial route and in maintaining zoonotic and sylvatic cycle of dengue.	January-February, 2006
• Development of comprehensive data base in GIS with respect to above parameters and developing computer simulations for prospective disease load in study areas.	March, 2006
• Development of Dengue forecasting model and computer software for easy use.	April-May, 2006
• Repeat survey of all study areas to validate the predicted results and developing correction factors if any.	June-July, 2006
• Enumeration of regional risk factors of DHF in Rajasthan in context of Halstead's Hypothesis.	August-October, 2006
• Studies on role of extrinsic virus activities in tree hole breeding mosquitoes for maintaining zoonotic cycle of dengue and its role in amplifying urban cycle.	November-December, 2006
• Research papers and final report preparation.	

Longitudinal studies for diseases dynamics in desert ecosystem of Rajasthan: Study of socio-cultural, socio-economic and epidemiological aspects of malaria using Geographical Information System (GIS)– *R. C. Sharma, Vinod Joshi, S. P. Yadav, A. K. Dixit and P. K. Anand*

Commencement**: January, 2005** Duration**: Three years** Status**: Ongoing**

Objectives

1. Study of health seeking behavior of desert population and determination of socio-economic, socio-cultural and educational basis of behavior. Situation analysis and development of updating mechanism using GIS.

2. Study of migration of human population as confounding risk factor for import and spread of desert diseases with special reference to malaria.

3. Entomological, parasitological and ecological profile of study villages with focus on adaptive mechanism of mosquito vectors of malaria.

4. Development of an integrated data base in GIS for prospective disease transition studies in desert with emphasis on malaria.

5. Study of inter-relationship of sociological, biological and epidemiological components to develop determinants and predictors for nay disease- For malaria as an example.

Rationale

Desert forms an exemplary system of peculiar adaptive abilities exhibited by dwelling human population, mosquitoes and other vector species, pathogenic bacteria and viruses. At a glance, it appears as a stable system having acquired its own characteristics for centuries with respect to above aspects of biosphere. To develop a long term and reliable strategy for monitoring, controlling and forecasting desert diseases, a complete profile study of desert is needed through launching continuous longitudinal studies in its selected representative areas.

Proposed study has been aimed to generate baseline data needed to understand human and its interaction with environment to maintain viable health status. The basic health relevant information on socio-cultural, socio-economic and educational status of human population in desert areas will generate a basis for understanding transition of any disease in desert. In addition its recording in latest computer programmes such as GIS would also impart an updating provision to data from time to time. Since the study of socio-health characteristics, ecology and adaptive associations will be common component required for any of the

prevailing communicable or non communicable diseases, generating such data base seems to be essential component. The conceptual demonstration of project will be presented as a case study through study of malaria in desert. It is proposed to undertake in-depth studies on sociological, entomological, ecological and epidemiological aspects of desert malaria as longitudinal study design to enumerate determinants and predictors for manifesting and control of malaria in desert.

Progress of the work

It is envisaged to undertake the study in three phases as mentioned below:

Phase I - Situation analysis on the basis of available and generated data, enumeration of common and specific characteristics of desert and perceptions of research questions to formulate prospective vertical studies.

Phase II - Undertaking specific studies sensitized through situation analysis and development of a GIS based programme embodying data wealth of available and generated observations.

Phase III - Development of disease specific up-datable GIS based disease modules for monitoring, controlling and forecasting desert diseases.

To present as an exemplary study, malaria has been taken up as a case study. The work done so far is mentioned below:

Situation analysis - epidemiology (Malaria)

Retrospective data of malaria incidence (available with the state health department) in all the 32 districts has been analyzed using GIS. The average API (Annual Parasitic Incidence) of last 10 years ie, 1986-1995 has been calculated and extrapolated over the districts (Figure 1). Following observations emerged:

- Jaisalmer district emerged as the peak endemic district for malaria. The average API of the district was found more than 20 API.
- It appears that Jaisalmer district being irrigated by IG canal may be more vulnerable to malaria transmission. However, since other districts such as Bikaner and Sriganganagar which are irrigated by IG canal had shown very low API, irrigation due to canal can not be associated with high average API. The factors responsible for more pronounced malaria in Jaisalmer therefore need to be worked out.

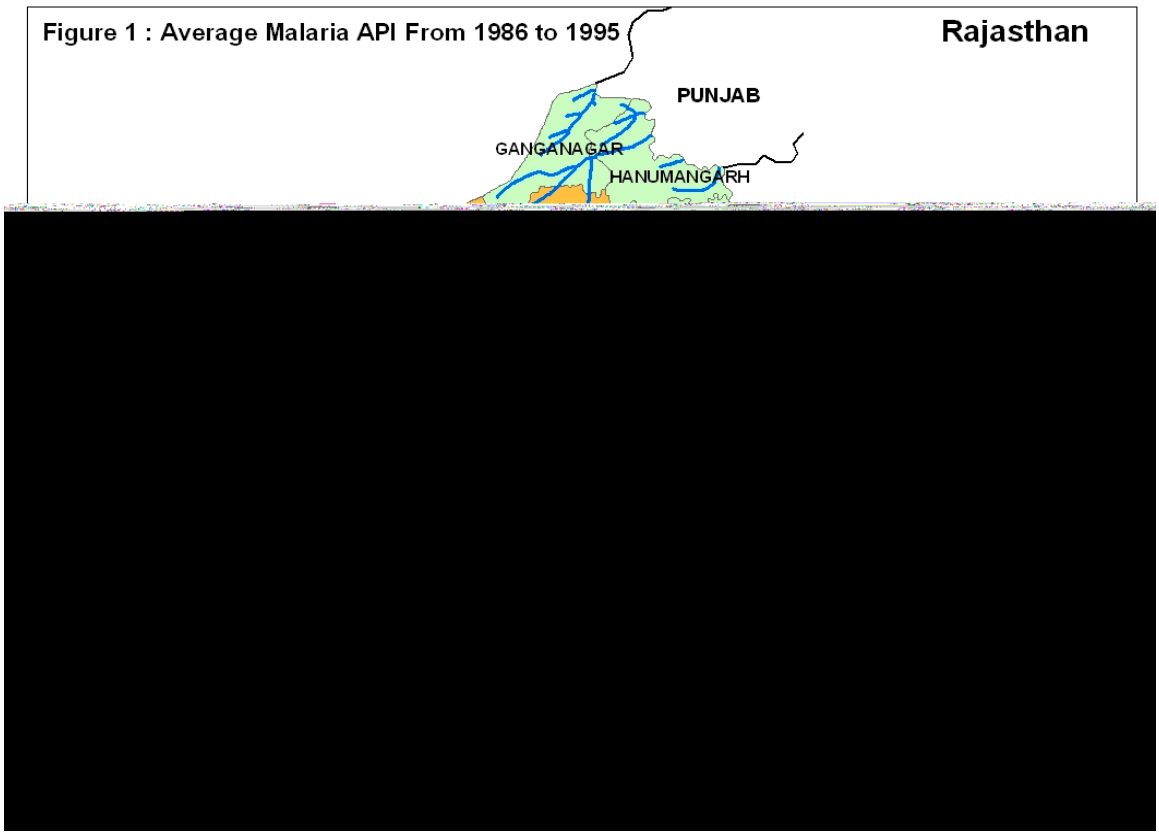
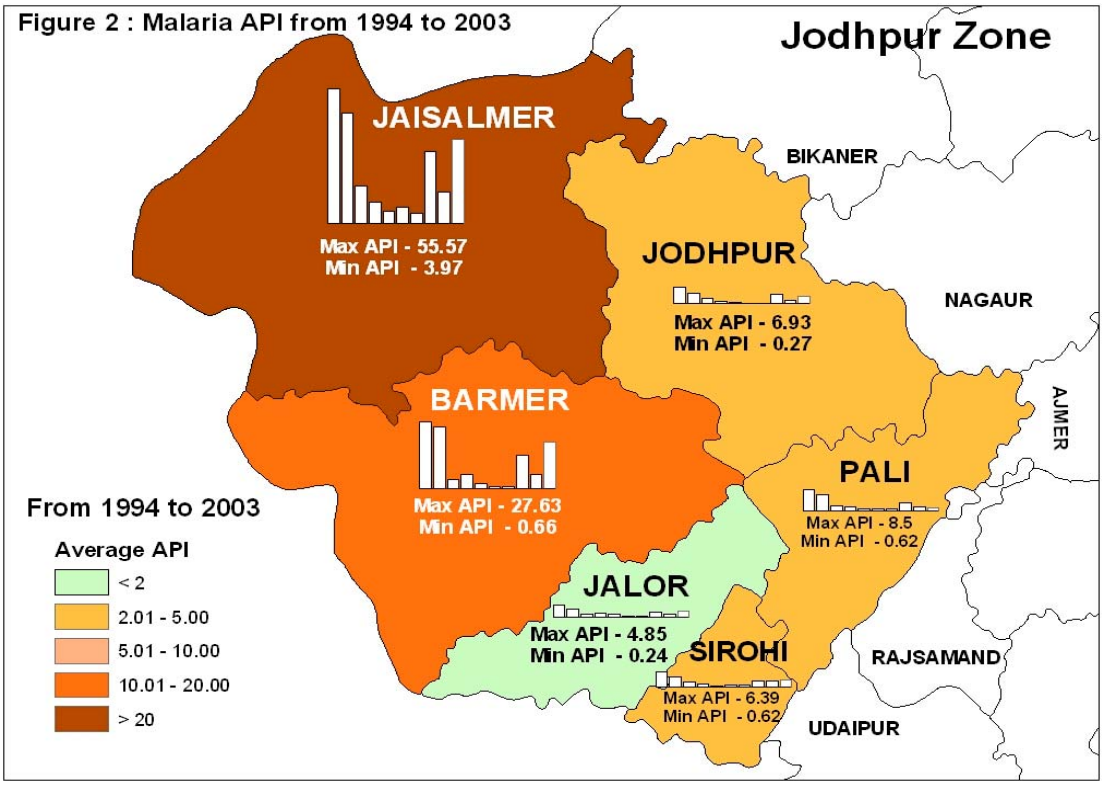


Figure 2 shows yearly trend of API in different districts of Rajasthan for 10 years (1986-1995). Following important observations were made from this analysis:

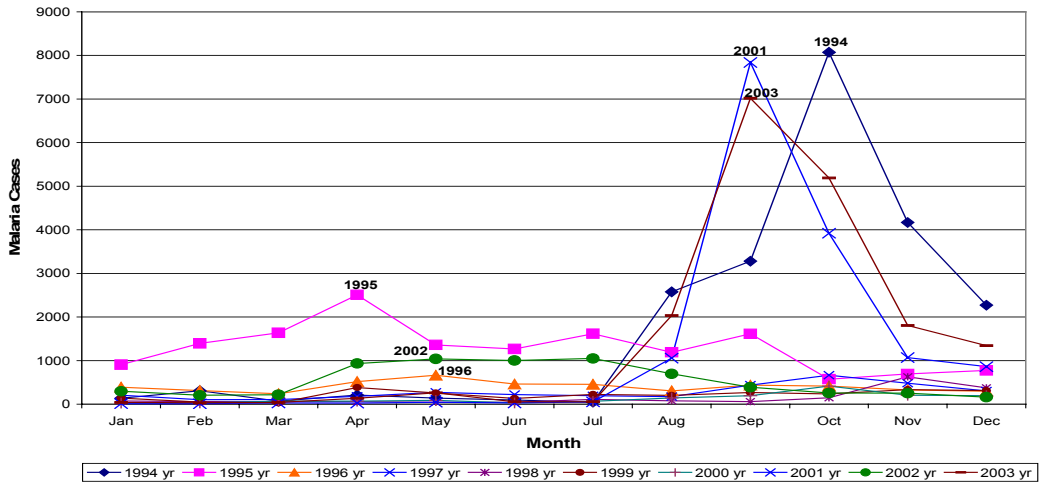
- The trend of average API consolidated for 10 years was also obvious in this analysis too. The analysis showed that highest malaria incidence recorded in Jaisalmer district only. The analysis indicated that consolidation of average API of 10 years was indicative of the same trend which could be observed for one individual year.

- However, one common observation emerged was that though magnitude of disease was highest in Jaisalmer, the trend in increase or decrease in the API from 1986 through 1995 in all the 32 districts was same.



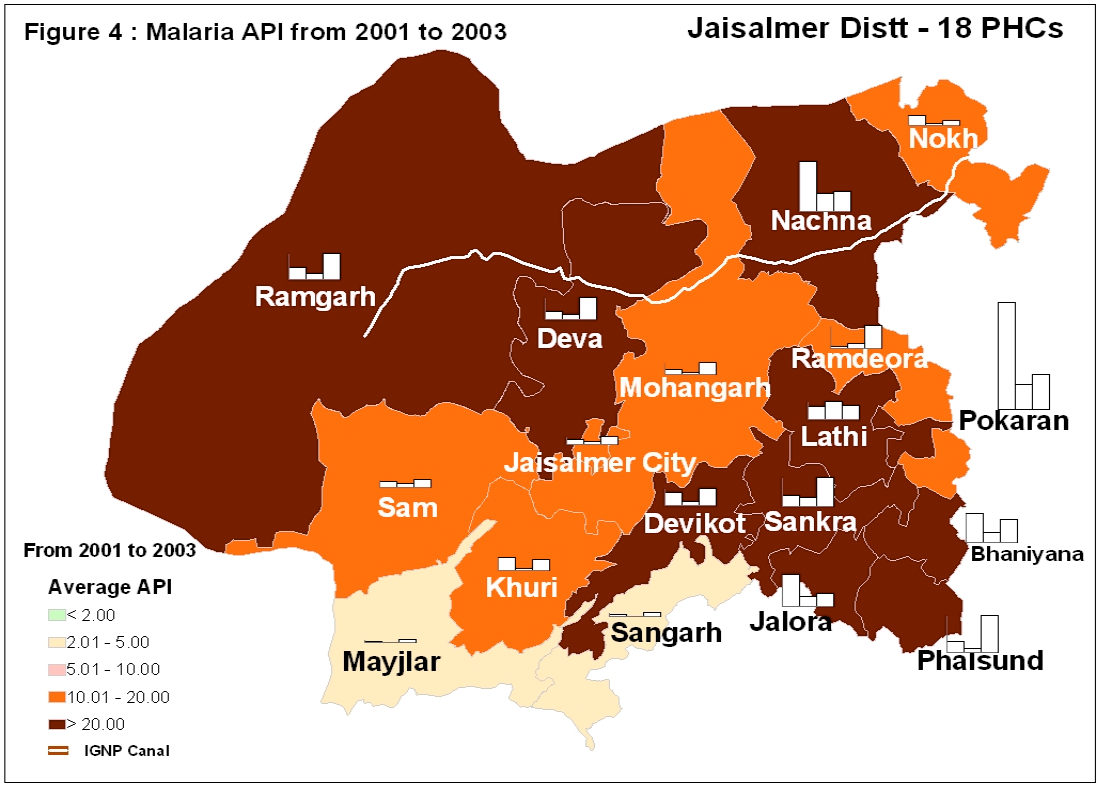
- Figure 3 shows seasonal peaks of malaria incidence across different months of the 10 years data consolidated. The analysis showed that all the three outbreaks of malaria which occurred in period of analysis, took place in the months of August to October only. The observations indicate that outbreak preparedness for malaria needs to be made in this period only. The investigative data generation with respect to mosquito vectors, surveillance and environmental conditions etc of this (August-October) season only be considered for epidemic control

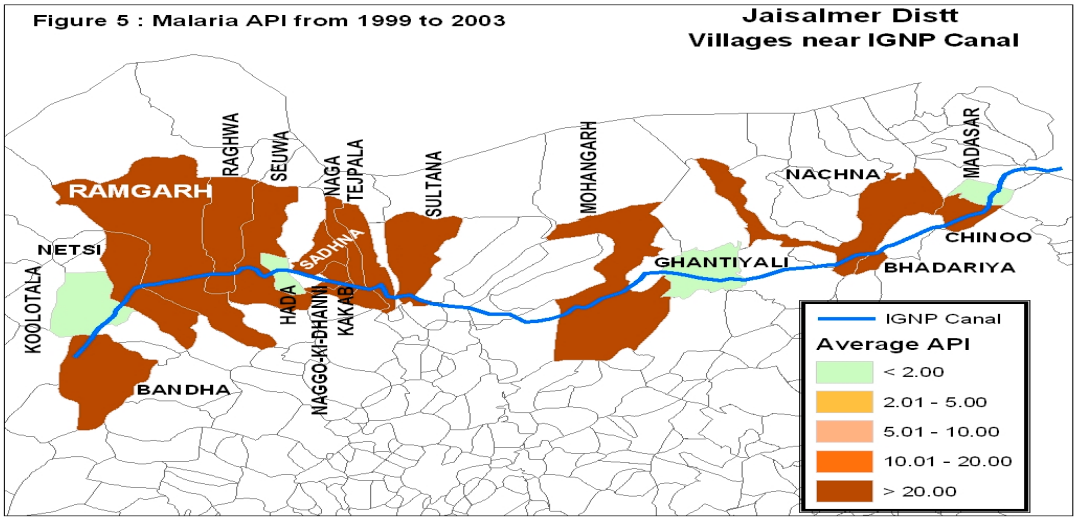
Figure 3 : Monthwise malaria cases in Jaisalmer (from 1994 to 2003)



- Figure 4 shows concentration of malaria incidence among different PHC areas of Jaisalmer district. Two prominent observations are emerging obvious. Malaria is confined to canal irrigated blocks but there are few villages which are even irrigated but do not show higher API.

- On contrary, the villages such as Ramdeora, Lathi and Devikot etc are not canal irrigated but have shown same API level as those of irrigated villages (Figure 4 & 5).





