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NATIONAL NUTRITION MONITORING BUREAU

Prevalence of Vitamin A Deficiency Among Preschool Children in Rural Areas

NATIONAL INSTITUTE OF NUTRITION
Indian Council of Medical Research
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Executive Summary

The National Nutrition Monitoring Bureau (NNMB), during the year 2002-03, carried out Micronutrient Deficiency Survey (MND) to assess the prevalence of Vitamin A Deficiency (VAD), Iodine Deficiency Disorders (IDD) and Iron Deficiency Anaemia (IDA) among the target individuals in the rural communities by covering statistically adequate sample, in eight States viz., Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh, Orissa, Tamil Nadu, Maharashtra, and West Bengal. The results of the same were brought out in the form of technical report (NNMB Tech Report # 22) in the year 2003.

Assessment of VAD included prevalence of clinical signs of vitamin A deficiency among 1-5 year children, estimation of blood vitamin A levels on a sub-sample of children by Dry Blood Spot (DBS) technique, extent of coverage of children for vitamin A supplementation during the preceding one year and knowledge of mothers of preschool children about VAD. However, the data on blood vitamin A levels of preschool children could not be included in the above report, due to delay in the analysis of samples, consequent to delay in establishing and commissioning National DBS facility at NIN. Therefore, this report is brought out exclusively to present the results of the survey on various aspects of VAD, including results of analysis of DBS samples for blood Vitamin A levels.

In each of the States, the survey was carried out in the same eighty villages covered for diet and nutrition assessment during 2000-2001. These villages were a sub-sample of the villages covered by the National Sample Survey Organization (NSSO), for the 54th round of 'Consumer Expenditure Survey' carried out in 1998.

A total of 71,591 children of 1-5 year age group from 75,600 households in 8 States were covered for clinical assessment of VAD. The blood vitamin A levels were assessed on a sub-sample of 3934 children. The socio-economic and demographic profile of the population covered in the present survey was comparable to that of the population covered in NNMB surveys during 2000-01. The overall prevalence of Bitot spots was about 0.8% (CI: 0.73 – 0.87), which ranged from nil in the State of Kerala to a maximum of 1.2 to 1.4% (CI: 1.15 – 1.65) in the States of Andhra Pradesh, Maharashtra and Madhya Pradesh. The overall prevalence of Bitot spots was comparable to the figures reported by the NNMB in 2000-01 (0.8%) and the district level micronutrient survey by ICMR (0.7%). The prevalence was above the WHO criterion of 0.5%, in all the

States except Kerala and Orissa. Severe forms of vitamin A deficiency such as corneal xerosis, corneal ulcers and Keratomalacia were not encountered in any of the States. The prevalence of Bitot spots was relatively higher in the HHs belonging to SC/ST communities, those engaged in agricultural and other labour and the HHs with an illiterate adult female.

Analysis of blood samples revealed that the overall median vitamin A level was 16.8 μg/dL, and ranged from a low 9μg/dL in Madhya Pradesh to a high 20.1 μg/dL in Tamil Nadu. The levels were similar between age groups and gender. About 62% of children in general, had vitamin A levels of <20 μg/dL, indicating sub-clinical VAD, and ranged from a low 49% in the State of Tamil Nadu to a high 88% in Madhya Pradesh. The proportion of children with sub-clinical VAD was significantly higher among 3-5 year children (63.1%) compared to 1-3 years (59.6%). No significant gender differentials were observed (Boys: 60.8%; Girls: 62.8%).

The prevalence of sub-clinical VAD (vitamin A levels <20 μg/dL) was significantly high among the preschool children belonging to Muslim (69.3%) and Christian (68.8%) communities, Scheduled Tribe (74.1%) and other backward communities (62.9%), those engaged in other labour (64.1%), and business (65.4%) compared to others.

Only about 41% of the mothers of 1-5 years preschool children were aware of night blindness. About 30% of index children reportedly received one or more doses massive dose vitamin A during the previous one year, while about 25% received two doses. Only about 1% of those children who received massive dose of vitamin A reportedly experienced side effects such as fever/vomiting (0.3%) or nausea (0.1%). Only about 13% of the women said that they received nutrition education on VAD.

The study thus revealed that the prevalence of sub-clinical VAD among 1-5 year children is very high, the coverage of children for massive dose of vitamin A was low, and the nutrition education component of IEC was poor. The earlier NNMB surveys have shown that the dietary intake of vitamin A of community was grossly inadequate. Given the deleterious consequences of VAD in the community in general and young children in particular, there is an urgent need to strengthen the programme of supplementation of massive dose vitamin A to young children and to extend the same up to 5 years of age. The IEC activities have to be intensified to bring in dietary diversification by encouraging the community to grow kitchen gardens and to include locally available vitamin A rich foods in their daily diets, more frequently. The scope of fortifying foods with vitamin A, wherever possible, also should be explored.

1. INTRODUCTION

The National Nutrition Monitoring Bureau (NNMB), established in the year 1972 under the aegis of the Indian Council of Medical Research (ICMR) in the States of Andhra Pradesh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Orissa, Tamil Nadu, Maharashtra, Uttar Pradesh and West Bengal, since its inception, has been carrying out annual surveys on diet and nutritional status of the population, on a regular basis. The results of these surveys are published in the form of technical reports, which include information on food and nutrient intakes at the household as well as individual levels, nutritional status of individuals of different age/sex/physiological groups in terms of anthropometry and prevalence of clinical signs of nutritional deficiency, at the State level. In addition, socio-economic and demographic particulars of the households surveyed are also provided.

During the past decade, micronutrient deficiencies have been attracting attention of both academicians and administrators. In India, the micronutrient deficiencies of public health significance are vitamin 'A' deficiency (VAD), iron deficiency anaemia (IDA) and iodine deficiency disorders (IDD). There have been no systematic surveys, covering adequate sample size, to assess their prevalence in different States.