Situation analysis – Socio-economic factors (Malaria)

Since the epidemiological situation analysis of the data has shown that confinement of malaria is there in canal irrigated as well as non canal irrigated villages, attempts to study other factors (other than canal irrigation) were made. The socio-economic factors of the population belonging to canal and non- canal areas were studied. Interpretations made from the Table below are as follows:

- In population of command villages percentage of educated people was 50 % as against 24% educated people in non command villages. This difference of education among the people and presence of canal, in combination is leading to 85 % of population present Above Poverty Line (APL) and 15 % Below Poverty Line (BPL). In non command villages, 40 % were in BPL category and 60 % in APL category.
- The difference of irrigation in two areas leading to difference of education and economy has led to a trend that from command villages only 10% villagers out migrate while 90% people in-migrate. On contrary among non command villagers 90% villagers out-migrated while only 10% in-migrated.
- Desert being an unstable malaria zone, transmission factors are not much pronounced in at least non command villages. Malaria in these villages is imported malaria because 90% people out migrate from here and when they return back to their homes they carry the infection. But these people will return back only during the year of good rains, thus malaria in desert (especially in non command areas) is associated with rainfalls.
- In non-command villages since people in-migrate it shows consistent API across the years and malaria here will be more stable than non command areas for local factors (canal irrigation) being mosquitogenic in nature.

Table 1. Study of role of socio-economic parameters in Epidemiology of desert Malaria

Type of villages	Total population	Male	Female	% Education	Major occupation	% Population		% Migration		% Bed net use
						BPL	APL	Out	In	
Command villages	4900	2563	2337	50	Agriculture and animal keeping	15	85	10	90	30
Non-command villages	3207	1753	1454	24	Agriculture and animal keeping	40	60	90	10	5

Inferences

The studies made with the holistic approach over diseases and their dynamics in desert led to following inferences:

- Extrapolation of malaria incidence data over different areas of Rajasthan has shown concentration of disease in areas of different attributes from irrigation point of view.
- Presence of canal has altered the human behaviour towards their migration pattern from and to the state. As a result, the determinants of malaria in two regions (command and non-command areas) are different. This has led to a somewhat persistent malaria situation in command villages and a seasonal or good rains associated malaria in non-command villages. The control measures against malaria in two regions therefore have to be different.
- The ongoing longitudinal studies are likely to deliver the useful results when completed.

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: **April, 2004** Duration: **Two years** Status: **On going**

Objectives

1. To reduce dengue vector breeding by using plant based larvicide against prevailing vector species *Ae. aegypti* and *Ae. albopictus* in Rajasthan , India.

2. To select most effective seasonal stock of plant and standarise its optimum concontration against both the vector species.

3. To study mode of action of larvicide in experimental and control settings.

4. In-vitro study of blocking potential of *Calotropis procera* against entry of dengue virus into cell line culture of *Aedes aegypti* and *Aedes 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 this region dengue with or without DHF has appeared in the epidemic forms in last few decades. 1,456 confirmed cases with 35 deaths have been reported in the state during the year 2001. In the absence of any specific chemotherapy aginst 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 emerges to be an effective means of prevention of disease. Evaluating indigenous flora as larvicide against local vectors species of dengue , is the ultimate step likely to be realized in the time to come. *Calotropis procera* , a wildely grown plant has been known to contain certain chemical constituents which may be responsible for the larvicidal efficacy. Through proposed project the possibility of utility of latex of *Calotrpis procera*, against *Ae. aegypti* and *Ae.albopictus* will be confirmed. In addition, the optimum dose determination of larvicide will be made to study feasibility of its use as handy and cost effective larvicide aginst vectors of dengue. The preliminary work undertaken by the PI and Co-PI has shown that site of action of larvicidal latex is GI tract of mosquito larvae. Since in the adult mosquitoes mid gut is the site of dengue virus development, the studies will be made in experimental cell line cultures of mid gut of these

species to study whether *Calotropis procera* in addition to being larvicidal, also act as blocking agent against entry of virus into cells.

Progress of the Work

After studying larvicidal efficacy of *Calotropis procera*, further studies have been designed to study effect of different concentrations of latex on refractory behaviour and its sustenance across gonotrophic cycles of *Ae. aegypti* . A set of experiments having 6 cages containing different sets of latex concentrations with or without control were taken for study. Sixteen gravid mosquitoes were released in each cage to lay eggs. The experiments were conducted at 25-30^0 c at relative humidity of about 60-70%. The eggs were counted after 48 hours in each cage and then after second and third blood meals were provided to facilitate G_{-2} and G_{-3} cycles, with males. The eggs were counted under dissecting microscope in control as well as in latex solution. The counted eggs were transfer to plain water to study the effect of latex on viability of eggs.

Important observations

The significance of the reported observations indicates that the refractiveness developed by the species is sustained across all its gonotrophic cycles when the choice of control is made available (Table-1). However , different water concentrations of this larvicide have shown very important observations on the ovipositioning behaviour of *Aedes aegypti*. At 0.7 % concentration of latex, the ovipositioning was avoided by the gravid female mosquitoes and this behaviour continued till all three gonotrophic cycles. However, at lower concentrations (0.2 and 0.1 %) of the larvicidal latex, the refractory behaviour of ovipositioning could not be retained up to the third gonotrophic cycles.

Further observation showed that in domestic containers where water is stored a non-lethal concentration of latex (0.1%) if used , the refractiveness of ovipositioning will not be there and domestic mosquito fauna in such premises will lay eggs but they will loose their viability to hatch into larvae (Table-2).

The behavioural observations reported in the present study may serve as significant information on choosing bio- larvicide for vector control against dengue.

Table 1. Ovipositing preference of *Aedes aegypti* in different larvicidal concentrations of latex of *Calotropis procera*

Cage	Latex Concentration (%) in experiment cages														
	A		B		C		D				E			F	
eggs laid within 24 hrs.	C	0.7	C	0.2	C	0.1	C	0.1	0.2	0.7	0.1	0.2	0.7	C	C
G_1	65	0	156	0	180	0	109	18	18	6	101	51	11	102	110
G_2	93	0	156	1	149	0	100	0	0	0	33	10	7	96	83
G_3	275	0	230	127	275	52	270	98	31	0	215	150	20	233	197

Table 2. Effect of *Calotropis procera* latex on the hatching of eggs of *Ae. Aegypti.*

Cage	A		B		C		D				E			F	
latex (%)	C	0.7	C	0.2	C	0.1	C	0.1	0.2	0.7	0.1	0.2	0.7	C	C
Eggs emersed	65	0	156	0	180	0	109	18	18	6	101	51	11	102	110
Eggs hatched	55	0	78	0	126	0	78	0	0	0	6	2	0	96	103
% egg hatched	84.6	0.0	50	0.0	70	0.0	73	0.0	0.0	0.0	5.9	4.0	0.0	93.1	93.6

Inventorization of Plants of medicinal importance in different ecotypes of Rajasthan - *Manju Singhi , Vinod Joshi and. P. K. Dam*

Date of commencement: **April, 2004** Duration: **Two years** Status: **On going**

Objectives

1. Study of occurrence and abundance of known plants of medicinal value.
2. To identify and classify the desert plants for their medicinal, insecticidal and antiviral Properties.
3. Study of socio-cultural practices being observed by inhabitants of study areas to utilize these plants.
4. Vegetational study of the area from the point of view of habitat and population biology.

Rationale

The section of plant medicine is a newly developed area of research at the Institute. To start with any new discipline scientifically generated reliable baseline observations are required to determine futuristic work. Proposed project has two components in its objectivity. It has been planned to inventorize plants of medicinal importance in the state with the details of associated factors and secondly to develop socio-cultural profile of their utility by the local inhabitants.

In the available literature knowledge about plants of medicinal importance as occurring in Rajasthan is chiefly based on the perceptions of the inhabitants. About 306 plants of medicinal importance have been reported to be occurring in Rajasthan. Out of these species about 100 species are known to occur in desert area. However, a complete knowledge of entire flora of medicinal importance, their seasonal abundance and association with the region, factors of ecology, edaphic and topography is not available in the form of results of a scientifically conducted study.

Progress of the work

Enquiries about commonly found plants of Medicinal, Insecticidal and famine food importance were made in Jaisalmer district. The interviews of traditional healers/ local population were undertaken and narrated distribution of plants across different villages was confirmed making collection of plants from reported sites. Following inventory of flora of medicinal / famine food plant was thus developed (Table 1 & 2).

Table 1. Medicinal / insecticidal plants of Jaisalmer district (desert region)

S. No.	Plant species	Utilization detail
1.	*Acacia nilotica* (Deshi babool)	Anti-diabetic
2.	*Asparagus racemosa* (Satavari)	Rejuvenator
3.	*Calotropis procera* (Aak)	larvicidal, anti-malarial, analgesic, and antipyretic.
4.	*Cucumis sativus* (Khira)	Insecticidal use
5.	*Ocimum americanum* (Ram Tulsi)	Mosquito repellent
6.	*Salvadora oleoids* (Kharo jhal)	Flowers are use in prevention of heat stroke.
7.	*Evolvus alsinoides* (Shankhpushpi)	As brain tonic
8.	*Euphorbia hirsuta* (Thor)	Analgesic
9.	*Solanum nigrum* (Makoii)	Larvicidal
10.	*Azadirachta indica* (Neem)	Mosquitoes repellent
11.	*Cymbopogam* jawarncusa (Buraro)	Mosquito repellent
12.	*Tephrosia purpurea* (Biyani)	Larvicidal

Inventory of plants used as famine foods in Jaisalmer district (Desert Region)

Sl. No.	Plant Plant species	Utilization details
1.	*Cenchrus biflorous* (Bhurat)	Most widely grown grass of the desert, during famine period this plant is used as emergency food in the area. The seeds are enclosed in prickly husk.. The seeds are grounded and baked into thick sogra. It is considered as most nutritious food of famine.
2.	*Prosopis cineraria* (Khejari)	Most common tree species growing on sand throughout the year. Young pods of the plant called sangeri , used as vegetable. Mature pods which contain sweet pulp are eaten as fruit. Bark of khejari is grounded and mixed with flour to prepare rotis.
3.	*Calligonum polygonoides* (Phog)	A typical sand - dune plant its buds use with butter milk.
4.	*Capparis decidua* (Kar)	A Very common shrub or tree of the desert found throughout the region. Its Unripe fruits are pickled and also use as vegetable contain high protein.
5.	*Zizyphus nummularia* (Bordi)	A thorny bush, very common in dry open plains it grows even in scanty rain fall. The fruits when ripped are stored, ground and eaten during scarcity.
6.	*Citrullus colocynthis* (Tumba)	A perennial cucurbit found on sand dunes throughout the region of Jaisalmer and Barmer. Seeds washed with salt water many times and grind to make chapattis. Very frequently used during famine.
7.	*Citrullus lanatus* (Matira)	A watermelon of the desert grows in the dry sand . Pulp of the fruit are eaten as fresh. Seeds are dried and made into flour which then mixes with bajra to prepare roti.
8.	*Salvadora oleoides* (Jal))	Evergreen shrub/ small tree found throughout arid part fruits are eaten.
9.	*Lasiurus hirsutus* (Sevan)	Seeds are collected, grouded and mix with Bajara to prepare rotis.
10.	*Sorghum halpense* (Baru)	This plant with stand long draught, this is used by cattles during famine.

Observations

- It has been observed there are at least about 12 plant species of medicinal / insecticidal plants are found in desert district Jaisalmer.

- The population dwelling desert areas appeared to be quite aware about mosquito menace. There have been about 6 plant species *viz*; *Cucumis sativus, Ocimum americium, Solanum nigrum, Azadirachta, indica, Cymbopogum jawarancusa and Tephrosia and Calotropis procera* which being used as insecticidal plants against mosquitoes. On the contrary Salvadora olioides is commnly used to prevent from heat stroke , other plants use as analgesic and antipyretic in the desert region of Rajasthan.

- As many as ten plant species have been reported to be used as famine food during draught period by the desert population. *Citrullus lanatus* has been discovered as water and carbohydrate rich fruit to compensate deficiency of water and electrolyte in the desert region.

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, and
2. 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 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 so collected 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 in; *An. stephensi* strain, collected from peri-urban areas of Jodhpur, against cyfluthrin, a synthetic pyrethroid being inducted in the national malaria control programme. 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 Cyfluthrin (Technical grade 95.5%), procured from M/S Bayer India Ltd.

A colony of *An. stephensi* was raised in the insectary of the centre. The standard procedure for rearing anopheline mosquitoes was followed. All life stages were reared in the insectary at temperature 28 ±2°C and RH 70±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 LC_{50} of each subsequent generation was considered for the selection of next generation. The consideration of LC_{50} was made taking into account the survivors for next generation. The survivors were raised as usual in the insectary. Approximately 1000 individuals were selected for each generation. The susceptibility level of cyfluthrin in successive generations was determined calculating LC_{50} and LC_{90} values. The susceptibility level of S-8 generation was found 14.9 times reduced in comparison to normal generation at LC_{50} level (Table 1).

Table 1. Data on the susceptibility of normal and S-8 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)	0.058 (0.012-0.277)
2.	S-8	2.69	Y=-0.68+2.69x	5.7 (3)	0.127 (0.103-0.157)	0.379 (0.220-0.653)

All values of LC_{50} and LC_{90} are in mg/l.

During the studies, tests were also conducted to determine the knockdown time of the selected generations to know whether the subsequent generations have developed the knockdown resistance during the process of selection. The knockdown time was observed prolonged in each subsequent generation and was calculated at 50 (KD_{50}) and 90 (KD_{90}) percent levels. KD_{50} in S-8 was found was found higher in comparison to normal generation (Table 2).

Table 2. Data on the knockdown time recorded in normal and S-8 generations of *An. stephensi* against cyfluthrin

S. No.	Generations Tested	Regression Coefficient	Regression Equation	Chi-Square (df)	KD_{50} (Fiducial limits)	KD_{90} (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-8	8.70	Y=-15.1+8.70x	0.87 (3)	20.5 (17.1-24.4)	28.7 (19.5-43.2)

All values of KD_{50} and KD_{90} are in minutes.

Tests were also conducted to determine whether the selected generations have developed resistance to other insecticides. Experiments with two compounds i.e. DDT and Malathion were conducted against normal and S-8 generations. Against DDT, the percent mortality with discriminating dose (4%) was found reduced in S-8 (33.3%) in comparison to normal generation (56.0%), exhibiting cross-resistance. Against Malathion, the percent mortalities with diagnostic dose (5%) were more or less same in normal and S-8 generations.

Use of different ovitraps for the surveillance and control of urban mosquito vectors, with special reference to *Aedes aegypti* - *Karam V. Singh and S. K. Bansal*

Date of Commencement: **January, 2005** Duration: **Two Years** Status: **New**

Objectives

1. To evaluate the efficacy of different types of ovitraps for the surveillance and control of urban mosquito vectors in arid situations

Rationale

Detection of the presence of different mosquito vectors in urban situations has been a difficult task owing to inherent human behaviour and some traditional habits, which in turn have also affected the impact assessment of the ongoing vector control programmes in a true sense. Ovitraps provide a very sensitive and economical method for detecting container breeders even when the population density is low and general larval surveys and adult collections produce unsatisfactory results. The addition of grass infusion in the ovitrap enhances significantly the trap efficacy. The use of different types of ovitraps for the detection and impact assessment of an ongoing urban vector control programme has given a new dimension in present context. The method has got potential to involve the local communities and seek their active participation in the programme with measurable behavioural changes resulting from well-planed social mobilization and communication actions. The studies would be conducted in Jodhpur city from where the cases of dengue have been reported. Since the technology is inexpensive and easy to adopt, it can be utilized without specialized training by the community on regular basis for the control of dengue vector *viz*., *Aedes aegypti*.

Progress of the work

Preliminary studies were undertaken to evaluate the feasibility of ovitraps in arid situations. The studies were conducted in 10 localities of Jodhpur city *viz*., Kudi Bhagtasni Housing Board, Railway Colony Bhagat ki Kothi, Indira Colony, Mahamandir, Soorsagar, Fidusar, Chopasni Housing Board, Mansuria colony, Pratap nagar and Bakra Mandi. The above colonies covered both old city areas as well as peripheral newly developed residential colonies.

Three types of ovitraps i.e. grass infusion (*Cynadon dactylon*), grass infusion with *Bacillus thuringiensis* var. *israelensis* (Bti) and lethal having cyfluthrin, were used during the studies. In 8 localities one type of trap along with control were laid, however, in 2 localities all 3 types plus control were laid. The studies were conducted for 2 weeks and the traps were observed at weekly intervals. Besides observing ovitraps, the information on the location of ovitraps, type of

house, water storage, type of water containers present, sleeping places and presence of cattle sheds was also considered.

The studies revealed that 37.5 percent traps were positive showing immature stages of urban mosquito vectors i.e. *Aedes aegypti* and *Anopheles stephensi*. 86.7 percent ovitraps were positive for *Ae. Aegypti* and 13.3 percent for *An. stephensi*. In case of *Ae. aegypti* 57.5 percent traps were found positive for eggs, 3.8 percent for larval forms and 38.5 percent for both eggs and larval forms. In case of *An. stephensi* only eggs were detected in the traps. *An. stephensi* eggs were found mostly in the traps laid in peripheral localities, whereas, the breeding of *Ae. aegypti* was detected mostly in the central old city areas. The details of the species-wise positivity of different types of ovitraps laid during the studies have been given in Table 1.

Table 1. Positivity of different types of ovitraps

Types of ovitraps	**Found +ive (%)**	**Species & Stage-wise distribution**					
		Aedes aegypti			***Anopheles stephensi***		
		Egg	**Larvae**	**Both**	**Egg**	**Larvae**	**Both**
Grass Infusion	46.6	05 (71.4)	01 (14.3)	01 (14.3)	--	--	--
Grass+*Bti*	26.7	02 (50.0)	--	02 (50.0)	--	--	--
Cyfluthrin	21.4	02 (100.0)	--	--	01 (100.0)	--	--
Control	44.4	06 (46.2)	--	07 (53.8)	03 (100.0)	--	--

Laboratory evaluation of these ovitrap solutions was also made against two important urban mosquito vector species to know their efficacy. In case of *Ae. Aegypti* the relative percentage of eggs laid in different solutions revealed that maximum no. of eggs (32.6%) were laid in grass infusion, followed by grass infusion and Bti (27.7%) control (23.6%) and cyfluthrin (16.1%). Cyfluthrin showing reduction in eggs laid exhibited deterrent effect. In case of *An. stephensi*, the relative percentages revealed reduction in no. of eggs laid, in all the three tested solutions. Grass infusion and *Bti* was found the most egg-laying inhibitor (16.6%), followed by grass infusion (24.4%) and cyfluthrin (26.5%).

Table 2. Laboratory evaluation of the effect of different ovitrap solutions on the oviposition of *Ae. aegypti* and *An. stephensi*

Mosquito species	**Relative percentage of eggs laid in different ovitrap solutions**			
	Control	**Grass infusion**	**Grass infusion + BTI**	**Cyfluthrin**
Ae. aegypti	23.6	32.6	27.7	16.1
An. stephensi	32.6	24.4	16.6	26.5

In case of *An. stephensi*, the observations on the individual percent reduction in the eggs laid in different solutions revealed 85.0, 74.2 and 53.0 percent in case of grass infusion, grass infusion and *Bti* and cyfluthrin respectively.

Determination of larvicidal potential of active principle(s) of *Solanum xanthocarpum* against important mosquito vectors - *S. K. Bansal, Karam V. Singh and Manju Singhi*

Date of Commencement: **January, 2005** Duration: **Two Years** Status: **New**

Objectives

1. Preparation of different solvent extracts from roots, leaves and fruits of *S. xanthocarpum* and isolation of their active constituents.

2. To identify different constituents of the extract and comparison of their larvicidal/repellant properties.

Rationale

Alternate vector control is an essential and effective means for controlling transmission of vector-borne diseases especially in areas where vector have become resistant to the insecticides. Moreover, increasing awareness of the environmental hazards of these synthetic insecticides and development of resistance has forced the scientists to look for other alternatives of vector control. Hence, biologically active plant materials with complex chemical substances of different composition found in various parts of the plants with selective anti-larval and anti-adult properties are being paid attention to replace the synthetic one's. In the process a number of plant species with insecticidal properties have been considered including *Solanum xanthocarpum,* the Indian night shade commonly known as 'baigan kateli' . It is found throughout the country but more abundantly in the arid areas and used widely for a variety of ailments in public health.

During our preliminary studies this plant has exhibited larvicidal properties against *Anopheles stephensi* and *Aedes aegypti*. During the proposed studies different parts of the plant *S. xanthocarpum* will be screened for its active principles, which have yet not been identified for their specific actions. The study will suggest the actual effective constituent(s) of the plant extract which has/have larvicidal/repellent properties and later can be considered for the development of a commercial product.

Progress of the Work

Susceptibility tests were carried out with larvae of three mosquito species viz. *Anopheles stephens*i, *Aedes aegypti* and *Culex quinquefasciatus.* For this purpose larvae of all the three mosquito species were collected from different areas of Jodhpur city and reared in the laboratory for further generations under controlled conditions of temperature (28±2°C) and humidity (75±5%). *S. xanthocarpum* has been selected for undertaking the proposed study.

The different parts of this plant differ in their active constituents when extracted in different solvents. Samples of roots, leaves and fruits of this plant were chopped and shade dried between 30-40°C for 10-15 days. Dried plant material was powdered separately and dissolved in different solvents and stock solutions and duration and serial dilutions were made as per requirement. Third or early fourth instar larvae of these mosquito species were tested as per standard WHO method for determining the baseline data on their susceptibility status. Experiments were carried out in 500 ml beakers containing 249 ml of water by using 20-25 larvae of each mosquito species. Mortality was noted after 24 hr and corrected by using Abbott's formula. Average of four observations was taken and data subjected to log probit regression analysis.

Observations on the results of the larval susceptibility to aqueous extracts of green unripe fruits are given in Table 1&2. With all the mosquito species mortality was dose and duration dependent i.e. mortality increased with increase in concentration. LC_{50} and LC_{90} values along with their fiducial limits, regression equation and chi-square were calculated. LC_{50} and LC_{90} values as observed for *An. stephens*i, *Ae. aegypti* and *Cx. quinquefasciatus* were 112.7, 498.2 & 846.3 and 431.7, 1414.0 & 2228.0 mg/l respectively. Comparative susceptibility calculated on the basis of LC_{50} value showed that larvae of *An. stephens*i are 4.42 and 7.51 times more susceptible than larvae of *Ae. aegypti* and *Cx. quinquefasciatus* respectively.

Larval susceptibility tests were also carried out with aqueous extracts of yellow ripe fruits of this plant with larvae of all the three mosquito species and the results have been given in Table 3&4. With all the mosquito species concentrations tried were the same as for green fruits and the mortality was again dose dependent. LC_{50} and LC_{90} values as determined for *An. stephens*i, *Ae. aegypti* and *Cx. quinquefasciatus* were 104.7, 267.7 & 832.2 and 490.4, 1111.0 & 2741.0 mg/l respectively which revealed that larvae of *An. stephens*i are much more susceptible than the rest of the two species. *An. stephens*i was found 2.56 and 7.95 times more susceptible than *Ae. aegypti* and *Cx. quinquefasciatus* respectively.

Experiments have also been carried out with the aqueous extracts of roots and leaves of this plant species which have been given in table 5. Experiments carried out up to 500 mg/l with root extract and from 100 to 2000 mg/l of leaves extract show only up to 1-5% mortality indicating that active principle may be present only in the ripe and unripe fruits. However, further experiments carried out with methanol extracts of ripe yellow fruits of this plant with *An. stephensi* showed it to be very much efficacious as compared to the aqueous extract with a LC_{50} and LC_{90} value of 52.2 and 177.3 mg/l respectively (Table 6).

Table 1. Efficacy of aqueous extracts of *S. xanthocarpum* (green unripe fruits) on larvae of different mosquito vectors

Mosquito species/ Concentrations (mg/l)	No. Exposed	No. Dead	Percent Experimental Mortality	Percent Corrected Mortality
An. stephensi				
Control	100	3	3.0	-
25	99	8	8.1	8.1
50	98	22	22.4	22.4
100	97	43	44.3	44.3
250	99	76	76.8	76.8
500	100	95	95.0	95.0
Ae. aegypti				
Control	97	6	6.2	-
100	97	12	12.4	6.6
250	95	20	21.1	15.9
500	93	47	50.5	47.2
750	98	70	71.4	69.5
1000	100	96	96.0	95.7
Cx. quinquefasciatus				
Control	117	6	5.1	-
250	116	13	11.2	6.4
500	113	32	28.3	24.4
1000	112	65	58.0	55.7
1500	114	90	78.9	77.8
2000	118	114	96.6	96.4

Table 2. Log probit regression analysis of the mortality data of larvae of different mosquito vectors to green unripe fruits of *S. xanthocarpum*

Mosquito species	Regression Equation	Chi-Square (DF)	LC_{50} (Fiducial limits)	LC_{90} (Fiducial Limits)
Anopheles stephensi	Y=0.50±2.19x	0.16 (2)	112.7 (85.5-148.6)	431.7 (236.4-788.4)
Aedes aegypti	Y=2.62±2.83x	4.20 (2)	498.2 (403.5-615.0)	1414.0 (870.0-2296.0)
Culex quinquefasciatus	Y=3.91±3.04	1.11 (2)	846.3 (743.9-962.7)	2228.0 (1828.0-2716.0)

Table 3. Efficacy of aqueous extracts of *S. xanthocarpum* (yellow ripe fruits) on larvae of different mosquito vectors

Mosquito species/ Concentrations (mg/l)	No. Exposed	No. Dead	Percent Experimental Mortality	Percent Corrected Mortality
An. stephensi				
Control	100	6	6.0	-
25	98	16	16.3	11.0
50	99	32	32.3	28.0
100	97	52	53.6	50.6
250	99	72	72.7	71.0
500	100	96	96.0	95.7
Ae. aegypti				
Control	96	4	4.2	-
100	97	20	20.6	20.6
250	99	44	44.4	44.4
500	100	68	68.0	68.0
750	99	86	86.9	86.9
1000	100	94	94.0	94.0
Cx. quinquefasciatus				
Control	120	7	5.8	-
250	120	16	13.3	8.0
500	118	39	33.1	29.0
1000	116	64	55.2	52.4
1500	116	93	80.2	79.0
2000	120	113	94.2	93.8

Table 4. Log probit regression analysis of the mortality data of larvae of different mosquito vectors to yellow ripe fruits of *S. xanthocarpum*

Mosquito species	Regression Equation	Chi-Square (DF)	LC_{50} (Fiducial limits)	LC_{90} (Fiducial Limits)
Anopheles stephensi	Y=1.14±1.91x	1.00 (2)	104.7 (77.64-141.3)	490.4 (248.2-968.7)
Aedes aegypti	Y=0.03±2.07x	1.00 (2)	267.7 (202.5-353.9)	1111.0 (598.2-2062.0)
Culex quinquefasciatus	Y=2.91±2.71x	1.80 (2)	832.2 (743.9-962.7)	2741.0 (1584.0-3852.0)

Table 5. Efficacy of aqueous extracts of *S. xanthocarpum* (root and leaves extract) on larvae of different mosquito vectors

Mosquito species/ Conc.(mg/l)	% Mortality with Leaves Extract			% Mortality with Root Extract		
	No. Exposed	No. Dead	% Mortality	No. Exposed	No. Dead	% Mortality
An. stephensi						
Control	100	01	1.0	75	00	0.0
100	99	01	1.0			
250	100	00	0.0			
500	98	01	1.2	74	01	1.4
1000	98	02	2.0			
2000	100	04	4.0			
Ae. aegypti						
Control	97	01	1.0	73	00	0.0
100	98	02	2.0			
250	100	00	0.0			
500	98	03	3.1	73	01	1.4
1000	99	03	3.0			
2000	100	05	5.0			
Cx. quinquefasciatus						
Control	100	00	0.0	74	01	1.4
100	100	00	0.0			
250	100	01	1.0			
500	99	03	3.0	73	03	4.1
1000	98	02	2.0			
2000	100	04	4.0			

Table 6. Log probit regression analysis of the mortality data of larvae of *An. stephensi* to methanol extracts of yellow fruits of *S. xanthocarpum*

Conc.(mg/l)	% corrected Mortality	Regression Equation	Chi-Square (DF)	LC_{50} (Fiducial limits)	LC_{90} (Fiducial Limits)
Control	-				
25	24.0	Y=0.86±2.41x	1.26	52.2	177.3
50	45.2		(2)	(40.4-67.4)	(101.6-309.4)
100	72.5				
150	87.0				
200	98.9				

Study of Glutaraldehyde Test in HIV positive subjects - *Dr. Murli L. Mathur in collaboration with Dr. S. D. Purohit, Director, (Clinical Programmes), FXB Rajasthan Society, Jodhpur*

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

Objective

1. To find out sensitivity and specificity of Glutaraldehyde test for diagnosis of Pulmonary or Extra-pulmonary Tuberculosis in HIV positive subjects.

Rationale

Tuberculosis (TB) continues to be a major public health problem in world. Early diagnosis is key issue in control of TB, still only a minority of approximately 8 million people developing tuberculosis annually, gets a laboratory-supported diagnosis. Diagnosis of TB in developing countries is largely based on microscopic detection of *Mycobacterium tuberculosis* (MTB), a method with a low and variable sensitivity (22-78%). The gold standard for diagnosis of TB is culture of MTB. However, culture of MTB takes 2-8 weeks to produce results and has low sensitivity in paucibacillary cases. Many new rapid diagnostic tests for TB *viz.* mycobacteriophage-based techniques, tests involving PCR, direct nucleic acid amplification tests and serological tests have shown acceptable levels of sensitivity and specificity, but most of these require sophisticated laboratory equipments and skilled technical persons and are presently not affordable by many developing countries. Hence, there is an urgent need of a simple, inexpensive, rapid, user-friendly and reliable diagnostic test for TB. In HIV positive subjects sensitivity of sputum smear and culture is low and therefore sputum smear and culture can not help in diagnosis of TB in all cases. To confirm the diagnosis of extra-pulmonary TB in HIV positive subjects is still more difficult in developing countries where facilities of above mentioned sophisticated tests are scarcely available.

Blood Glutaraldehyde gelification test was described by Larson et al in 1990 as a rapid easy sensitive, economic and specific test for tuberculosis. It was based on the observation that after mixing with 2·5% glutaraldehyde, EDTA blood of patients of tuberculosis coagulated within 10 minutes. When this test was tried in our laboratory, the results showed gross variations at different hours with different room temperature. It was therefore hypothesized that temperature and time of testing affect the result of Glutaraldehyde Test. We had studied utility of this test in our region and found that temperature and other factors affected results of this test and therefore we re-standardised method of this test and found it was highly sensitive in detecting new sputum positive cases of pulmonary tuberculosis. The exact mechanism of faster coagulation of blood by glutaraldehyde in tuberculosis is not known but it may be due to non-specific immunoglobulins and acute phase reaction in tuberculosis. The performance of the test was not known in HIV positive subjects and was hypothesized that it may be different in them because of immunocompromised state. It was therefore decided to carry out this study to find out sensitivity and specificity of Glutaraldehyde test for diagnosis of Pulmonary or Extra-pulmonary Tuberculosis in HIV positive subjects.

Progress of the work

Study included HIV positive subjects attending out door of FXB Rajasthan Society, Jodhpur and those attending outdoor of district tuberculosis clinic (DTC), Jodhpur. The subjects were explained about the objectives of the study and then their written informed consent was obtained in Hindi.

In the group of patients from FXB, only those declared HIV positive by Voluntary Confidential Counseling and Testing Centre (VCCTC), Dr. S. N. Medical College, Jodhpur were included in the study. Their sputum smear examination was carried out at District Tuberculosis Clinic Jodhpur and their IV blood sample was collected and transported to DMRC, where glutaraldehyde test was carried out. Perfect blinding was maintained as the technician of DMRC carrying out the test had no access to information about clinical or bacteriological status of patient. The glutaraldehyde test was found to be positive in 34.8% of forty-six non-tubercular HIV positive patients. As shown in table I, the test was positive in only 39.6% in HIV positive patients of tuberculosis.

Table 1. Proportion of HIV positive cases of TB showing positive glutaraldehyde test

Category of TB Case	Glutaraldehyde Test Positivity in the cases					
	Fresh Untreated Cases		Cases with H/O ATT for >15 days		Total	
	% Pos.	(n)	% Pos.	(n)	% Pos.	(n)
Sputum positive Pulmonary TB	25.0%	(8)	0%	(3)	18.2%	(11)
Sputum negative pulmonary TB	85.7%	(7)	36.4%	(11)	55.6%	(18)
Extra-pulmonary TB	37.5%	(8)	36.4%	(11)	36.8%	(19)
Total	47.8%	(23)	32.0%	(25)	39.6	(48)

Table 2. Proportion of cases of TB at DTC (HIV status unknown) showing positive glutaraldehyde test

Category of TB Case	Glutaraldehyde Test Positivity in the cases					
	Fresh Untreated Cases		Cases with H/O ATT for >15 days		Total	
	% Pos.	(n)	% Pos.	(n)	% Pos.	(n)
Sputum positive Pulmonary TB	75.7	(37)	23.1	(13)	62.0	(50)
Sputum negative pulmonary TB	77.3	(22)	19.2	(26)	45.8	(48)
Extra-pulmonary TB	55.6	(9)	100.0	(2)	63.6	(11)
Total	73.5	(68)	24.4	(41)	55.0	(109)

Figures in parentheses indicate number of subjects examined

Among patients attending DTC, Jodhpur, sensitivity of glutaraldehyde test was found to be only 24.4% in patients who gave history of anti-tuberculous treatment for 15 or more days before giving blood sample for the test, while the same was 75.7% in fresh untreated sputum positive cases of pulmonary TB.

Outcome and possible Utilization

The results of the study indicate that the glutaraldehyde test is not useful in HIV positive subjects and it is not sensitive in detecting tuberculosis in patients who have already consumed anti-tuberculous medication for 15 or more days.

A study of the potential interventional variables associated with delay in diagnosis/treatment of pulmonary tuberculosis (PTB) cases in the Thar desert of Rajasthan - *S.P. Yadav, M.L. Mathur, A.K. Dixit and P.K. Anand*

Date of commencement: **April, 2004** Duration: **3 years** Status: **On going**

Objectives:

1. To measure the time lapse between disease onset and diagnosis/or starting treatment of PTB under DOTS.

2. To find out the causes for delay in diagnosis/treatment for PBT

3. To determine the suitable interventional methods for early new case finding and bringing to diagnosis and treatment under DOTS and find out the cast effectiveness.

Progress of the work

The schedules were prepared in English and pre-tested in District Tuberculosis Centre, Jodhpur. To avoid communication gap between investigator and respondent, it was communicated in Hindi or in local dialects *i.e*. "Marwadi". As per recommendations of the SAC of DMRC was held on 4th October 2004, the pre-tested schedules were sent to Dr. V. M. Katoch, Director, Central JALMA Institute for Leprosy, Agra for his valuable suggestions. After receiving his suggestions, those were incorporated in the study.