Therefore, the NNMB undertook exclusive surveys during 2002-03 in eight States viz., Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh, Orissa, Tamil Nadu, Maharashtra, and West Bengal, to assess the prevalence of the micronutrient deficiencies viz., VAD, IDA and IDD among the vulnerable groups of rural population. The investigations included assessment of i) prevalence of clinical forms of vitamin A deficiency among the pre-school children; ii) haemoglobin levels among preschool children, adolescent girls and pregnant & lactating women; iii) prevalence of clinical forms of IDD among 6-<12 year children; iv) iodine content of cooking salt samples collected from the households using spot testing kit, and v) collection of finger prick blood samples for blood vitamin A levels in preschool children using dried blood spot (DBS) technique[1]. In addition, information on household socio-economic and demographic particulars and awareness of women about IDA & VAD and the coverage of the target beneficiaries for the supplementation of iron & folic acid tablets, and massive dose of vitamin A under the national programmes, with particular reference to coverage and regularity was also collected. The results of the survey were published as technical report No.22 in the year 2003[1].

The data on blood vitamin A levels of preschool children could not be included earlier in the above report, due to delay in the analysis, consequent to delay in establishing and commissioning of DBS facility at NIN. This report presents the results

of the survey, including the analysis of DBS samples for blood Vitamin A levels and examine any association between VAD and administration of vitamin A.

2. OBJECTIVES

2.1. GENERAL OBJECTIVE

The general objective was to assess the vitamin A status of preschool children in the rural areas of NNMB States.

2.2. SPECIFIC OBJECTIVES

The specific objectives were,

1. To assess the prevalence of clinical forms of vitamin A deficiency (particularly Bitot spots) among the pre-school children in the rural areas of the States covered by NNMB,
2. To estimate prevalence of sub-clinical vitamin A deficiency in preschool children, and
3. To assess the awareness of women about VAD and the coverage of the target beneficiaries for the supplementation of massive dose of vitamin A under the national programme.

3. METHODOLOGY

3.1. INVESTIGATIONS

The following investigations were carried out:

3.1.1. Collection of Household Demographic and Scio-economic particulars

Household demographic and socio-economic particulars of all the 1-5 year children covered for the survey were collected using pre-coded proformae.

3.1.2. Examination for presence of signs & symptoms of VAD

All the available 1-5 year children were examined clinically for the presence of ocular manifestations of vitamin A deficiency such as night blindness (XN), conjunctival xerosis (X1A), Bitot spots (X1B), corneal xerosis (X2), corneal ulcer (X3A) and Keratomalacia (X3B).

3.1.3. Estimation of Blood vitamin A levels

Blood vitamin A levels were estimated from finger prick blood samples by Dried Blood Spot technique using HPLC (Craft et. al.)[2] at the National facility of DBS Technology, at the National Institute of nutrition (NIN), Hyderabad.

3.1.4. Assessment of Knowledge and practices about VAD among mothers of Index children

Pre-tested questionnaire was administered on women in a sub-sample of households, to assess their awareness about VAD. In addition, information on the extent of coverage of 1-5 year children for the supplementation of massive dose of

vitamin A under the National Prophylaxis Programme for Prevention of Blindness due to vitamin A deficiency during the previous one-year was collected.

3.2. SAMPLE SIZE

The following procedure was adopted for computing sample size required for various investigations:

3.2.1. Prevalence of Clinical forms of VAD

The prevalence of Bitot spots (X1B), an objective sign of vitamin A deficiency among preschool children, as reported in the earlier NNMB surveys was considered for computing sample size for estimating the current prevalence of VAD in the rural communities in each State. Thus, assuming a current prevalence of 1% of Bitot spots, confidence interval (CI) of 95% and a relative precision of 20%, a sample size of 9,508 preschool children per State, was arrived at.

Assuming that 1-<5 years children constitute about 10% of total population, a population of 95,000 or approximately 23,750 households (HHs) (assuming an average family size of 4) was the target to be covered in each State. Since, the proportion of preschool children may vary from State to State; it might have necessitated coverage of more number of households or population than presumed, in different States.

3.2.2. Estimation of Blood Vitamin A levels

The available literature indicated that the average prevalence of low blood vitamin A levels (<20μg/dl) among preschool children was about 40%. Thus, assuming a current prevalence of low blood vitamin A levels of 40%, with 95% of CI and a relative precision of 10%, a sample size of 576 preschool children (1-5 year) per State, was arrived at.

3.2.3. Knowledge and Practices on VAD

Information on knowledge and practices (K&P) about VAD and distribution of massive dose vitamin A during the previous one-year was collected using pre-coded questionnaires, on a sub-sample of mothers of every 50th preschool child covered for clinical examination.

3.3. SAMPLING PROCEDURE

The sampling procedures were discussed and finalized in the Steering Committee meeting of NNMB (2001), as follows:

3.3.1. Selection of the villages

In each State, the survey was carried out in the same eighty villages covered for rural diet and nutrition survey[3] during 2000-2001. These villages were a sub-sample of

the villages covered by the National Sample Survey Organization (NSSO), for the 54th round of 'Consumer Expenditure Survey' in 1998[4].

The NSSO adopts a two stage stratified random sampling method in which the villages formed the first stage units (FSU), while the households (HHs) formed the second stage units (SSU). For the purpose, each State was divided into different agro-economic regions. Each region within a State consisted of groups of contiguous districts having similar cropping pattern and population density.

A district or part of the district with rural population of less than 1.8 millions formed one stratum. Districts with rural population of more than 1.8 million were divided into two or more strata by grouping contiguous *taluks/tehsils* having similar cropping pattern and population density. The number of children to be covered in each of the villages in a given State was computed based on probability proportion to the population size of the village.

3.3.2. Coverage of children

Each village was divided into five geographical areas based on natural groups of houses, streets or *mohallas*. Households belonging to SC/ST community, who generally live in a group, constituted one of the five areas. In each of the geographical areas, all the households were enumerated. From each of these areas, by selecting a random start, consecutive households were surveyed till the required number of children is covered for clinical examination. A sub-sample of these children was covered for blood vitamin A estimation, by adopting systematic random sampling procedure.