During the report period, 2707 persons were reported at District Tuberculosis Centre (DTC), Jodhpur and PHC, Balesar for medical check and laboratory investigation for the confirmation of the tuberculosis. The sputum samples three times (same day, next day morning and next to next day on spot sample) of all the subjects were examined. Disease history was collected. Sputum slides were prepared and microscopy was done to see presence of *mycobacterium tuberculosis*. About sixty five per cent (65.2%) were new subjects and 34.8% were old. New subject was defined as whose sputum was first time examined and found positive for *mycobacterium tuberculosis* and old whose sputum was examined and found positive more than one time at least 8 weeks interval after taking ATT (Table 1).

Table 1. Coverage of study subjects

	Total Examined			Positive Cases Detected		
	New	**Old**	**Total**	**New**	**Old**	**Total**
Number	1764	943	2707	223	51	274
Percentage	65.2	34.8	100.0	81.4	18.6	100.0

About ten percent (10.1%) were positive for pulmonary tuberculosis. Of these 81.4% were new cases, recurrence cases 9.1%, Irregular cases 6.2% and drop out cases were 3.3% (Table 2). Further, out of 223 new cases 205(91.9%) cases were delay in their diagnosis and treatment.

Table 2. Category of study subjects

Category	**Number**	**Percentage**
New Cases	223	81.4
Recurrence cases	25	9.1
Irregular cases	17	6.2
Dropout cases	9	3.3
Total	274	100.0

Table 3 depicts socio-demographic characteristics of the study subjects. About eleven percent (11.2%) subjects were < 20 years of age, 25.4% between 20-30 years, 34.6% between 30-39 years, 21.5% between 40-49 years of the age group and 7.3% were > 50 years of age. About Seventy five per cent (74.6%) were male and 25.4% female. About sixty nine (69.3%) were Hindu, 30.7% were other than Hindu. Among the Hindus 20.4% were general caste, 35.9%

OBC, 43.7% SC/ST, 59.1% Illiterate, 23.9% Literate, 10.7% Primary, 6.3% Middle School and above, 2.0% at home, 9.3% house wife, 16.1% service, 58.0% labour and 14.6% were doing other jobs. Nearly twenty eight per cent (28.3%) were living in urban area and 71.7% were belonging to the rural area. About seventy nine per cent (79.5%) were smokers, 40.0% alcoholics and 22.0% opium addicts.

Table 3. Socio-Demographic characteristics of the study subjects

Characteristics	Number	Percentage
Age		
<20	23	11.2
20-29	52	25.4
30-39	71	34.6
40-49	44	21.5
>50	15	7.3
Sex		
Male	153	74.6
Female	52	25.4
Religion		
Hindu	142	69.3
Other than Hindu	63	30.7
Caste		
General Caste	29	20.4
OBC	51	35.9
SC & ST	62	43.7
Education		
Illiterate	121	59.1
Literate	49	23.9
Primary	22	10.7
Middle School & above	13	6.3
Occupation		
At home	4	2.0
House wife	19	9.3
Service	33	16.1
Labour	119	58.0
Others	30	14.6
Place of Living		
Urban	58	28.3
Rural	147	71.7
Personal Habits		
Smokers	163	79.5
Alcoholics	82	40.0
Opium addicts	45	22.0

Majority (77.1%) were belonging to low socio-economic group followed Middle income group (17.6%) and high income group (5.4%). Source of referral was one of the important factors for suspected case reporting to examination and treatment. It was found that majority (45.8%) cases were reported to DTC and PHC by own or on the suggestions of the TB patient who had taken experiences of diagnosis and treatment of the disease or by the motivation of their relatives and friends. About thirty four (33.7%) subjects were referred by government hospital and 20.5% referred by private practitioners (Table 4).

Table 4. Distribution of subjects according to economic status and referral

Characteristics	Number	Percentage
Economic Status		
Low Income Group	158	77.1
Middle Income Group	36	17.6
High Income Group	11	5.4
Source of referral		
Self/or suffer/or relatives	94	45.8
Private Practitioners	42	20.5
Government Hospital	69	33.7

Table 5. Present Complaints of the study subjects

Complaints	Number	Percentage
Fever	142	69.4
Cough with expectoration	159	77.6
Haemoptysis	39	19.0
Loss of appetite	56	27.3
Loss of weight	78	38.0
Chest Pain	125	61.0
Breathlessness	83	40.5

The study subjects (77.6%) were complaining as cough with expectoration followed by fever (69.4%), chest pain (61.0%), breathlessness (40.5%), loss of weight (38.0%) and loss of appetite (27.3%) Table5.

Table 6. Period of delay according to category wise

Parameter	<1 Month	1-2 Month	2-3 Month	>3 Month	Total
Sex					
Male	13(8.5)	42(27.5)	33(21.6)	65(42.5)	153(100.0)
Female	4(7.7)	8(15.4)	9(17.3)	31(59.6)	52(100.0)
Educational status					
Illiterate	5(4.1)	8(6.6)	17(14.1)	91(75.2)	121(100.0)
Literate	12(14.3)	42(50.0)	25(29.8)	5(6.0)	84(100.0)
Economic Status					
Low	5(3.2)	31(19.6)	28(17.7)	94(59.5)	158(100.0)
Middle	4(11.1)	17(47.2)	13(36.1)	2(5.6)	36(100.0)
High	8(72.7)	2(18.2)	1(9.1)	0(0.0)	11(100.0)
Sputum status					
Positive	17(8.3)	50(24.4)	42(20.5)	96(46.9)	205(100.0)
Source of Referral					
Self/Sufferers/relatives	2(2.1)	6(6.4)	7(7.5)	97(84.0)	94(100.0)
Private practitioners	1(2.4)	4(9.5)	25(59.5)	12(28.6)	42(100.0)
Government Hospital	14(20.3)	40(58.0)	10(14.5)	5(7.2)	69(100.0)

Table 6 depicts the period of delay according to category wise. Females as compared to males, illiterate as compared to literate, low income group as compared to high income group were more delay in diagnosis/or treatment.

Table 7 Reasons for delay in diagnosis/treatment

Reasons	Number	Percentage
Lack of Knowledge	174	84.9
Others	31	15.1
Total	205	100.0

Table 7 shows the causes for the delay in diagnosis/treatment of the tuberculosis patient. Most dominating cause of delay in diagnosis /treatment was lack of awareness among the patients about causation of disease, signs and symptoms of the disease, preventive and curative measures as a result failed to recognize symptoms of disease by the patient (84.9%) and did not report to the doctors for the diagnosis and treatment.

Inferences

Based on the study undertaken so for following inferences can be drawn:

- There is a substantial proportion of patients (91%) of Pulmonary Tuberculosis (PTB) who delay the diagnosis and treatment of the disease.
- Out of this 91% of patients delaying, 92% makes day of more than 1 month which is a dangerous period of delay for infection such as PTB.
- Lack of awareness was the major cause of delay in 85% of patients who delayed.
- Socio-Demographic characteristics suggest that patients belonging to illiterate, low income and SC/ ST & OBC are vulnerable sets of population.

Work remains to be carried-out

Collection of remaining data from desert area and similar observations from non desert areas in same number and by same methods will be done to compare social determinants of delay in diagnosis and treatment among desert versus non desert population. Determinants emerging need to be confirmed and verified to plan an intervention based on them.

Important leads/outcomes from the study

The study will reveal the duration of delay in diagnosis/ treatment of the tuberculosis in the desert population of Rajasthan. Further, this study will identify the causes of delay in diagnosis/ treatment. After completion of this study an intervention programme could be planed for the reduction in delay in diagnosis/ treatment in national tuberculosis control programme. Certainly this will be great achievement of this study and as a result decreasing will start in new cases of tuberculosis in the community. The control programme will achieve its goal for early diagnosis and treatment for the tuberculosis control.

Epidemiology of Essential Hypertension in Arid Population of Rajasthan-

K.R. Haldiya, R. Sachdev, Murli L. Mathur and J. Lakshminarayana

Date Of Commencement: **June, 2004** Duration: **18 months** Status: **Ongoing**

Objectives

1. To identify the risk factors for high prevalence of hypertension in Gachipura village of desert part of Rajasthan.

1. To administer specific lifestyle interventions based on identified risk factors and assess their impact on control of hypertension.

Progress of the Work

A cross sectional survey has been undertaken in Gachipura village as study area and Balarwa village as control area for identifying the risk factors of high prevalence of hypertension in Gachipura. A field training was given to field investigators recruited in the project. Pilot study was carried out to pre test the individual schedules based on WHO step wise schedule. The methods were standardized. In the cross sectional survey, all houses of both villages are being covered. House to house visit of the houses are carried out. The members of the household who are above 15 years age are interviewed and examined. The information is obtained about smoking habits, level physical activity, alcohol consumption and dietary habits particularly salt, oil and ghee intake at household level. Body weight, height, waist circumference and hip circumference are measured using standard techniques. The blood pressure is measured in supine position after rest for five minutes. So far 520 households in Gachipura and 470 households in Balarwa village has been covered. The data entry of the house holds covered has been started. The preliminary analysis of the data entered has shown following gross observations.

There were 1031 subjects in 264 households of control village Balarwa, of which 693 (67.1%) could be examined. Mean family size was 8.2 ± 4.1members. Of all members 50.9% were males. Mean age of members was 35.1 ± 16.8 years. Of all members 48.6% were illiterate, 76.6% were vegetarians, 24.8% were tobacco consumers, 4.1% consumed alcohol, 0.8% consumed crude opium and BMI of 13.2% was above 25. Prevalence of hypertension was 10.2% in Balarwa. Only 25% of hypertensives knew that they had hypertension. Only 40% of those knowing about their hypertension were taking antihypertensive treatment. The dietary survey and biochemical investigations will be undertaken after completion of current survey.

There were 912 subjects in 234 households of study village Gachipura, of which 623 (68.3%) could be examined. Mean family size was 7.5 ± 4.0 members. Of all members 47.2% were males. Mean age of members was 37.0 ± 17.0 years. Of all members 30.7% were

illiterate, 88.1 were vegetarians, 29.3% were tobacco consumers, 3.9% consumed alcohol, 0.0% consumed crude opium and BMI of 13.1% was above 25. Prevalence of hypertension was 23.3%. Only 64.1% of hypertensives knew that they had hypertension. Only 29.0% of those knowing about their hypertension were taking anti-hypertensive treatment.

Table 1. Distribution of Socio Demographic Indicators and Prevalence of hypertension in studied population of Gachipura and Balarwa

	Gachipura	**Balarwa**
House Holds Covered	234	264
Mean family size	7.5±4.0	8.2±4.0
Total Individuals Age>14 years	912	1031
Total individuals examined	623 (68.3%)	693(67.1%)
Mean age	37.0±17.0	35.1±16.8
Sex Males Females	47.2% 52.8%	50.9% 49.1%
Education Illetrates	30.7%	48.6%
Diet Vegetarian	88.1%	76.6%
Tobacco users	29.3%	24.8%
Alcohol	3.9%	4.1%
Opium	0.0%	0.8%
BMI>24.99	13.1%	13.2%
Prevalence of Hypertension	23.3%	10.2%
Known Hypertension	64.1%	25.0%
Taking Treatment	29.0%	40.0%

Work remaining to be carried out

The dietary survey and biochemical investigations will be undertaken after completion of current survey. Then the prevailing risk factors responsible for higher prevalence of hypertension in Gachipura will be identified and appropriate lifestyle intervention programme will be introduced.

Possible outcome and Utilization

The study will help in identifying the risk factors and planning of intervention programme to reduce the high prevalence in this area.

Nutritional Status along with micronutrient deficiency disorders and morbidity in pregnant and lactating women in desert areas of Rajasthan -

Madhu B. Singh, Ranjana Fotedar and J. Lakshminarayana

Date of commencement: **July, 2004** Duration: **2 years** Status: **Ongoing**

Objectives

1. To what extent the micronutrients deficiency disorders i.e. Iron deficiency Anemia, Vitamin A deficiency disorder and Iodine deficiency disorder are prevalent in pregnant and lactating women

2. To assess the nutritional status of pregnant and lactating women by means of anthropometry, dietary intake as well as through clinical examination

3. To study the morbidity profile of diseases among the rural pregnant and lactating women of the desert areas of Rajasthan and

4. To develop nutrition package for pregnant and lactating women of the desert areas based on the findings of the study, during the second phase of the study.

Progress of the work

Project preludial activities included development of protocol, formulation of sampling design in detail and the preliminary field visits to the studied area. As per suggestions/recommendations made by SAC member, one panchayat samiti is to be selected in Jodhpur district. In Jodhpur district, there are six tehsils as per the census book (1991) i.e. Phalodi, Osian, Bhopalgarh, Shergarh, Jodhpur and Bilara. These tehsils are distributed in Nine panchayat Samitis in the rural area i.e. Luni (32), Bilara (30), Phalodi (24), Bap (18), Bhopalgarh (32), Shergarh (21), Osian (41), Balesar (22) and Mandore (20). In these panchayat Samitis there are different Panchayats mentioned in the parenthesis and villages are distributed in these panchayats. In the present study one tehsil i.e. Jodhpur tehsil is being selected and from Jodhpur tehsil one panchayat samiti i.e. Luni Panchayat samiti is being selected by Random sampling technique which represents desert area of Jodhpur which have 32 Panchayats. In these 32 panchayats, there are 15 villages with more than 3000 population. The criteria for selecting bigger villages is to get the adequate number of pregnant and lactating mother. Out of these 15 villages, nine villages have been selected based on Simple Random Sampling technique using tippets random number tables. The selected villages will be completely surveyed i.e. complete enumeration of the village will be done and all the Pregnant and lactating mothers found in these villages will be covered for the present study (If required sample size could not be achieved in these 9 villages, than the target population will be completed from adjacent villages).

During this reported period, data have been collected from five villages belonging to Luni Panchayat samiti of Jodhpur tehsil, Jodhpur district. A total of 402 households have been covered. At each household level information for demographic and socio-economic aspects have been collected. Pregnant and lactating women found in these villages along with control group of non pregnant and non lactating women have been interviewed / examined for the nutritional deficiency signs, dietary pattern (24 hours recall method) along with morbidity survey (Data will be collected by the standard technique as followed by NIN (ICMR), Hyderabad) and Micronutrient deficiency disorders i.e. Anemia, Iodine and Vitamin A. Anemia have been assessed by clinical signs (platinichia and koilonichia). Hemoglobin levels have been estimated using Cyanmethaemoglobin technique and classified according to WHO classification. Iodine deficiency disorders have been assessed by clinical examination of thyroid gland using the standard method as recommended by the joint WHO / UNICEF / ICCIDD consultation. A casual urine sample were collected for estimation of Urinary Iodine Excretion (UIE) levels to asses the Iodine nutriture status. Iodine was determined by WET digestion method using standard laboratory technique. UIE level less than 10 mcg/dl have been considered as indicator of iodine deficient nutriture. 25 to 30 percent of women selected randomly had been requested to bring sample of 20 gm. salt consumed in their families in auto seal LDPE pouches. Iodine content of salt sample have been estimated using standard iodometric titration method. Salt samples having iodine content less then 15 ppm classified as with inadequate iodine. Vitamin A deficiency was assessed by administering pre-tested semi structured questionnaire on the presence of symptoms of night blindness. The women were asked specific questions regarding their seeing at the time of sunset and later in dim light, had any problems in cooking during dusk period due to lack of proper vision and any change in their activity pattern due to vision problems in the dusk. The subjects with positive response to these questions have been classified as suffering from VAD.

Project is continuing. Preliminary analysis of 402 individuals have been done so far out of which 95 were pregnant, 173 lactating women and 134 NPNL (control) women. The inclusion criteria for the pregnant mothers were those mothers whose pregnancy was more than 24 weeks of gestation period. Those mothers were not registered / excluded whose gestation period was less than 24 weeks and with nulli pregnancy. The inclusion criteria for the lactating mothers were those mothers who were breast feeding their child and the cut off level for breast feeding was up to 6 months period. The inclusion criteria for the control group was those who were 15 years and above women (unmarried) or mothers who are more than 15 years, just married living together not attained their family status by becoming pregnant because till this age, the girls were not being sent to stay with husband even though they were married much earlier.

Table 1 showed distribution of women according to anemia on the basis of haemoglobin estimation. Anemia was observed to be maximum among pregnant women (78.9 %) followed by lactating women (77.5 %) and least in control group (66.9 %). Pregnant women suffered maximum from severe anemia (11.6 %) in comparison to lactating women (8.1 %) and control group (1.5 %).

Table 1. Distribution of women according to Anemia (Haemoglobin estimation)

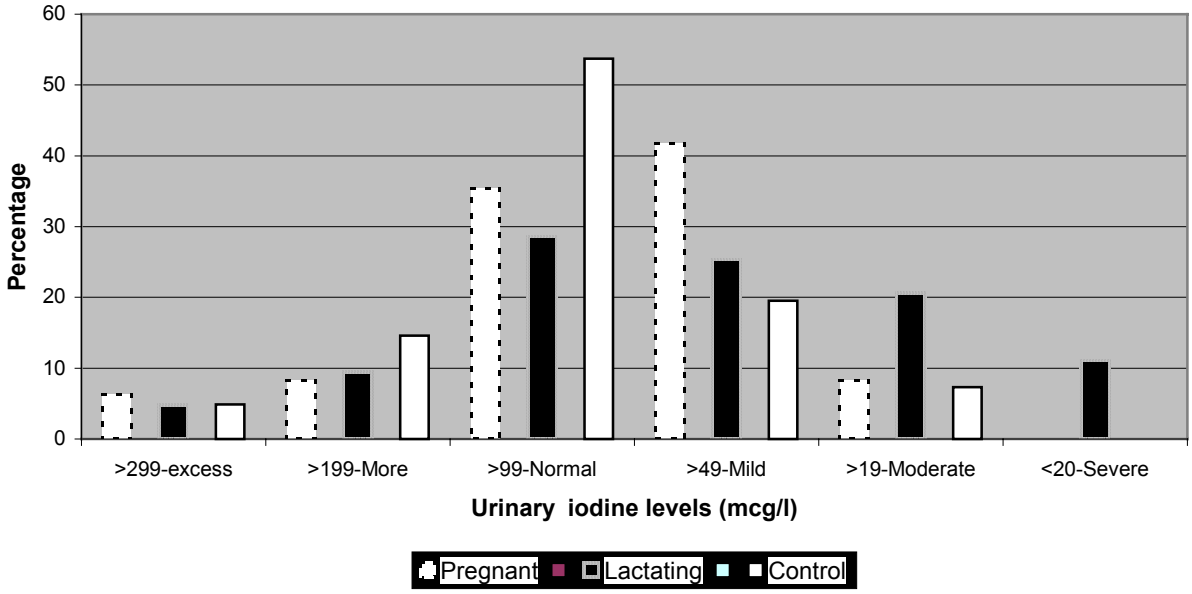
Women	Normal		Mild		Moderate		Severe	
	No	%	No	%	No	%	No	%
Pregnant N=95	20	21.1	16	16.8	48	50.5	11	11.6
Lactating N=173	39	22.5	41	23.7	79	45.7	14	8.1
Control (NPNL)=124	41	33.1	39	31.5	42	33.9	2	1.5

Epidemiological criteria, as prescribed by WHO, for assessing iodine nutrition is based on median urinary iodine concentrations / levels as shown in tables 2 and figure 1. Analysis of 152 urine samples have been done so far. Preliminary trend showed that the median urinary iodine values were observed less in pregnant (95 mcg/l) and lactating women (85 mcg/l) according to WHO cut off points (100 mcg/l) where as control group showed optimal values. Nearly 46 to 50 percent lactating and pregnant women suffered from mild to moderate iodine deficiency disorder whereas in control group it was only 26.8 percent. Severe iodine deficiency disorder was observed in lactating women (11.1 %).

Table 2. Urinary Iodine Excretion levels in women

Women	No. of urine samples	Median (mcg/l)
Pregnant	48	95.0
Lactating	63	85.0
Control (NPNL)	41	135.0

Fig. 1 Distribution of Women according to UIE level (mcg/l)



Detailed analysis is under process. Data remains to be collected from 798 women belonging to 5 villages of Luni Panchayat samiti of Jodhpur tehsil, district Jodhpur.

Important leads/Outcome from the study

Results will help in developing the database on nutritional status along with micronutrient deficiency disorders and morbidity in pregnant and lactating women in desert areas. The results of the first phase of the present study will be helpful in assessing the magnitude and distribution of three micronutrients deficiency disorders i.e. Iron, Vitamin A and Iodine along with the nature and type of nutritional deficiencies and their morbidities. These results will be helpful in formulating nutritional intervention packages for this region by introducing the adequacy i.e. bio-availability - of iron, and vitamin A etc. in usual diets which can be improved by altering meal pattern to favour enhancers and lower inhibitors or both during the second phase of the study. According to WHO, at present, Iron and Vitamin A supplementation are the most common strategy currently used to control these deficiencies in developing countries for the time being. This is likely to remain the case until either significant improvements are made in the diets of entire populations or food fortification is achieved. Second phase of the study will try to achieve this aim.

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

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

Project preludial activities included working on sampling plan in detail. The similar sampling design and protocol was adopted for the Nutrition Monitoring type of survey for carrying 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.

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. 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/mohallas/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.

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.

During this reported period data, a total of 20 villages were covered from four tehsils of Jodhpur district i.e. Jodhpur, Bilara, Osian and Bhopalgarh (five villages from each tehsil), covering 400 households. All the selected household were 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. Project work is being continued and detailed analysis will be reported later on. Preliminary analysis of 140 households covering 820 individuals has been done so far. Table 1 showed age and sex wise distribution of population (420 males and 400 females). Analysis revealed that 97.6 percent of population were Hindus and 2.4 percent were Muslims. Nuclear families were more (58.6 %) as compare to joint families i.e. 38.5 percent (Tables 1-2). Table 3 revealed that illiteracy is high in females (39.0 %) than males (17.1 %). Higher education is very low in this area.

Table 1. Age and sex wise distribution of population covered

Age group	Males	%	Females	%	Total	%
0-4	38	9.1	49	12.3	87	10.6
5-9	71	16.9	47	11.8	118	14.4
10-19	99	23.6	94	23.5	193	23.6
20-29	68	16.2	66	16.5	134	16.3
30-39	51	12.1	46	11.5	97	11.8
40-49	44	10.5	49	12.2	93	11.3
50-59	30	7.1	24	6.0	54	6.6
> 60	19	4.5	25	6.2	44	5.4
Pooled	420	100.0	400	100.0	820	100.0

Table 2. Distribution of households according to type of family

Type of family	No.	Percentage
Nuclear	82	58.6
Extended Nuclear	4	2.9
Joint	54	38.5
Pooled	140	100.0

Table 3. Distribution of population according to educational status

Educational status	Males	%	Female	%	Total	%
Illiterate	72	17.1	156	39.0	228	27.8
Read & Write	7	2.7	8	2.0	15	1.8
1-4 Standard	101	24.0	70	17.5	171	20.9
5-8 Standard	88	20.8	48	12.0	136	16.6
9-12 Standard	59	14.0	14	3.5	73	8.9
College	19	4.5	1	0.2	20	2.4
N. A.	74	17.6	103	25.8	177	21.6
Pooled	420	100.0	400	100.0	820	100.0

Main morbidities observed in population were acute respiratory infection (9.6 %) and fever (8.5 %) followed by diarrhea (1.7 %). Both the morbidities i.e. acute respiratory infection and fever were higher in females than males (Table 4). Regarding nutritional deficiency signs, it is observed that that discoloration of hair, a sign of protein calorie malnutrition was observed to be high i.e. 7.2 percent which was higher in females than males. Angular stomatitis, cheliosis and glossitis were ranging from 0.6 to 1.3 percent. Prevalence of dental caries (36.1 %) and dental fluorosis (18.5 %) are observed high in this area. Females suffered more from dental caries and dental fluorosis than males (Table 5). Koilinichia, a sign of anemia, was observed only in females (2.0 %).

Table 4. Distribution of population according to Morbidity profile

Morbidity	Males	%	Females	%	Total	%
N.A.D.	357	85.0	299	74.8	656	80.0
Fever	26	6.2	44	11.0	70	8.5
Diarrhoea	7	1.7	7	1.7	14	1.7
Dysentery	1	0.2	0	0.0	1	0.1
ARI	29	6.9	50	12.5	79	9.6
Measles	0	0.0	0	0.0	0	0.0
Pooled	420	100.0	400	100.0	820	100.0

Table 5. Distribution of population according to Nutritional deficiency signs

Deficiency Signs	Males	%	Females	%	Total	%
Hair Discoloured	27	6.4	32	14.8	59	7.2
Angular Stomat.	2	0.5	3	0.8	5	0.6
Chelosis	2	0.5	5	1.3	7	0.8
Glossitis	3	0.7	8	2.0	11	1.3
Koilinychia	0	0.0	2	0.5	16	2.0
Gums/spongy Bl.	7	1.7	13	3.3	20	2.4
Dental Caries	123	29.3	173	43.3	296	36.1
Dental Fluorisis	67	16.0	85	21.3	152	18.5
Others	4	1.0	17	4.3	21	2.6

The weights of pre-school children were expressed as percent of NCHS standards and categorized into different nutritional grades, based on Gomez classification (Tables 6-8). The overall prevalence of under nutrition was very high i.e. 94.2 percent. The overall prevalence of severe under nutrition was higher in Scheduled Castes and Scheduled Tribes (8.2 %) communities followed by backward and other communities. Under nutrition was higher in joint families (90.7 %) than nuclear families (88 %). Severe under nutrition was observed maximum in semi pucca houses (7.4 %) followed by kutcha houses and least in pucca houses (3.8 %).

Table 6. Distribution of 1-5 years children according to Gomez distribution and community

Community	N	Nutritional Grades			
		Normal	Mild	Moderate	Severe
S.C	36	10.3	36.9	44.6	8.2
S.T	10	10.3	36.9	44.6	8.2
B.C	25	8.4	41.2	43.2	7.2
Others	45	8.6	43.4	41.6	6.4
Pooled	116	5.8	40.2	46.4	7.6

Table 7. Distribution of 1-5 years children according to Gomez distribution and type of family

Type of Family	N	Nutritional Grades			
		Normal	Mild	Moderate	Severe
Nuclear	76	14.0	34.6	45.2	6.2
Joint	39	9.3	40.2	44.2	6.3
Extrended	1	-	-	-	-

Table 8. Distribution of 1-5 years children according to Gomez distribution of type of house

Type of House	N	Nutritional Grades			
		Normal	Mild	Moderate	Severe
Kutcha	32	7.0	39.8	46.5	6.7
Semi-pucca	74	6.8	41.2	44.6	7.4
Pucca	10	5.4	42.4	38.4	3.8

The distribution of adults according to BMI grades have been shown in Tables 9-11). At the aggregate level, 51.4 percent had normal BMI (18.5-25.0), while 48.6 percent had chronic energy deficiency. Severe chronic energy deficiency was observed higher in Scheduled Castes and Scheduled Tribes (11.4 & 11.2 % communities followed by backward and other communities. Severe chronic energy deficiency was higher in joint and extrended families (10.4 %) than nuclear families (9.6 %). Severe chronic energy deficiency was observed maximum in kutcha houses (14.4 %) and least in pucca houses.

Table 9. Distribution of adults (>=18 years) according to BMI classification and community

Community	N	Nutritional Grades			
		Normal	Mild	Moderate	Severe
S.C	16	56.0	26.4	16.2	11.4
S.T	105	50.8	24.4	14.6	11.2
B.C	92	53.8	23.2	12.4	10.6
Others	246	55.9	22.4	10.8	10.9
Pooled	464	51.4	24.1	13.5	11.0

Table 10. Distribution of adults (>=18 years) according to BMI classification and Type of family

Type of Family	N	Nutritional Grades			
		Normal	Mild	Moderate	Severe
Nuclear	234	53.4	25.6	11.4	9.6
Joint	215	52.6	26.6	10.8	10.2
Extrended	8	55.2	23.8	10.4	10.6

Table 11. Distribution of adults (>=18 years) according to BMI classification and type of house

Type of House	N	Nutritional Grades			
		Normal	Mild	Moderate	Severe
Kutcha	104	43.1	16.4	16.1	14.4
Semi-pucca	298	47.9	25.3	14.2	12.6
Pucca	62	51.8	24.2	11.6	12.4

Project work is being continued and detailed analysis is under process. Data remains to be collected from 200 household from Shergarh and Phalodi tehsils of Jodhpur district.

Important leads/Outcome

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.

Estimation of Burden of Disease by DALY Measure in Desert Region of Rajasthan - *Raman Sachdev, K. R. Haldiya and J. Lakshminarayana*

Date of commencement: **January, 2005** Duration: **Two & half Year** Status: **Initiated**

Objectives

- To quantify the burden of premature mortality (YLL) and disability (YLD) by age, sex and region for major causes or groups of causes with specific objective to carry out a comprehensive assessment of the burden of disease, injuries and important risk factors for the population of desert region in order to:
  - provide a baseline for assessing improvements in health and performance of health systems
  - provide comprehensive data on health needs to support rational resource allocation and to address inequalities in health status across subpopulations.

Progress of Work

The draft proposal was sent to the experts for their valuable comments/suggestions. The same were incorporated. The study was recommended to be undertaken with six-monthly review. It was also submitted to in-house review committee. Meanwhile a schedule has been prepared for initiating the collection of required information.

Important leads/outcome from the study and possible utilization

The burden of disease estimate based on community rated disability weight is expected to emphasize disability component of the disease burden. Such estimates can be useful for planning of health care delivery capacity and types of health care delivery institutions. The expert rated disease burden estimates would show the mortality component of the disease burden more than the other estimate. Hence they can be used to plan for preventive programs and to set priorities for research. Some leading causes of burden may show up in all estimates. Such causes of disease burden found to be important from more than one perspective will naturally deserve greater attention and be prime objects of health policy. The burden of diseases in tropical and developing countries remains massive. New, especially molecular, parasitological techniques and lines of research, and scientific methods for investigations and management of tropical diseases can contribute to the reduction of the burden of disease.

The present study will be used to highlight the importance of communicable, non-communicable and degenerative diseases which will influence in planning of health care interventions programs useful to respective groups in desert region of Rajasthan.

Retrospective analysis and prospective prioritization of disease burden in Rajasthan - *A.K. Dixit and P.K. Anand*

Date of commencement: **March 2004** Duration: **One Year** Status: **Concluded**

Objectives

1. To study the prioritization of disease incidence in the state through retrospective data analysis
2. To study the disease wise prioritization by DALY like measures
3. To study disease linked mortality
4. To estimate the magnitude of epidemiological transition

Rationale

For priority setting, we need to know the behavior of diseases not only at a given point of time but in a retrospective fashion. The disease incidences, analyzed retrospectively provide us a stabilized behavior and thus help in formulation of strategies for future. The commonly used measures for such studies are prevalence/ incidence and the mortality recorded. However, the incidence perspective based measures which integrate also the 'suffering' associated with a disease state together with years of life lost due to mortality are gaining much momentum as they are considered more closer to describe health scenario.

To integrate the traditional and modern approach, we have analyzed the year wise data obtained from directorate of health, Govt. of Rajasthan from the year 1998 to 2002 for 156 reported diseases, from both the perspectives. The top killing diseases are also identified.

This exercise has lead us to estimate the magnitude of epidemiological transition as to know about the magnitude of non-communicable diseases shading over the communicable diseases.

To support the health planners take decisions we have here also attempted to read the trends and predict the situation in the year 2010.

Progress of the Work

Data (1998-2002) obtained from Directorate of Health, Govt of Rajasthan was analysed year wise for
Disease wise incidence
Disease wise DALYs

Disease wise mortality
Epidemiological transitional assessment and
Prediction of the situation in the year 2010.

Table 1, depicts the change in rankings of the top 10 diseases as per their incidence per lakh of population over the years. Table 2, supplements it with incidence figures. Changes in the ranks of top 10 diseases as per the DALYS are given in the table 3 with the DALYs loss from these top ranking diseases given in table 4. The top 10 killers are identified in table 5 with their performances over the study period, while table 6 gives us the percentage mortality associated with the top 10 killing diseases. Rate of epidemiological transition is worked out in table 7. Each table from 1 to 6, also reads the predicted situation of the described entity in the year 2010

Observations

Table 1 and 2 clearly indicate that social threats to health continue to be at the top, which becomes a socio-medical concern of worth consideration .Chromic disease of tonsils, anaemia and conjunctivitis are behaving similarly over the years. Anaemia secures 5th position while acute bronchitis is coming up fast and is expected to bag 3rd position in the year 2010. We then expect 3850 cases per lakh of population per year from this disease. Similarly, 2609 anaemic cases per lakh population per year are expected in the year 2010.

Looking the situation as per DALYs, we note from table 3 and 4 that social threats to health remains at the top, followed by acute myocardial infraction . The fifth position is then expected of the pneumonia than the anemia, with 2141 DALYs loss per lakh population. This suggests to change in our control strategies planned for incidence based scenario. It is important to note that Pulmonary tuberculosis has ranked 10th and expected to rank 3rd in the rear 2010, only through DALY analysis, whereas through routine analysis; PTB could not figure among top 10 diseases. The strength of new approach is clear from here. From table 5 and 6, we note that tetanus is the potential top killer with 7% mortality associated with it. Other promising killers being septicemia, cerebro-vascular diseases which need proper attention. Table7 puts the rate of epidemiological transition. We note that non-infectious diseases are coming up to the tune that for one case of infectious diseases, there are 1.68 cases of non infectious diseases. The DALYs loss from these diseases are much more than the infectious diseases.

Conclusion

Through the data analyzed here is hospital data and does not speak of general community. However for priority setting, this is worth considering. We note from this analysis that epidemiological transition is fast. The diseases ranked 7th (acute bronchitis) is going to rank 3rd in year 2010. For non-communicable diseases, this rate is still fast. The disease (Acute Myocardial infection) which was at position 4 in the year 1998 is predicted to rank 2nd in the year 2010. Among top 10 ranking of the diseases, incidence wise, the non communicable

diseases occupied 5 positions and as per their ranking with respect to DALYs, they together occupied 8 positions. This speaks of the important role of new measure in priority setting.