3.4. PREPARATION OF DRIED BLOOD SPOT (DBS) SAMPLE & TARNSPORTATION

A free falling drop of blood from finger-prick was collected on a pre-coded special chromatography paper ('Whatman' International Ltd, Maidstone England). It was shade dried and wrapped in black paper and was sent to NIN through courier every third day. The samples were protected from light and preserved in a deep freezer at -20^0C in DBS facility for estimation of retinol levels by high-pressure liquid chromatography method (HPLC) [2, 5]. There was a gap of 220 days on an average, between the collection of sample and analysis, which was largely due to delay in the establishment and commissioning of the DBS facility at the Institute.

3.5. TRAINING AND STANDARDIZATION OF THE INVESTIGATORS

The Medical Officers, Nutritionists and Social Workers of all the NNMB Units were given a two-week orientation-cum-standardization training at NIN, in the techniques of identification of clinical forms of vitamin A deficiency, collection of finger-prick blood samples and administration of K&P schedule. During the training, emphasis

was given to achieving the maximum intra and inter-observer agreement in respect of assessment of clinical signs of VAD. After the initial training, each team carried out 'mock surveys' in their respective States. The proformae were then finalized, considering their experiences in the mock surveys. One-week reorientation training programme was organized for the teams at NIN, before they initiated actual surveys.

3.6. QUALITY CONTROL

To ensure quality control, scientists from CRL made regular visits to each State and carried out random checks on a sub-sample of the children covered by the teams on the previous day of their visit.

4. RESULTS

4.1. COVERAGE

A total of 75,600 HHs from 633 villages in the States of Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra, Madhya Pradesh, Orissa and West Bengal were covered for various investigations in the present survey. The survey in Gujarat and Uttar Pradesh was disrupted due to manpower problems. In the States of Andhra Pradesh, Karnataka, Kerala, Orissa, Tamil Nadu and West Bengal, the survey was completed in all the targeted number of villages. In the State of Madhya Pradesh, however, only 94% of villages (75/80) could be surveyed, since the unit had to participate in ad-hoc drought surveys in two States. The particulars of coverage for various investigations in each State are presented in **Table 1,** and are discussed below.

4.1.1. Clinical examination

A total of 71,591 preschool children were covered for clinical assessment for vitamin A deficiency (VAD) as against the required number of 76,064. The overall extent of coverage was 94%, which ranged from about 100% in the States of Orissa (99.5%), Andhra Pradesh (98%), West Bengal and in Tamil Nadu (97% each) to a low of 88% in Kerala.

4.1.2. Estimation of Blood vitamin A levels

Finger prick blood samples were collected from a total of 4,499 preschool children (97.6%) as against the target of 4,608 from 8 States. However, 3,934 samples were analysed for vitamin A levels. About 70 samples were either lost in system or missed, while about 495 samples were miss-matched with linking of various other variables. Thus, the over all effective coverage of samples against the set target was 85%, which ranged from 100% in the State of West Bengal (102.4%) and Karnataka (97.1%) through 94.4% in Orissa, about 85% in Maharashtra (85.6%) and Tamil Nadu (83.4%), 78% in Andhra Pradesh, to a low of 71% in Kerala.

4.1.3. Knowledge and Practices

Knowledge and practices on VAD were assessed on 2,681 mothers of index children of 1-<5 years of age.

4.2. PROFILE OF THE HOUSEHOLDS COVERED

The socio-economic and demographic profile of the population covered in the present survey was comparable to that of the population covered during 2001-NNMB surveys[3] **(Tables 2 - 7)**

4.2.1. Religion

A majority of the HHs covered for various investigations were Hindus (85.3%), followed by Muslims (10.6%) and Christians (3.6%) (**Table 2**). The proportion of Muslim households was relatively higher in the States of Kerala (31.6%) and West Bengal (22.5%) than in the other States.

4.2.2. Community

About 42% of the HHs surveyed, belonged to other backward communities (OBCs) and about 30% HHs belonged to Scheduled caste/Scheduled tribe communities. The proportion of tribal households was relatively higher in the States of Madhya Pradesh (28.4%) and Orissa (19.5%), while the proportion of Scheduled caste HHs was higher in the State of West Bengal (27.5%), Andhra Pradesh (25.1%) and Tamil Nadu (24.6%). About three fourths of HHs belonged to other backward communities in the States of Tamil Nadu (75.1%) and Kerala (73.8%) (**Table 3**).

4.2.3. Occupational status

The major occupation in about 45% of the HHs was either agricultural labour (15.9%) or other labour (29.5%). Agriculture was major occupation in about 27% of the HHs, while about 20% were engaged in either 'service' (9.7%) or business (10.2%). The proportion of HHs engaged in agricultural labour was very low in the State of Orissa (1.3%), Kerala (4.0%) and Madhya Pradesh (8.4%), while in Andhra Pradesh (32.5%), they constituted a third of the total sample covered. The proportion of HHs engaged in non-agricultural activities such as other labour (43.6%) and business/services (37.5%) was relatively higher in the State of Kerala compared to other States (**Table 4**).

4.2.4. Adult Female Literacy

The overall adult female literacy rate in the HHs surveyed was observed to be about 48%. The proportion of illiterate women was maximum in the State of Madhya Pradesh (76%), followed by Karnataka (71%), Andhra Pradesh and Orissa (60% each), West Bengal (57%), Tamil Nadu (46%), Maharashtra (38.2%) to low of about 6% in Kerala (**Table 5**).