Table 1. **Ranks of top 10 diseases according to their incidence/ lakh Population in different years**

S. No.	Name of Diseases	1998	1999	2000	2001	2002	…..	2010
1.	Other violence	1	1	1	1	1	..	1
2.	Chronic disease of tonsils & adenoids	2	2	2	2	2	..	2
3.	Diseases of skin & subcutaneous tissue	3	4	4	4	5	..	4
4.	Open wounds & injuries to blood vessels	4	5	6	6	6	..	6
5.	Anaemia	5	6	5	5	4	..	5
6.	Sign symptoms & ill defined conditions	6	24	23	23	83	..	-
7.	Acute-bronchitis & bronchiolitis	7	3	3	3	3	..	3
8.	Bronchitis chronic & emphysema & asthma	8	7	7	7	7	..	7
9.	Conjunctivitis	9	8	9	9	8	..	9
10.	Diseases of teeth & supporting structures	10	8	8	8	9	..	8

Table 2. **Incidence / lakh population of top 10 diseases in different years**

S. No.	Name of Diseases	1998	1999	2000	2001	2002	…..	2010
1.	Other violence	8348	7720	9227	8979	8934	….	8820
2.	Chronic disease of tonsils & adenoids	4909	4532	4701	4572	4957	….	4743
3.	Acute-bronchitis & bronchiolitis	2079	4160	3977	3869	3981	….	3850
4.	Diseases of skin & subcutaneous tissue	3129	2835	2856	2778	2647	….	2780
5.	Anaemia	2756	2462	2556	2497	2760	….	2609
6.	Open wounds & injuries to blood vessels	2788	2663	2443	2376	2419	….	2465
7.	Bronchitis chronic & emphysema &asthma	1876	1837	1694	1649	1851	…..	1762
8.	Diseases of teeth & supporting structures	1713	1584	1540	1498	1392	…..	4175
9.	Conjunctivitis	1809	1551	1518	1477	1425	…...	1497
10.	Other ill defined Intestinal Infections	1581	1425	1341	1304	1339	…..	1337

Table 3. **Ranks of top 10 diseases according to their DALYs / lakh population in different years**

S.No.	Name of Diseases	1998	1999	2000	2001	2002	…..	2010
1.	Other violence	1	1	1	1	1	..	1
2.	Sign symptoms & ill defined conditions	2	10	11	11	83	..	-
3.	Ulcer of stomach & duodenum	3	26	36	36	26	..	24
4.	Acute myocardial infection	4	6	2	2	2	..	2
5.	Intra-cranial & internal injuries including nerves	5	8	5	5	8	..	6
6.	Pneumonia	6	3	6	6	6	..	5
7.	Burns	7	4	10	11	11	..	10
8.	Anemia	8	5	8	8	10	..	9
9.	Bronchitis chronic & emphysema & asthma	9	7	4	4	3	..	4
10.	Pulmonary T.B.	10	2	3	3	4	..	3

Table 4. DALYs per/population of top 10 diseases in different years

S. No.	Name of Diseases	1998	1999	2000	2001	2002	….	2010
1.	Other violence	6434	4677	6943	6752	8519	….	7100
2.	Acute myocardial infraction	2526	2291	2768	2692	2535	….	2591
3.	Pulmonary Tuberculosis	2112	2641	2596	2525	2158	…	2402
4.	Bronchitis chronic & emphysema & asthma	2132	2229	2583	2511	2284	…	2390
5.	Pneumonia	2474	2412	2156	2097	2016	…	2141
6.	Intra-cranial & internal injuries including nerves	2498	2202	2166	2106	1915	…	2072
7.	Hypertensive heart diseases	1921	2036	2147	2088	1916	…	2035
8.	Acute-bronchitis & bronchiolitis	1286	1441	2051	1994	2098	…	1921
9.	Anaemia	2351	2308	2078	2021	1682	…	1976
10.	Burns	2397	2331	2046	1990	1491	…	1903

Table 5. Ranks of top 10 diseases according to their mortality/ lakh population in different years

S. No.	Name of Diseases	1998	1999	2000	2001	2002	…..	2010
1.	Slow fetal growth total malnutrition, immaturity	1	3	8	8	8	..	7
2.	Tetanus	2	1	2	1	1	..	1
3.	Malignant Neoplasm of Stomach	3	8	9	7	7	..	8
4.	Accidental poisoning	4	4	7	6	5	..	6
5.	Septicemias	5	7	3	2	2	..	2
6.	Meningococcal Infection	6	9	1	4	6	..	5
7.	Malignant Neoplasm of trachea bronchus, lungs	7	10	10	10	10	..	10
8.	Poisonings & toxic effects	8	5	4	5	3	..	4
9.	Birth trauma	9	6	6	9	9	..	9
10.	Cerebrovascular diseases	10	2	5	3	4	..	3

Table 6. Percentage mortality of top 10 killing diseases in different years

S. No.	Name of Diseases	1998	1999	2000	2001	2002	…..	2010
1.	Slow fetal growth total malnutrition, immaturity	10.48	3.70	2.57	2.28	1.56	..	2.79
2.	Tetanus	6.44	6.12	7.74	7.33	7.15	..	7.14
3.	Malignant Neoplasm of Stomach	5.87	1.95	1.75	2.46	2.13	..	2.41
4.	Accidental poisoning	4.03	3.46	2.99	3.24	2.76	..	3.11
5.	Septicemias	3.88	3.05	4.69	4.75	3.94	..	4.051
6.	Meningococcal Infection	3.62	1.92	9.52	4.09	2.39	..	4.34
7.	Malignant Neoplasm of trachea, bronchus, lungs	3.28	1.57	1.20	1.34	1.17	..	1.41
8.	Poisonings & toxic effects	3.20	3.37	4.21	3.37	3.54	..	3.59
9.	Birth trauma	2.96	3.33	3.59	1.98	1.18	..	2.27
10.	Cerebrovascular diseases	2.94	3.89	3.67	4.31	3.39	..	3.52

Table 7. Rate of Epidemiological Transition

Infectious → Non infectious diseases	
Cases dy/dx = 1.68	x = number of cases of infectious diseases in different years y = number of cases of non-infectious diseases in different years i.e. with unit addition of a case of infectious disease, there is addition of 1.68 cases of non-infectious diseases
DALYs dy/dx = 0.62	x = number of DALYs of non-infectious diseases in different years y = number of DALYs of infectious diseases in different years i.e. per 100 DALYs loss from non-infectious diseases, there are 62 DALYs loss from infectious diseases

Desert Development and Disease Burden: A Situational Study - *A. K. Dixit and P.K Anand*

Date of commencement: **October, 2004** Duration: **Six Months** Status: **Completed**

Objectives

1. To identify developmental factors influencing health in desert
2. To know the impact of development on diseases in desert
3. To study the association of developmental factors with the disease scenario in desert.

Rationale

There has been tremendous overall development in the desert. It is thought generally that adequate level of development takes care of health. However, each developmental activity has its own impact on health. It is desirable to know then, which developmental activity affects the health to what extent so that necessary prioritization could be planned to achieve better health targets, given the limited resources. This study is an effort in this direction.

The data obtained from Directorate of Health, Govt. of Rajasthan for the eleven desert districts for the year 2000, is analyzed to study the influence of the selected developmental activities on health and disease scenario.

The data on selected developmental activities, which include demographic, socio-economic, physical, utilization of health facilities, health institutions and improved immunization, is obtained from institute of health management, Jaipur for the year under study.

This exercise has lead us to identify the particular developmental activities influencing health, to know diseases scenario in relation to desert development, so as to assist the planners to prioritize the developmental schedule to achieve better health goals.

Progress of Work

Square of rank correlations of developmental activities with the three health indices, IMR, life expectancy and the percentage of under weight children born are depicted in table 1, 2 and 3 respectively. The behavior of the desert districts as regard to the number of cases per lakh of population of infectious and non-infectious diseases according to integrated development score (overall development) is given in table 4 to know about the influence of development in desert on disease scenario. Association of the specific developmental factors with infectious and non infectious diseases in desert are shown in table 5. The infectious and non-infectious diseases which show upward/downward trend with desert development have figured in tables 6 & 7.

Observations

Observing the ranking of D^2statistic in tables 1, 2 and 3; we note that IMR and life expectancy are best influenced by integrated development; however literacy rate influences best the underweight children .Income, at 5^{th} position is shown to have lesser influence. The important point to note from table 4 is that developmental activities do not influence non-infectious disease scenario though their number is double the infectious diseases. This perhaps relates to life style more.

If we look at the rankings of correlations of developmental factors with infectious and non-infectious disease vide table 5, we note that electrification, road development, poverty and percentage of urban poor in particular have high influence. As such, these activities should receive high priority .From table 6 and 7, we may note of the upcoming diseases and plan our strategies accordingly.

Conclusion

The overall development has influenced high the health parameters, IMR and life expectancy. Educational improvement is directly related with nutrition. We also noted that developmental activities do not influence the non-infectious scenario. They are better related to life style. To achieve better health goals, addressing electrification, road development, poverty and in particular reduction in percentage of urban poor need to receive high priority

Table 1. Developmental factors and their association with IMR in desert

Factor	r_s	D2 (%)	Rank
Integrated Development	.782	61.15	1
Urban population	.645	41.60	2
Human development	.627	39.31	3
Literacy rate	.355	12.60	4
Income	.173	2.99	6
Complete Immunization	.282	7.95	5

Table 2. Developmental factors and their association with Life Expectancy in desert

Factor	r_s	D2 (%)	Rank
Integrated development	.445	19.80	1
Urban population	.318	10.11	2
Human development	.300	9.00	3
Literacy rate	.318	10.11	2
Income	.100	1.00	4
Complete Immunization	.382	14.59	2

Table 3. Developmental factors and their association with under weight children in desert

Factor	r_s	D2 (%)	Rank
Integrated development	.800	64.00	2
Urban population	.000	0.00	
Human development	.800	64.00	2
Literacy rate	.900	81.00	1
Income	.100	01.00	4
Complete Immunization	.200	04.00	3

Table 4. Association of Inf./non-inf. diseases with development in desert

Districts	Integrated developmental score	Total cases per lakh	
		Infectious	Non infectious
Ganganagar	247	9786	25317
Bikaner	243	13878	51636
Churu	212	15396	22467
Jodhpur	197	11824	33278
Jhunjhunu	193	16267	29462
Sikar	191	18348	29843
Nagour	189	15834	27535
Pali	187	14467	38821
Jalore	181	9596	24161
Jaisalmer	178	10844	38840
Barmer	177	4804	14023
	TOTAL	141044	335383
r=.102 , r=.331, RR Dev/inf. = 1.14	Ratio (Non inf. & inf.) = 2.37 RR Dev/Non inf. = .87		

Table 5. Developmental factors and their association with infectious /non-infectious diseases

Developmental factor	Infectious		Non-Infectious	
	r^2	rank	r^2	rank
Population density	29	3	1.44	11
% of Urban population	16	6	38	1
Lit rate	26	5	4.8	10
Human developmental index	2.3	9	17.6	6
Human poverty index	28	4	23	3
Road dev	.01	2	5.3	9
Electrification	42	1	20.2	4
Availability of toilet	.25	11	6.2	8
% of Urban poor	2	10	30.2	2
% of family below poverty line	24	6	1.4	12
No. of health institution	5	7	19.4	5
Immunization	37	2	13.7	7
% of women visiting health facilities	3	8	0.01	13
% of H/H visited by health worker	.01	12	0.01	13
r_s =0 .22				

Table 6. Infectious Diseases showing upward trend according to development in desert

Diseases	r	D2
Influenza	+.49	24.01
Otitis Media	+.46	21.16
Pulmonary T B	+.42	17.64
Typhoid fever	+.39	15.21
Whooping Cough	+.38	14.44
Conjunctivitis	+.27	07.29
Amoebiasis	+.27	07.29
Inf. Geneto-urinal	+.25	06.25
Inf. colitis	+.19	03.61
Trachoma	+.13	01.61

Table 7. Non-infectious diseases showing upward trend according to development in desert

Diseases	**r**	**D^2**
Fetal problems	+.77	59.29
Kwashiorkor	+.60	36.00
Chronic diseases of tonsils	+.53	28.09
Nephrotic Syndrome	+.50	25.00
Chronic Asthma	+.44	19.36
Blindness/ Low vision	+.35	12.25
Menstrual Disorder	+.33	10.89
Diseases of teeth and supportive structure	+.31	9.61
Hypertension Heart Disease	+.29	8.41
Injuries/ Trauma	+.17	2.89

Household distribution of disease burden in community health management - A study in desert - *A.K. Dixit and P.K .Anand*

Date of commencement: **October, 2004** Duration: **Two Years** Status: **Ongoing**

Objectives

1. To study the household distribution of disease burden
2. Locating the pockets of the population needing health care attention
3. Suggesting for appropriate strategies for health care delivery to remove unevenness in household disease burden distribution across the community

Rationale

The widely used approach in disease burden studies has been to provide estimates of disease burden in the community, using secondary data. This speaks for priority setting but does not provide ways and means to address the situation at household level. Infect, a household serves as a basic unit to decide upon the intake and care of a household member in relation to the other members within a household. The unevenness with respect to it within a household is then reflected in the community, which is an entity composed of households. If we study the disease burden at household level, which will correlate with physical (type of house, living area etc.), economical (family income) and social (caste, belief and practices) factors, it will be possible to identify the groups of people needing attention and will help in management of disease burden in the community better.

Progress of Work

As per the recommendations of the SAC, the project is revised and initiated, in district Jodhpur through intramural funds as to develop a prototype for the state and formulate it for extramural funding. The data obtained from the survey so for in Tinwari area is summarized in tables 1-3.

Observations

Table1 supports the hypothesis that H/H level disease burden distribution in the community is not distributed evenly. It tends to concentrates at the two end points. Table-2 and 3 depict the variations as per social groups and the gender differences within them. We note that as per YLDs/person, Muslim community carries more disease burden. Caste wise variations are also noted. The Meghwal community is found suffering most. Gender differences within communities are considerable.

Conclusion

Though the data is too small to conclude anything at this stage, however it supports our strong contention that the approach adopted will lead to successful identification of the groups of people needing attention and will help in formulation of appropriate strategies to address disease burden in a community.

Table 1. **Household distribution of YLDs/person**

YLDs at H/H level/person	No. of H/H
<0.5	59
0.5-2.5	19
2.5-4.5	9
4.5-6.5	5
6.5-8.5	4
8.5-10.0	1
10.0-20.0	3
20.0-30.0	1
30.0-40.0	3
>40.0	4
Total	108

Table 2. YLDs /person religion wise

Religion	n	Mean	SD
Hindu	141	6.752	20.95
Muslim	34	12.811	37.77

Table 3. **YLDs /person, sex and caste wise**

		M	F	All
Bhil	Mean	0.413	1.68	0.915
	SD	1.58	5.18	3.48
	n	26	17	43
Jat	Mean	3.96	2.65	3.22
	SD	10.5	5.4	7.9
	n	24	32	56
Meghwal	Mean	27.09	6.2	18.33
	SD	76.4	12.1	58.9
	n	18	13	31
Rajput	Mean	23.35	0.21	14.93
	SD	60.7	0.2	48.5
	n	7	4	11

Assessment of Impact of Environmental Pollution on Human health in the city of Jodhpur, Rajasthan - *R.C. Sharma, Vinod Joshi, A.K. Dixit, S.P. Yadav, R. Fotedar, P.K. Anand, H.S. Rumana and P.C. Sharma*

Date of Commencement: **April, 2004** Duration: **Two year** Status: **Ongoing**

Objectives

1. To assess the magnitude of environmental pollution analyzing air, water and solid waste pollutants by seasonal and periodic sampling.

2. To collect information on incidence and prevalence rates for specific health end points such as respiratory ailments, infectious diseases, cardiovascular diseases and cancer.

3. To formulate a design for rational mitigation strategies for the environmental management for the area based on the health risks assessment, economic costs and community perceptions.

Rationale

Pollution increases not only due to increase in population with decrease in the available living space for each person but also because of continuously increasing per capita consumeristic demands. An estimated 3 million people die each year because of air pollution. This figure represents about 5% of the total 55 million deaths per annum in the world. According to WHO air pollution causes 8 00 000 premature deaths from lung cancer, cardiovascular and respiratory diseases worldwide, in addition to increased incidence of chronic bronchitis, acute respiratory illness, exacerbation of asthma and coronary disease, and impairment of lung function. Worldwide approximately 1.1 billion people do not have access to safe water and 2.4 billion lack basic sanitation. Approximately 3.1 % of deaths and 3.7 % of DALYs worldwide are attributable to unsafe water, sanitation and hygiene. In India, magnitude of the problem is significantly high. According to a study economic loss due to pollution was estimated 9715 million US $ / year or 4.53 % of GDP that include 5710 million US $ / year from water pollution, 1310 million US $ / year from air pollution and 1642 million US $ / year from soil pollution in terms of premature deaths, physical disability, restricted activity days etc. It is estimated that the hazardous wastes generated in India is about 4.4 million tons per annum. The most polluting of them are the city sewage and industrial waste.

In Jodhpur city a large number of people suffer from respiratory and diarrheal diseases. Out of 6027 cases, about 61.12 % cases of diarrheal diseases and 25.16 % cases of respiratory diseases have been reported from the city (2003-2004, CMHO Office, Jodhpur). The city of Jodhpur, the second largest city in the state, has registered 21% decadal population growth. It has more than 3 lakh of registered vehicles contributing to air pollution with more than 10 000 industrial units. The city has no proper sewerage system. Inadequate maintenance of the

existing system causes the problem of water borne pollution, which is reflected through some 60% of water borne diseases cases registered every year.

Magnitude of impact of pollution on health in the city remains unknown due to lack of studies on the problem. Owing to increasing pollution in the city, it has become necessary to study the impact of it on human health.

In the present study, to assess the impact of air, water and solid waste on human health, attempts are being made to find out the current magnitude of environmental pollution in respect to it's meteorological conditions and also for assessment of health problems associated with environmental pollution. The present study is expected to reveal the status of pollution-associated health problems but also form a baseline data for further detailed investigation on health impact assessment. This study will also be helpful for extrapolation of the scenario and for formulation of mitigation strategies.

Progress of the Work

Selection of study areas and classification as per attributes:

For assessment of environmental pollution on human health, the Jodhpur city, which has 60 wards, is divisible into different zones with respect to different types of pollution i.e. air, water and solid hazardous, socio-economic and cultural behaviour and topographical conditions. Study sites from within zones are selected to represent them statistically also. The detail map of selected study sites in the city has been shown in the fig. -1.