4.2.5. Family Size

The average family size pooled for the States was 5.1 (CI: 4.83 – 4.85). It was relatively higher for the States of Madhya Pradesh (6.1), Karnataka (5.9) and Maharashtra (5.4), and was least for the State of West Bengal (4.3) (**Table 6**). The proportion of families with family size of <4 was relatively higher in West Bengal (66.9%), and lower in the States of Madhya Pradesh (26.7%), Karnataka (29.7%) and Maharashtra (31.9%). The proportion of HHs with family size >8 ranged from a maximum of about 26% in the States of Karnataka and Madhya Pradesh to a low 2-3% in the States of Andhra Pradesh and West Bengal.

4.2.6 Sanitary latrine

In general, only about a fourth of the HHs (24.2%) had sanitary latrine. A majority of the households in the State of Kerala (94%) had sanitary latrine. In contrast, their proportion in the rest of the States ranged from a low 8-9% in Orissa and Madhya Pradesh to about 17-18% in Maharashtra, Andhra Pradesh, Karnataka and 20% in Tamil Nadu (**Table 7**).

4.3. PREVALENCE OF VAD

4.3.1 Clinical Forms of VAD

The overall prevalence of Bitot spots among 1-5 year children, an objective sign of vitamin A deficiency, was about 0.8% (CI: 0.73 – 0.87), which ranged from nil in the State of Kerala to a maximum of 1.4% (CI: 1.15 – 1.65) in the State of Madhya Pradesh followed by 1.3% in Maharashtra and 1.2% in Andhra Pradesh. The prevalence was >0.5%, a cut-off level recommended by WHO to indicate public health significance, in all the States except Kerala and Orissa (**Table 8 & Map**). The overall prevalence of night blindness was about 0.3% (CI: 0.26 - 0.34) and that of conjunctival xerosis was about 1.8%. It may be mentioned that quite often assessment of night blindness is difficult in routine surveys. The prevalence of Bitot spots was comparable to that observed in the earlier NNMB survey (2002)[3] (0.8%) and the district micronutrient survey of ICMR (0.7%)[6].

4.3.1.1. Clinical Forms of VAD Vs Socio-economic Variables

The prevalence of vitamin A deficiency among 1-<5 year children according to the socio-economic variables is given in the **Table 9 & Figs. 1- 5**.

Religion

The prevalence of Bitot spots was significantly ($p<0.05$) higher among Hindus (0.8%) compared to Muslims (0.3%) and Christians (0.2%). Similarly, the prevalence of conjunctival xerosis was significantly higher among Hindus (1.8%) compared to Christians (0.2%).

Map:

Prevalence (%) of Bitot spots among 1-5 year children

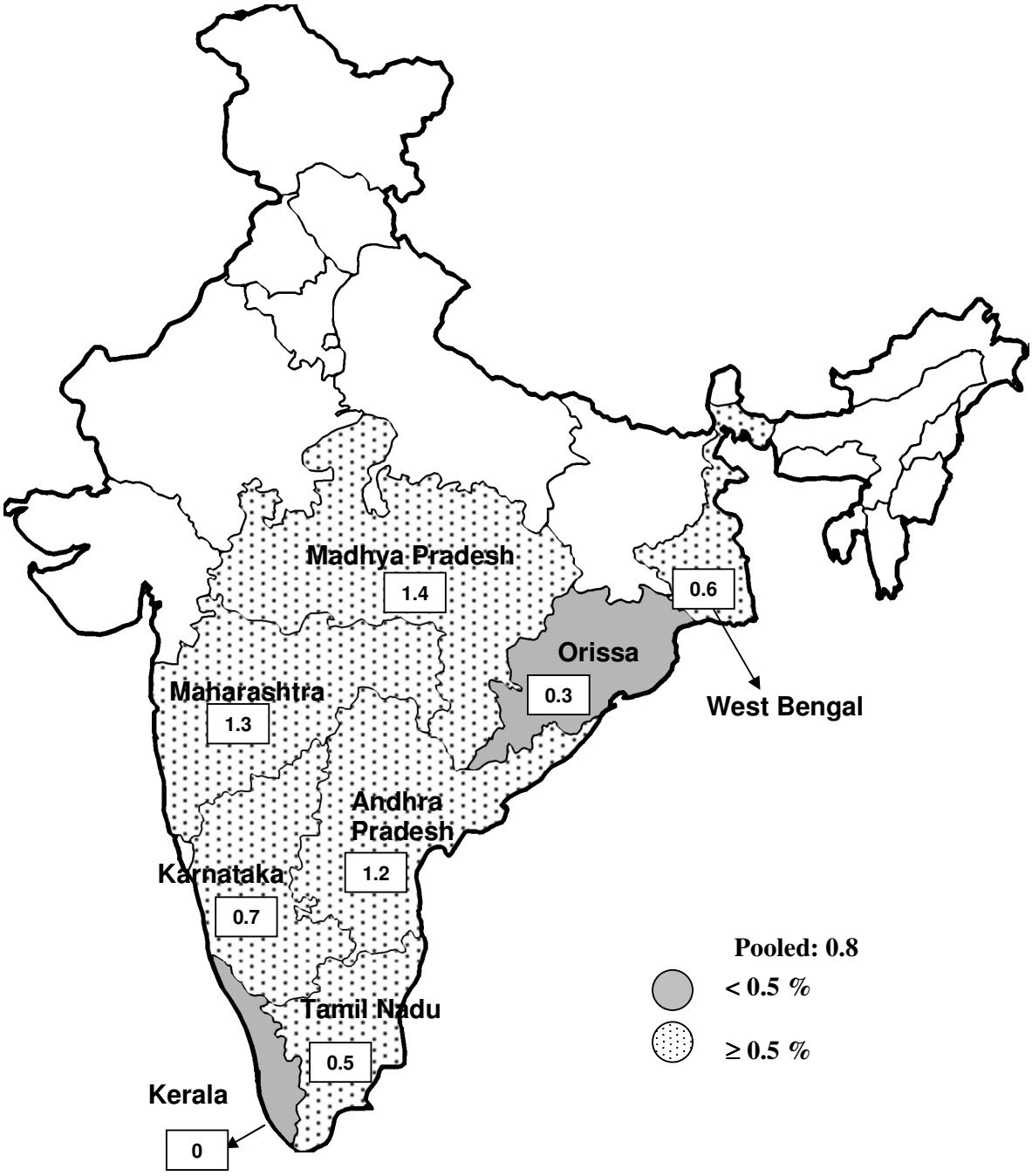


Fig. 1 Prevalence (%) of Bitot Spots in 1-<5 Yrs. Children by Community

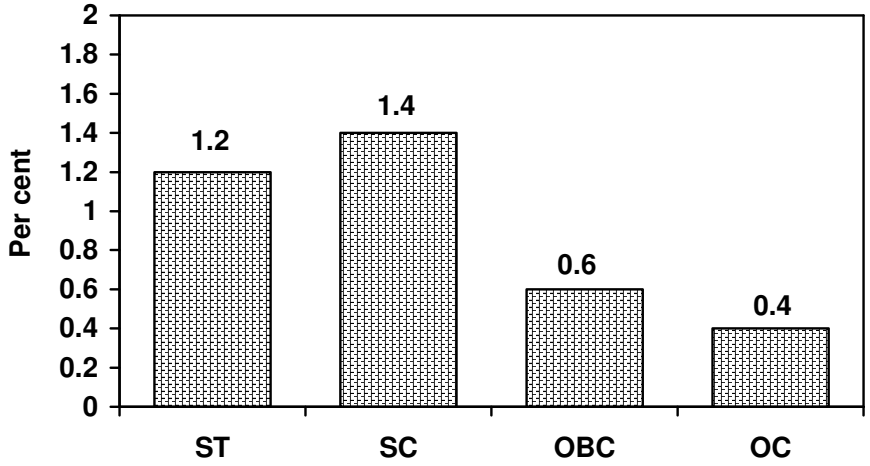


Fig. 2 Prevalence (%) of Bitot Spots in 1-<5 Yrs. Children by Occupation

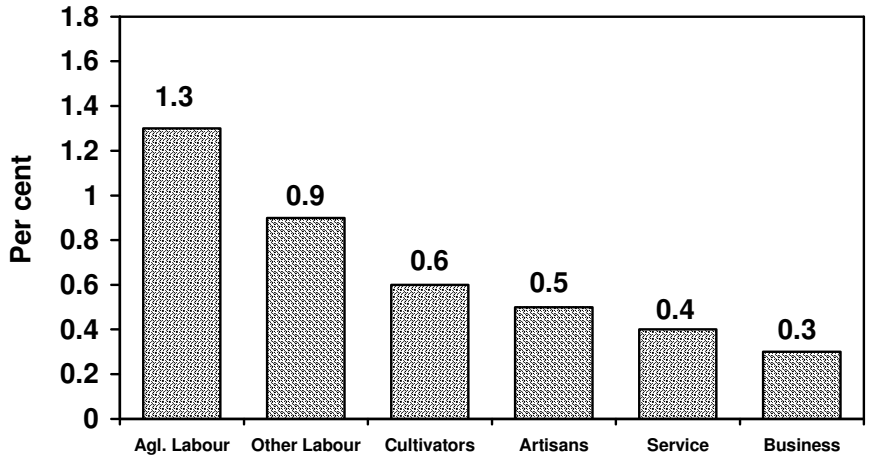


Fig. 3 Prevalence (%) of Bitot Spots in 1-<5 Yrs. Children by Family Size

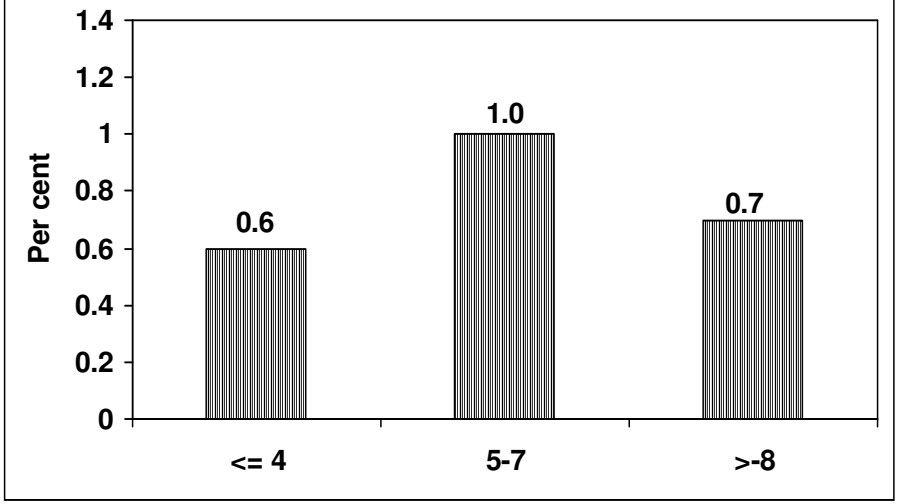
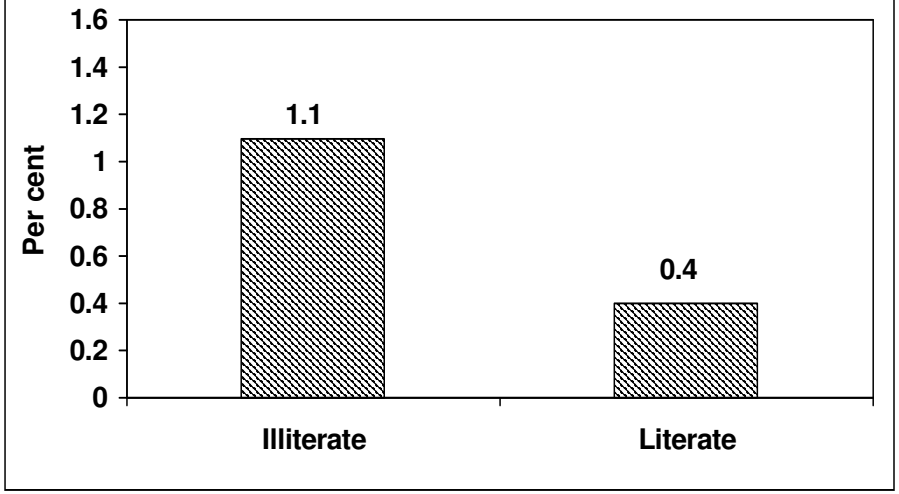