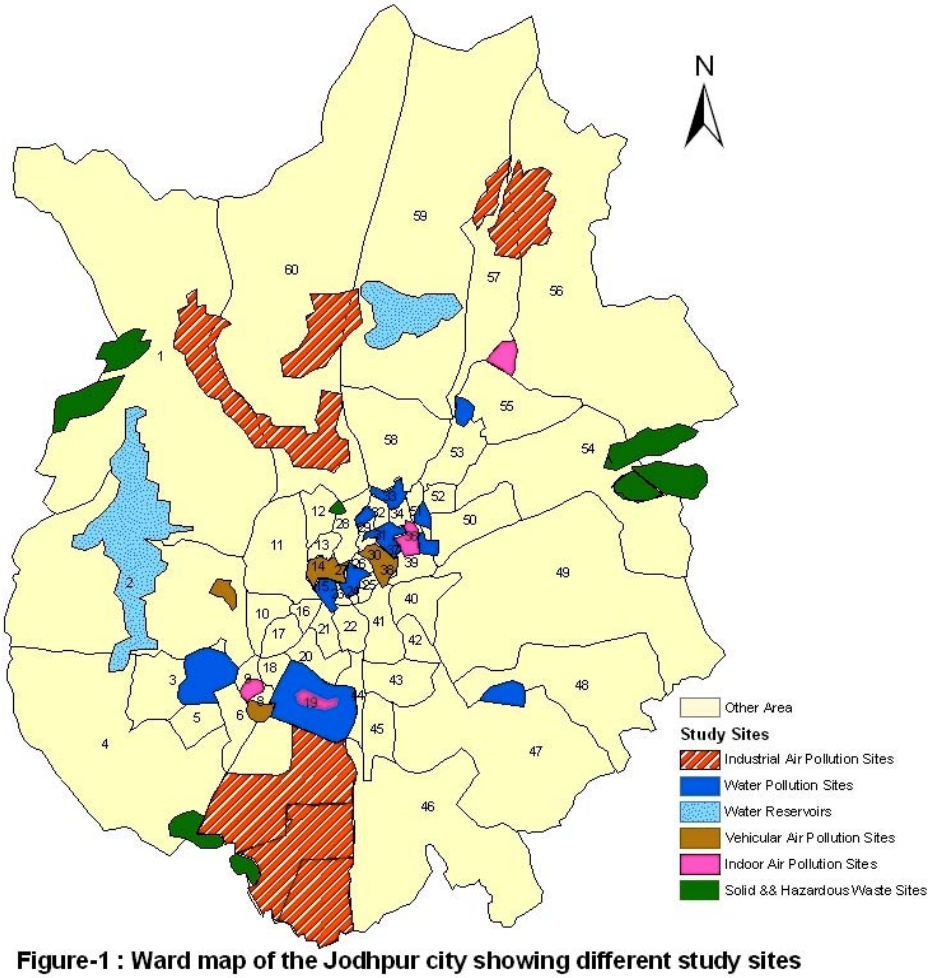


Figure-1 : Ward map of the Jodhpur city showing different study sites

For air quality assessment different study sites were selected for analysis of vehicular, industrial and indoor (residential) air pollution. For vehicular pollution analysis the study sites were selected on the basis of intensity of traffic at the site and area specific details. For industrial pollution assessment the sites are selected from the main industrial areas of the city on the basis of type of industries and industrial effluent. For indoor air quality assessment various sites were selected on health, on the basis of type of fuel used for indoor activities and in-house conditions.
The study sites selected for air pollution are:

For vehicular air pollution assessment:

Category 1: congested commercial sites with heavy vehicular load
1.Jalori gate: site-I 2. Khanda Phalsa: site-II
3. Katla Bajar: site-III 4. Sojati gate: site-IV

Category 2: less congested sites with moderate to heavy vehicular load
1. New Sadak circle: site-V 2. Paota circle: site-VI
3. Pal link road: site-VII 4. Akalia circle: site-VIII

For industrial air pollution assessment:

Category 1: textile / timber / Guar gum industries-
1.Basni phase-I: site-I 2. Basni phase-II: site-II

Category 2: metal / engineering industries-
1. Light Industrial Area: site-III 2. Heavy Industrial Area: site-IV

Category 3: export promotion zone- Boranada Ind. Area phase I,II,III&IV : site- V

Category 4: handicrafts/ oil mills/ Guar gum/ textile- Mandore Ind. Area: site- VI

Category 5: minerals/ stone extraction- Soor sagar Industrial Area: site- VII

For indoor air pollution assessment:

Category 1: Congested area with maximum use of LPG- 1. Bamba Mohalla: site-I

Category 2: Maximum use of kerosene/wood/coal- 1. Chandana Bhakor: site-II

Category 3: Spacious area with maximum use of LPG- Shashtri Nagar: site-III

Category 4: Mixed dwelling with mixed use of fuels- Massooria : site-IV

Category 5: Slum area - Sansi basti (Mandore): site- V

Similarly for water pollution assessments the study sites are selected on the basis of type of water source used, condition of public water distribution network and it's proximity with sewerage network, socio-economic and cultural conditions and topographic conditions.
The study sites of various categories are:

Category 1: congested area: The category is further subdivided on the basis topographic conditions;

a) High slope – 1. Kolari Mohalla: site-I, 2. Umaid Chowk: site-II
b) Middle slope- 1. Bhim ji Ka Mohalla: Site-III 2. Jalap mohalla: site-IV
3. Hathiram ka Odha: site-V 4. Jalorion ka Vas: site-VI
c) Foothill - 1. Jalori gate: site-VII 2. Merti gate: site-VIII

Category 2: well planned area:
1. Shashtri nagar: site-IX 2. Chaupasani Housing Board: site-X

Category 3: slum areas:
1. Pabupura basti: site-XI 2. Bhadasia: site-XII

Category 4: large water reservoirs, ground water resources as step wells and hand pumps

1. Rajiv Gandhi canal: site-I 2. Kailana lake: site -II
3. Chaupasani water filter plant: site-III 4. Balsamand lake: site –IV
5. Balsamand filter plant: site –V 6. Kolari Mohalla: site-VI
7. Bhimji Ka Mohalla: site VII 8. Jalap Mohalla: site-VIII
9. Jalori gate: site-IX 10. Sojati gate: site-X
11. Merti gate: site XI 12. Hathi Ram ji Ka Oda: site-XII
13. Jalorion ka Vas: site-XIII 14. Umaid choulk: site-XIV

For solid and hazardous waste pollution assessment some study sites are selected on the basis of quality and quantity of solid waste and type of human exposure.
The various study areas selected are:

Category 1: Municipal solid waste dumping area
1. Banar : site-I 2. Badli : site-II

Category 2: Industrial effluents used in agricultural practices-
Salawas/Sangria: site-IV
Category 3: City sewerage water used in agricultural practices- Banad : site-V

Sample Collection:
The samples were collected from the respective sites identified in Jodhpur. The sampling of air, water and solid hazardous waste were timed as to capture the seasonal variations of winter, summer and rainy seasons. Simultaneously surveillance of human health is done by filling up a health schedule through on spot clinical examination of individual family members of the selected households from a study site.

The study plan is described as below-

1. During winter season sampling will be done between the periods from mid of November 2004 to mid of February 2005.
2. In summers data will be collected from mid of the month of April to July 2005.
3. In rainy season sampling will be done from mid of July 2005 to mid of October month 2005.

Observations

The samples collected were examined for physico-chemical and bacteriological parameters separately for air, water and solid wastes to study the impact on human health. The preliminary observations of the data collected during winter seasons are given in table 1-8. The meteorological data is also given in the table-9. Tables10-12 depicts the health survey data obtained. Based on the present analysis of the samples for the given parameters (table-1-9), the results for different sites (localities) in the city are analyzed. The values of the parameter recorded together with their ranges are provided. However, a trend of environmental health and its impact on human health cannot be understood until a picture in totality is projected. The work is continued.

Table1. Description of water samples collected from households during monsoon season

S. No.	Study sites / Parameters*	Acceptable Limits (mg/l)	Site I	Site II	Site III	Site IV	Site V	Site VI	Site VII	Site VIII	Site IX	Site X
1	Temperature (^{o}C)	-	27.5-32.0	28.0-34.0	27.0-29.5	25.0-31.0	29.0-31.0	27.0-29.0	23.0-29.0	25.0-28.0	25.0-31.0	27.0-30.0
2	pH	7.0-8.5	7.0-7.2	7.0-7.3	6.8-7.1	7.0-7.2	7.3-7.5	6.9-7.2	6.8-7.3	6.9-7.4	7.1-7.2	6.8-7.0
3	Alkalinity	<200	100-230	120-135	110-140	120-140	90-170	110-120	110-190	120-160	110-130	110-120
4	Total Hardness	<200	42-90	28-40	44-56	40-44	60-64	42-48	40-46	42-86	52-56	52-61
5	Ca hardness	<75	28-60	18-26	30-36	26-30	40-41	28-32	26-31	28-58	34-36	34-40
6	Mg hardness	<30	3.4-7.3	2.4-3.4	3.4-4.8	3.4-3.6	4.8-5.6	3.4-3.9	3.4-3.5	3.4-6.8	4.4-4.8	4.4-5.1
7	Dissolved Oxygen	>5.0	6.1-7.32	4.0-6.7	6.5-7.3	6.1-.9	5.7-6.5	6.09-6.9	3.3-7.3	6.1-7.7	6.1-7.5	6.9-7.3
8	TS	-	120-160	105-185	125-135	100-130	-	110-125	115-560	140-510	105-160	120-140
9	TDS	<500	105-110	95-110	105-115	95-100	-	105-110	110-115	105-110	100-110	105-110
10	TSS	-	15-50	10-75	20-30	05-30	-	05-15	05-450	35-400	05-50	15-30
11	Chloride	<200	29-40	29-32	27-33	25-27	29-40	26-32	28-40	25-64	31-33	31-35
12	Salts	<320	47.8-66.0	47.0-52.0	44.5-54.4	41.2-44.5	47.0-66.0	42.8-52.7	46.0-66.0	41.2-105.6	51.0-54.4	51.1-57.7

* Parameters are in mg/l

Table 2. Description of water samples collected from reservoirs, filter plants and hand pumps during monsoon season

S. No.	Study sites /Parameters*	Acceptable Limit (mg/l)	Site I	Site II	Site III	Site IV	Site V	Site VI	Site VII	Site VIII	Site IX	Site X	Site XI	Site XII	Site XIII	Site-XIV
1	Temperature	-	30.0	30.0	29.9	30.0	30.0	28.0	-	-	-	32.0	30.5	29.5	31.5	-
2	pH	7.0-8.5	7.4	7.3	6.6	7.3	7.4	7	-	-	-	6.9	6.5	6.4	6.9	-
3	Alkalinity	<200	150	120	120	120	130	230	-	-	-	520	530	550	450	-
4	Total Hardness	<200	180	210	210	170	210	90	-	-	-	440	590	640	390	-
5	Ca hardness	<75	120	140	145	115	140	63	-	-	-	290	395	425	258	-
6	Mg hardness	<30	14.6	17.0	15.8	13.4	17.0	28.05	-	-	-	36.5	47.4	52.2	32.1	-
7	Dissolved Oxygen	>5.0	6.1	6.5	7.3	6.5	5.3	6.09	-	-	-	4.0	3.2	2.8	5.7	-
8	TS	-	248	180	124	1460	144	160	-	-	-	1606	3084	2944	1680	-
9	TDS	<500	222	150	92	168	84	55	-	-	-	842	1008	2826	1166	-
10	TSS	-	26	30	32	1292	60	105	-	-	-	764	2076	118	514	-
11	Chloride	<200	16.99	20.99	32.0	23.0	65.98	39.98	-	-	-	184.9	404.9	479.8	219.9	-
12	Salts	<320	28.03	34.6	57.8	37.9	108.9	65.98	-	-	-	305.1	668	791.8	362.9	-

*Parameters are in mg/l

Table 3. Description of water samples collected from households during winter season

S. No.	Study sites / Parameters*	Acceptable Limit (mg/l)	Site I	Site II	Site III	Site IV	Site V	Site VI	Site VII	Site VIII	Site IX	Site X
1	Temperature	-	12.0-15.5	16.5-17.0	12.5-14.5	12.5-14.0	14.0-14.5	13.5-14.5	14.5-15.0	12.5-16.5	14.5-16.5	14.0-16.5
2	pH	7.0-8.5	6.9-7.2	6.8-7.1	6.6-7.0	7.0-7.6	7.1-7.3	6.6-7.4	6.9-7.8	6.8-7.2	7.5-7.8	6.9-7.2
3	Alkalinity	< 200	100	30-60	95-120	100-200	90-170	105-110	150-200	40	95-110	110-120
4	Total Hardness	< 200	40-50	130-132	110-116	42-46	90-98	66-80	46-62	88-108	40-68	52-66
5	Ca hardness	< 75	31-36	82-84	75-80	32-34	60-65	41-26	35-46	78-88	30-22	17-22
6	Mg hardness	< 30	2.2-3.4	11.2-12.15	8.5-8.7	2.4-2.9	7.3-8.0	6.1-8.3	2.67-3.9	1.9-4.86	2.4-11.2	8.5-10.7
7	Dissolved Oxygen	> 5.0	3.65-4.46	4.46-5.27	3.65-4.87	4.057	3.65-5.68	4.46-5.27	3.65-4.057	4.86-5.27	4.05-5.68	3.65-5.27
8	TS	-	110-140	95-165	105-115	100-130	95-105	95-105	105-430	120-410	95-110	105-120
9	TDS	< 500	105-120	85-100	95-100	95-100	85-90	85-90	85-115	100-110	85-90	90-95
10	TSS	-	5-20	10-65	10-15	05-30	10-15	10-15	20-315	20-300	10-20	15-25
11	Chloride	< 200	22.99-24.99	23.99	22.9-24.9	22.99	23.99-25.9	22.9-25.9	26.99-85.9	23.99-24.99	21.9-23.9	20.9-24.9
12	Salts	< 320	37.93-41.23	39.58	37.8-41.23	37.93	39.6-42.73	37.8-42.73	44.5-141.8	39.58-41.23	36.1-39.58	34.5-41.23

*Parameters are in mg/l

Table 4. Physico-chemical variations of water samples of reservoirs, filter plants and hand pumps during winter season

S. No.	Study sites / Parameters*	Acceptable Limits (mg/l)	Site I	Site II	Site III	Site IV	Site V	Site VI	Site VII	Site VIII	Site IX	Site X	Site XI	Site XII	Site XIII	Site XIV
1	Temperature	-	16.0	17.0	18.5	16.5	17.5	19.0	-	20.4	20.5	24.5	24.0	24.5	25.0	24.5
2	pH	7.0-8.5	7.3	7.5	6.5	7.8	7.3	6.9	-	7.0	6.9	7.2	6.5	6.6	7.1	6.8
3	Alkalinity	< 200	300	100	50	100	100	100	-	150	200	510	50	480	430	60
4	Total Hardness	< 200	80	66	76	64	62	40	-	122	76	182	236	176	144	236
5	Ca hardness	< 75	56	44	50	46	42	31	-	92	39	126	82	124	124	160
6	Mg hardness	< 30	5.83	5.346	6.31	4.37	4.86	2.2	-	7.24	8.99	13.6	37.42	12.6	4.86	18.46
7	Dissolved Oxygen	> 5.0	5.27	4.86	4.46	4.46	4.86	4.06	-	2.83	2.83	2.02	2.4	2.4	2.02	2.02
8	TS	-	235	1360	120	1420	134	1610	-	2615	2365	1505	2865	2850	1590	2560
9	TDS	< 500	192	1250	82	196	105	1520	-	1702	1694	1042	2158	2746	1026	2340
10	TSS	-	43	110	38	1224	29	90	-	913	671	463	707	104	564	220
11	Chloride	< 200	20.99	19.99	23.99	130.95	67.97	22.99	-	101.9	265.9	173.2	24.99	419.8	98.8	63.98
12	Salts	< 320	34.63	32.98	39.58	216.08	112.16	37.93	-	152.9	398.8	285.7	41.23	692.7	163.02	105.5

*Parameters are in mg/l

Table 5. Description of Industrial air pollution samples collected during winters

S. No.	Study Sites	Permissible limits (CPCB)*		Air quality parameters (range)	
		SPM ($\mu g/m^3$)	RSPM ($\mu g/m^3$)	SPM ($\mu g/m^3$)	RSPM ($\mu g/m^3$)
1	Site-I	$\frac{360}{500}$	$\frac{120}{150}$	512.75-536.40	90.00-163.75
2	Site-II	$\frac{360}{500}$	$\frac{120}{150}$	390.20-886.25	195.00-488
4	Site-III	$\frac{360}{500}$	$\frac{120}{150}$	582.77-886.25	86.25-367.50
5	Site-IV	$\frac{360}{500}$	$\frac{120}{150}$	830.125-884.26	131.25-140.12
3	Site-V	$\frac{360}{500}$	$\frac{120}{150}$	613.97-783.70	92.857-116.25
6	Site-VI	$\frac{360}{500}$	$\frac{120}{150}$	859.49-874.12	98.75-104.32

*Time-weighted average Annual Average/ 24 hours

Table 6. Description of vehicular air pollution samples collected during winter season- Morning hours