Fig. 4 Prevalence (%) of Bitot Spots in 1-<5 Yrs. Children by Adult Female Literacy Status



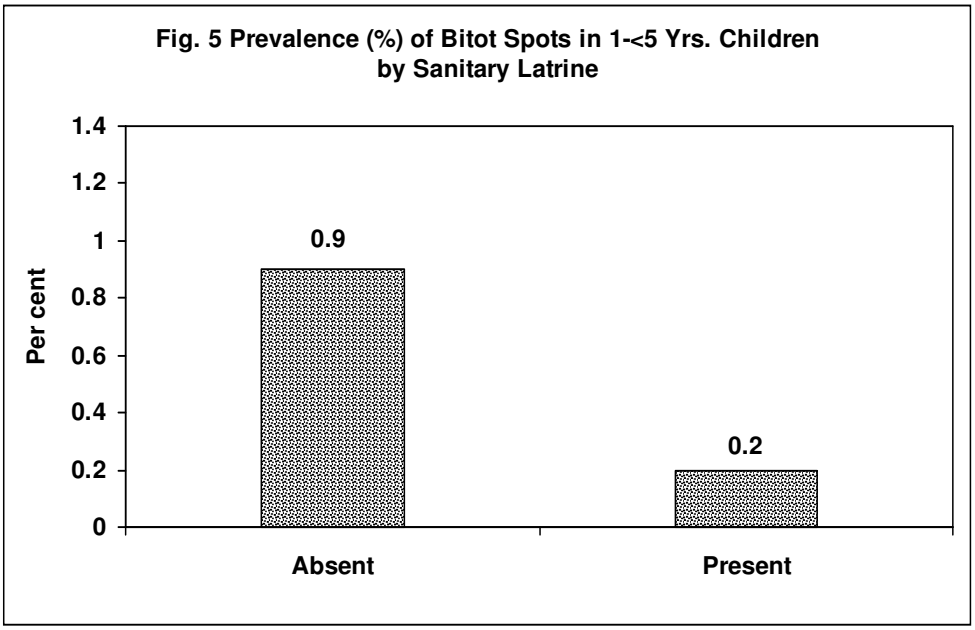


Fig. 5 Prevalence (%) of Bitot Spots in 1-<5 Yrs. Children by Sanitary Latrine
Per cent
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.9
0.2
Absent
Present

Community

The prevalence of Bitot spots was significantly higher among children belonging to Scheduled Caste (1.4%) and Scheduled Tribe (1.2%) communities, than those of backward castes (0.6%) and other communities (0.4%) (**Fig. 1**).

Occupation

The prevalence of Bitot spots was significantly higher among children belonging to households engaged in labour activities, compared to those in other occupations (**Fig. 2**).

Family size

The proportion of Bitot spots was higher (1%) among the households with larger family size (5-7) as compared to those with a family size of ≤ 4 (0.6%) (**Fig. 3**).

Adult female literacy

The prevalence of Bitot spots was significantly higher (1.1%) in the HHs with an illiterate adult female than those with literate (0.4%) (**Fig. 4**).

Sanitary Latrine

The prevalence of vitamin A deficiency (Bitot spots) was significantly lower in the HHs having sanitary latrine (0.2%), compared to those who did not (0.9%) (**Fig. 5**).

4.3.2. Sub-clinical VAD

The overall median blood vitamin A level was about 17 μg/dL, which ranged from a low 9 μg/dL in the State of Madhya Pradesh to a high of about 20 μg/dL in the States of Tamil Nadu & Karnataka (**Table 10**). The levels were comparable between 1-3 (17.2 μg/dL) and 3-5 year (16.6 μg/dL) age group of children ($p > 0.05$) and between boys (17.2 μg/dL) and girls (16.5 μg/dL) (**Table 11- 12 & Figs. 6-9**).

The percent frequency distribution of children according to blood vitamin A levels is given in **Table 13 & Fig. 10**. According to WHO[7] children with blood vitamin A levels of <20 μg/dL are considered as vitamin A deficient. About 62% (CI 60.3-63.3) of children in general had blood vitamin A levels of <20 μg/dL indicative of sub-clinical vitamin A deficiency (**Table 14**). Their proportion tended to increase from a low 58.2% in 1 year to a high 65.6% in 4-year children. The proportion ranged from a high of about 88% in Madhya Pradesh, through 79% in Kerala to about 50-60% in the remaining States (**Fig. 11**).

About 40% of the children had vitamin A levels in the range of 10-20 μg/dL, 26% in the range of 20-30 μg/dL and 22% below 10μg/dL (**Table 13**). It was observed that the proportion of children with blood vitamin A levels of <10 μg/dL was significantly higher in the States of Madhya Pradesh (53.8%) and Kerala (47.7%) compared to others (about 9