S. No.	Study sites	Permissible limits (CPCB)*		Air quality parameters (range)	
		SPM ($\mu g/m^3$)	RSPM ($\mu g/m^3$)	SPM ($\mu g/m^3$)	RSPM ($\mu g/m^3$)
1	Site-I	$\frac{140}{200}$	$\frac{60}{100}$	1005.60-1212.30	320.00-345.32
2	Site-II	$\frac{140}{200}$	$\frac{60}{100}$	1383.41-1402.20	162.50-165.23
3	Site-III	$\frac{140}{200}$	$\frac{60}{100}$	1069.67-1416.7	197.50-295.00
4	Site-IV	$\frac{140}{200}$	$\frac{60}{100}$	635.33-1291.75	200.00-212.50
5	Site-V	$\frac{140}{200}$	$\frac{60}{100}$	1209.80-1235.65	445.00-455.12
6	Site-VI	$\frac{140}{200}$	$\frac{60}{100}$	634.40-732.98	97.50-102.85
7	Site-VII	$\frac{140}{200}$	$\frac{60}{100}$	593.40-682.95	85.00-175.00
8	Site-VIII	$\frac{140}{200}$	$\frac{60}{100}$	934.58-1430.99	113.33-450

*Time-weighted average Annual Average/ 24 hours

Table 7. Description of vehicular Air pollution samples collected during winter season – Evening hours

S. No.	Study sites	Permissible limits (CPCB)*		Air quality parameters (range)	
		SPM ($\mu g/m^3$)	RSPM ($\mu g/m^3$)	SPM (mg/m^3)	RSPM (mg/m^3)
1	Site-I	140/200	60/100	998.00-1045.65	295.00-354.68
2	Site-II	140/200	60/100	1131.71-1365.80	220.00-284.60
3	Site-III	140/200	60/100	1129.29-1467.20	217.50-375.00
4	Site-IV	140/200	60/100	986.30-1401.56	170.00-196.87
5	Site-V	140/200	60/100	1056.33-1256.6	312.5-412.65
6	Site-VI	140/200	60/100	634.04-745.56	115.00-146.98
7	Site-VII	140/200	60/100	748.58-844.00	110.00-249.75
8	Site-VIII	140/200	60/100	836.17-950.25	315.10-411.21

*Time-weighted average Annual Average/ 24 hours

Table 8. Daily averages of particulate matters of vehicular air pollution during winter season

S. No.	Study sites	Permissible limits (CPCB)*		Air quality parameters (range)	
		SPM ($\mu g/m^3$)	RSPM ($\mu g/m^3$)	SPM ($\mu g/m^3$)	RSPM ($\mu g/m^3$)
1	Site-I	140 200	60 100	942.875	273.75
2	Site-II	140 200	60 100	989.50	165.00
3	Site-III	140 200	60 100	1165.021	321.25
4	Site-IV	140 200	60 100	1091.75	192.50
5	Site-V	140 200	60 100	1150.6875	345.00
6	Site-VI	140 200	60 100	608.875	86.25
7	Site-VII	140 200	60 100	609.958	223.03
8	Site-VIII	140 200	60 100	641.50	88.75

*Time-weighted average Annual Average/ 24 hours

Table 9. Monthly averages of meteorological data for Jodhpur

Months (Year 2004)	Avg. high temp.	Avg. low temp.	Mean	Precipitation
January	23	6	14	5.1
February	25	8	17	7.6
March	32	15	23	10.2
April	38	22	30	7.6
May	42	27	34	30.5
June	41	28	35	45.7
July	38	27	33	106.7
August	36	27	32	71.1
September	37	24	31	33.0
October	37	19	28	5.1
November	31	12	22	2.5
December	25	7	16	0.0

The maximum average precipitation occurs in July.

*May is the average warmest month.

*On average, the coolest month is January.

*Sunny day/clear, cloudy, raining, dust storms-typhoon

Table 10. Distribution of diseased persons according to their age and sex

Age	Male			Female		
	Examined	Diseased	%	Examined	Diseased	%
<05	11	03	14.29	09	00	00.00
05-14	24	03	14.29	25	03	15.79
15-44	49	07	33.33	57	12	63.16
45-59	08	03	14.29	09	01	5.26
60 +	07	05	23.80	09	03	15.79
Total	99	21	100.00	109	19	100.00

Table 11. Distribution of the diseased persons as per their religion

Religion	Examined	Diseased	%
Hindu	100	11	27.50
Muslim	108	29	72.50
Total	208	40	100.00

Table 12. Morbidity pattern of the diseased persons

Morbidity pattern	Number	%
Respiratory diseases	14	35.00
Non-communicable diseases	5	12.50
Musculo-skeletal diseases	5	12.50
Ophthalmic diseases	5	12.50
Gastrointestinal diseases	4	10.00
Urogenital diseases	4	10.00
Allergic diseases	2	5.00
Head-ache	1	2.50
Total	40	100.00

5. *Papers published/accepted*

Published

1. Bansal S K, Singh Karam V. Efficacy of different organophosphate and synthetic pyrethroid insecticides to the larvae of malaria vector *Anopheles stephensi* Liston. *J Environ Biol 2004;* 25: 485-88.

2. Dewan A, Bhatnagar VK, Mathur ML, Chakma T, Kashyap R, Sadhu HG, Sinha SN, Saiyed HN. Repeated Episodes of Endosulfan Poisoning. *J Toxicol-Clin Toxic* 2004; 42; 363-69.

3. Haldiya KR, Mathur ML, Sachdev R and Saiyed HN. Dermal ulcers and hypertension in salt workers. *Curr Sci (India)* 2004; 87: 1139-1141.

4. Haldiya KR, Sachdev R, Mathur ML and Saiyed HN. Knowledge, Attitude and Practices about Occupational Health Problems among Salt Workers working in Desert of Rajasthan, India. *J. Occup Hlth. (Japan)* 2004 ; 47 : 85-88.

5. Mathur ML and Sachdev R. Temperature affects results of Glutaraldehyde Test for diagnosis of Pulmonary Tuberculosis. *Int J. tubercul. and Lung Dis.* 2005; 9: 200-205.

6. Sachdev R, Haldiya KR, Dixit AK. Acute Intermittent Porphyria in Kumhar Community of Western Rajasthan. *Journal of Association of Physicians of India* 2005, 53: 101-103.

7. Singh, Madhu B. Anthropometric assessment of the nutrition in female children of Thar desert of Rajasthan. *Annals of Arid Zone*, 2004; 43: 199-203.

8. Singh, Madhu B. Nutritional aspects of children residing in desert areas of Rajasthan. *Proc. Workshop on Research Methodologies for Micronutrients Research, Ranikhet, Uttaranchal,* 2002. Indian Council of Medical Research, 2004, 21-25.

9. Singh Madhu B, Lakshminarayana, J. and Fotedar, R. Smoking pattern among the workers engaged in Textile industries of desert districts of Rajasthan. *Indian J Med. Sci.* 2004; 58: 486-488.

10. Singhi Manju., Joshi V., Sharma RC. and Sharma Keerti Ovipositioning behaviour of *Aedes aegypti* in different concentration of latex of *Calotropis procera* : Studies on Refrectory behaviour and relative preference trend across gonotrophic cycles. *Dengue Bulletin* 2004, 28: 184-188.

Accepted

11. Joshi V., Sharma RC, Sharma Yogesh, Adha Sandeep, Sharma Keerti, Singh Himmat, Purohit Anil and Singhi Manju. Importance of socioeconomic status and tree holes in the distribution of Aedes mosquitoes (Diptera: Culicidae) in Jodhpur, Rajasthan, India. *Journal of Medical Entomology* 2004.

12. Joshi, V., Sharma, R.C. Singhi, Manju, Singh, Himmat, Sharma, Yogesh and Adha Sandeep. Entomological studies on malaria in irrigated and non-irrigated areas of desert Rajasthan, India. *J. Vec. Born. Dis*., 2005; 42:

13. Mathur ML, Haldiya KR, Sachadev R and Saiyed HN. Risk of Pterygium in Salt Workers. *Int. Ophthalmol* 2005.

14. Singhi Manju., Joshi, Vinod , Sharma RC, Adha Sandeep and Dixit AK. Larvicidal efficacy of *Calotropis procera* against vectors of dengue, malaria and lymphatic filariasis in Arid Zone of Rajasthan. *Annals of Arid Zone.* 2005;

15. Yadav, SP and Mathur, ML. Knowledge and practices about malaria among the sandstone quarry workers in Jodhpur district, Rajasthan. *Annals of Arid Zone*, 2004.

6. Workshops/Conferences/ Symposia/ Scientific meetings attended/ participated/ organized by scientists

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

- Attended Scientific Advisory Group (SAG) meeting of the Division of NCD held on 14th & 15th May, 2004 at ICMR Hqrs., New Delhi

- Participated Task Force Group meeting on Camel Milk & Diabetes held on 7th June, 2004 at ICMR Hqrs., New Delhi

- Attended" Second meeting of the ICMR forum for Epidemiology" held on 12th & 13th October 2004 at Chennai.

- Participated" Joint Annual Conference of the Indian Society for Malaria and other Communicable Diseases and the Indian Association of epidemiologists" held on 19th to 21st November 2004 at New Delhi.

- Participated "Scientific Advisory Committee" meeting of Central JALMA Institute of
  Leprosy held on 29th & 30th November 2004 at CJIL, Agra.

- Attended Meeting on " Longitudinal studies in core problem areas of Jaisalmer district to identify risk factors at micro level for preparation of strategic action plan to roll back upward trend of malaria" held on 15th & 16th December,2004 at MRC, Delhi.

- Attended 92nd meeting of "Indian Science Congress" held on 3rd to 7th January 2005 at Ahmedabad.

- Attended 22nd Annual National Conference of "Indian Society for Medical Statistics" (ISMS) held on 21st to 23rd January 2005 at Pondicherry.

Dr. K.R. Haldiya, Deputy Director (SG)

- Participated in Expert Working Group on 'National Programme for Control and Treatment of Occupational Diseases (Ninth Five year Plan) - Third Meeting', on 23rd September, 2004 at NIOH, Ahmedabad

- Attended a Workshop on Biomedical Communication organized by ICMR Hqs, held at Desert Medicine Research Centre, Jodhpur on November 18 – 19, 2004.

- Attended National UGC Seminar on Recent Advances in Analytical Chemistry (RAAC – 2004) organized by and held at Department of Chemistry, Jai Narain Vyas University, Jodhpur from November 29 to December 01, 2004 and delivered an invited lecture on 'Role of trace elements in cardiovascular diseases'.

- Delivered a lecture on 'Occupational Health Hazards of Salt laborers' in Workshop on prospects of salt Industry in Rajasthan at Jodhpur on 10th January, 2005.
- Invited as a member of Advisory Committee and Technical Committee for WHO Study entitled 'Pretest of the WHO Questionnaire for the Study on Global Ageing and Adult Health (SAGE)', being conducted by Department of Medicine, S.N. Medical College, Jodhpur. Also invited as a Faculty for the training programme of this project.

Dr. Vinod Joshi, Deputy Director

- Attended a Workshop on Biomedical Communication organized by ICMR at DMRC, Jodhpur on 18th and 19th November, 2004.
- Delivered expert lectures on Dengue and Malaria in "Training programme of medical officers of Jodhpur zone" during Nov.- Dec. 2004.
- Delivered expert lectures on "Malaria and Dengue in Rajasthan" at Aurvedic University, Jodhpur in Nov. 2004.
- Delivered expert lecture on "Mosquito pests of malaria and dengue" at annual meeting of "Pesticide association of India, Pune" on 18th October,2004.
- Delivered lecture on Epidemiology of malaria in desert in the session of Continued Medical Education (CME) for medical officers od Pali district in Nov. 2004

Dr. Murli L. Mathur, Deputy Director

- Attended a Workshop on Biomedical Communication organized by ICMR at DMRC, Jodhpur on 18th and 19th November, 2004.

- Delivered an invited Key-Note Address in the "National Workshop on Environmental Pollution and Its Health Impact on Human Being" sponsored by All India Council of Technical Education, organized by Department of Civil Engineering Faculty of Engineering, J. N. V. University Jodhpur on March 12, 2005.

Dr. Raman Sachdev, Deputy Director

- Attended a Workshop on Biomedical Communication organized by ICMR at DMRC, Jodhpur on 18th and 19th November, 2004.

- Attended National UGC Seminar on Recent Advances in Analytical Chemistry (RAAC – 2004) organized by and held at Department of Chemistry, Jai Narain Vyas University, Jodhpur from November 29 to December 01, 2004 and delivered an invited lecture on 'Fluoride and its hazards on human health'.

- Invited as a member of Advisory Committee and Technical Committee for WHO Study entitled 'Pretest of the WHO Questionnaire for the Study on Global Ageing and Adult Health (SAGE)', being conducted by Department of Medicine, S.N. Medical College, Jodhpur. Also invited as a Faculty for the training programme of this project.

Dr. Karam V. Singh, Deputy Director

- Attended a two days workshop on *'Vigyan avam Takniki Shabdavali* ', sponsored by Vaigyanik avam Takniki Shabdavali Ayog, Ministry of HRD, at ZSI, Desert Regional Station, Jodhpur, from 19th to 20th May, 2004.

- Attended a Workshop on Biomedical Communication organized by ICMR at DMRC, Jodhpur on 18th and 19th November, 2004.

Dr. S.K. Bansal, Deputy Director

- Attended a Workshop on Biomedical Communication organized by ICMR at DMRC, Jodhpur on 18th and 19th November, 2004.

Dr. S.P. Yadav, Assistant Director

- Attended a Workshop on Biomedical Communication organized by ICMR at DMRC, Jodhpur on 18th and 19th November, 2004.

- Attended International Conference on Men as partners in Sexual and Reproductive Health at Mumbai from 28th November to 1st December, 2004 and presented a paper entitled 'A study of impact assessment of modernization and women status on fertility behaviour in the Thar desert of Rajasthan'.

- Attended pre-conference CME-IV Workshop/Seminar from 19-20 January, 2005 on Epidemiological and statistical methods in health and medical research in JIPMER, Pondicherry.

- Attended 22nd Annual Conference of Indian Society for Medical Statistics in JIPMER, Pondicherry from 21-23 January, 2005 and presented a paper entitled 'A community based study on malaria in desert'.

Dr. Madhu B. Singh, Assistant Director

- Attended 'National workshop on methodologies for assessment of Vitamin A Deficiency, Iron Deficiency Anemia and Iodine Deficiency Disorders' jointly organized by Human Nutrition (AIIMS), Indian Public Health association, Indian Association of Preventive and Social Medicine, Nutrition Society of India and Indian Academy of Pediatrics at AIIMS, New Delhi from 13th to 15th September, 2004

- Attended a Workshop on Biomedical Communication organized by ICMR at DMRC, Jodhpur on 18th and 19th November, 2004.

- Attended National UGC Seminar on Recent Advances in Analytical Chemistry (RAAC – 2004) organized by and held at Department of Chemistry, Jai Narain Vyas University, Jodhpur from November 29 to December 01, 2004 and delivered an invited lecture on 'Iodine Deficiency Disorders and its consequences'.

- Attended 92nd Indian Science Congress organized jointly by NIOH, ICMR and Nirma University of Science & Technology at Ahmedabad from January 03-07, 2005

Dr. J. Lakshminarayana, Assistant Director

- Attended a Workshop on Biomedical Communication organized by ICMR at DMRC, Jodhpur on 18th and 19th November, 2004.

- Attended the International Epidemiological Association – South East Asia (IEA-SEA) 8th regional scientific meeting held at Jhansi during 5-8th December, 2004.

- Attended 22nd Annual Conference of Indian Society for Medical Statistics in JIPMER, Pondicherry from 21-23 January, 2005 and presented a paper entitled 'Associated risk factors of tobacco smoking among opium consumers in rural areas of Rajasthan'.

Dr. A.K. Dixit, Assistant Director

- Attended training program in Biomedical information search at NIC, New Delhi July, 27-30, 2004.

- Attended 22nd Annual Conference of Indian Society for Medical Statistics in JIPMER, Pondicherry from 21-23 January, 2005 and presented a paper entitled 'Retrospective analysis and prospective prioritization of disease burden in Rajasthan'.

- Attended seminar on dissemination of district level RCH survey under MHFW, IIHMR, Jaipur, Feb.7, 2005.

Dr. Ranjana Fotedar, Senior Research Officer

- Attended 'National workshop on methodologies for assessment of Vitamin A Deficiency, Iron Deficiency Anemia and Iodine Deficiency Disorders' jointly organized by Human Nutrition (AIIMS), Indian Public Health association, Indian Association of Preventive and Social Medicine, Nutrition Society of India and Indian Academy of Pediatrics at AIIMS, New Delhi from 13th to 15th September, 2004

- Attended a Workshop on Biomedical Communication organized by ICMR at DMRC, Jodhpur on 18th and 19th November, 2004.

Dr. Manju Singhi, Research Officer

- Attended international seminar on plant based medicine sponsored by HO and Dept. Ayush, Ministry of Health and Family welfare at National Institute of Ayurveda, Jaipur from October 25-27, 2004

- Attended a Workshop on Biomedical Communication organized by ICMR at DMRC, Jodhpur on 18th and 19th November, 2004.

Dr. Praveen Anand, Research Officer

- Attended pre-conference CME-IV Workshop/Seminar from 19-20 January, 2005 on Epidemiological and statistical methods in health and medical research in JIPMER, Pondicherry

- Attended 22nd Annual Conference of Indian Society for Medical Statistics in JIPMER, Pondicherry from 21-23 January, 2005 and presented a paper entitled 'Prevalence of severe anemia among draught affected population of Jodhpur'.

Dr. H.R. Balotiya, Research Officer

- Attended a Workshop on Biomedical Communication organized by ICMR at DMRC, Jodhpur on 18th and 19th November, 2004.
- Attended National UGC Seminar on Recent Advances in Analytical Chemistry (RAAC – 2004) organized by Department of Chemistry, JNVU, Jodhpur from November 29 to December 01, 2004 and delivered an invited lecture on 'Iodine Deficiency Disorders and its consequences'

7. Scientific Advisory Committee

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Smt. Kanchan Bala, Junior Hindi Translator
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Smt. Chandra Kala, Upper Division Clerk
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