Fig. 6 MEDIAN BLOOD VITAMIN A LEVELS (µg/dL) - BY AGE

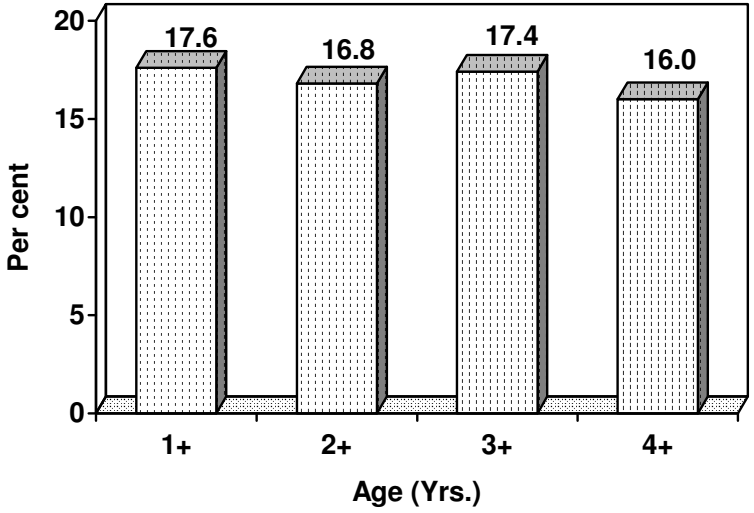


Fig. 7 MEDIAN BLOOD VITAMIN A LEVELS (µg/dL) - BY STATE

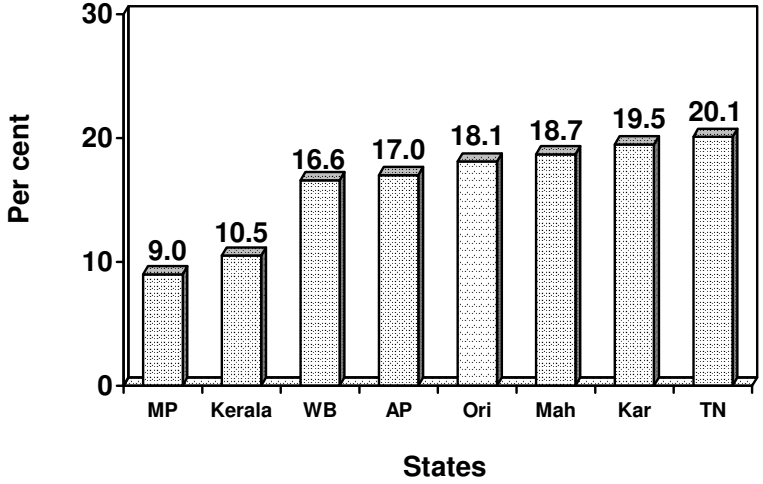


Fig. 8 MEDIAN BLOOD VITAMIN 'A'LEVELS (µg/dL) AMONG 1-5 YEAR CHILDREN - BY AGE GROUP

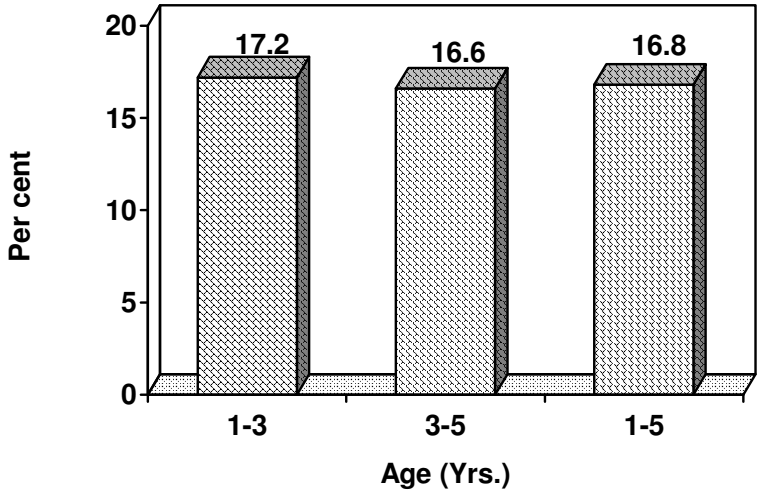


Fig. 9 MEDIAN BLOOD VITAMIN 'A'LEVELS (µg/dL) AMONG 1-5 YEAR CHILDREN - BY GENDER

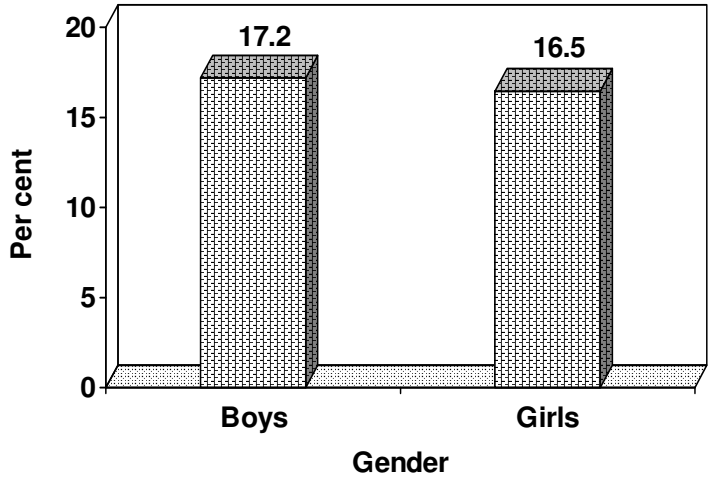


Fig. 10 FREQUENCY DISTRIBUTION (%) OF 1-5 YEAR CHILDREN ACCORDING TO BLOOD VITAMIN 'A' LEVELS

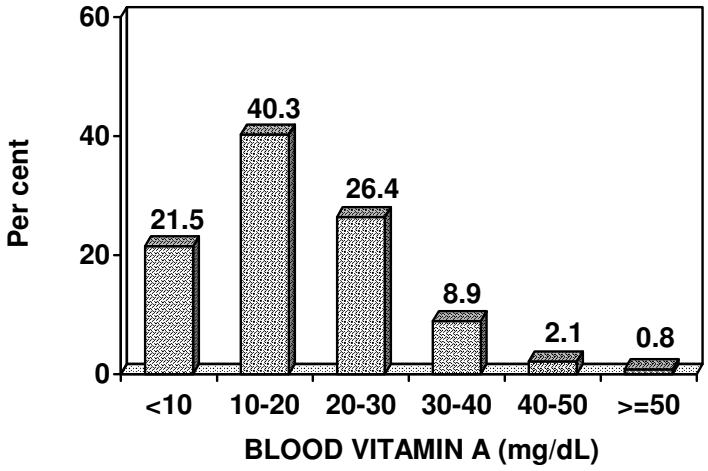


Fig. 11 DISTRIBUTION (%) OF 1-5 YEAR CHILDREN WITH BLOOD VITAMIN A LEVELS OF < 20 µg/dl – BY STATE

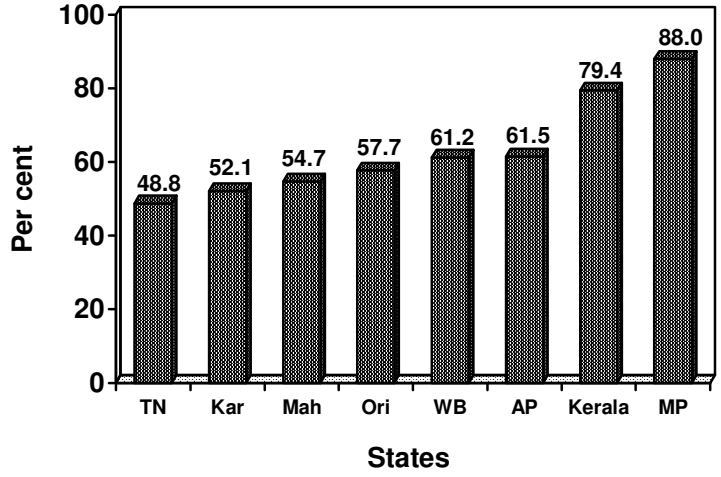


Fig. 12 FREQUENCY DISTRIBUTION (%) OF 1-5 YEAR CHILDREN ACCORDING TO BLOOD VITAMIN A LEVELS <20 µg/dl – BY AGE GROUP

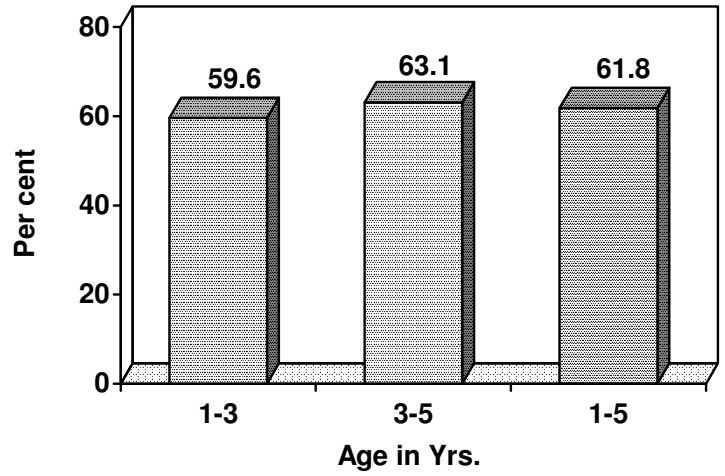
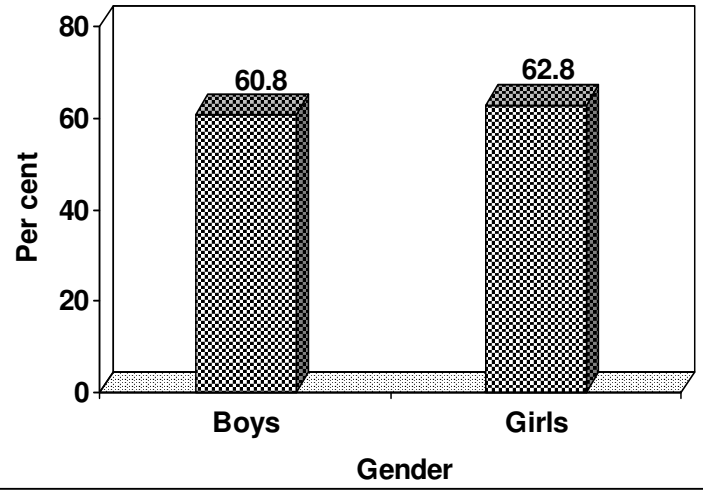


Fig. 13 FREQUENCY DISTRIBUTION (%) OF 1-5 YEAR CHILDREN ACCORDING TO BLOOD VITAMIN A LEVELS <20 µg/dl – BY GENDER



to18 %). The proportion of blood vitamin A level of <20 μg/dL was significantly (p<0.05) higher among 3-5 year children (63.1%, CI:61.2-65.0) compared to 1-3 year children (59.6%, CI: 57.1-62.1) (**Table 15 & Fig. 12**). No significant gender differentials were observed in the prevalence of sub-clinical vitamin A deficiency (Boys: 60.8%; Girls: 62.8%) (**Table 16 & Fig. 13**).

4.3.2.1 Blood vitamin A levels Vs Socio-economic variables

The prevalence of low blood vitamin A levels (<20μg/dL) among 1-<5 year children according to the socio-economic variables is given in (**Table 17- 22 & Figs. 14-19)**.

Religion

The proportion of children with low blood vitamin A levels was significantly (p<0.05) lower among Hindus (60.7%) compared to Christians (68.8%) and Muslims (69.3%) (**Table 17 & Fig. 14**).

Community

The proportion of children with low blood vitamin A levels was significantly (p<0.05) higher among Scheduled Tribes (74.1%) compared to the rest, and among backward communities (62.9%) compared to Scheduled Castes (57.7%) and other communities (58.8%) (**Table 18 & Fig.15**).

Occupation

The proportion of children with of blood vitamin A levels (< 20 μg/dL) ranged from a high of about 65% in households where major occupation was other labour or others to 57-60% among agriculturists. However these differences were found to be not statistically significant (**Table 19 & Fig.16**).

Family size

The proportion of children with low blood vitamin A levels, though not statistically significant, tended to be higher among the households with large family size of ≥ 8 (65.9%) compared to those of smaller family size of ≤4 (60.5%) (**Table 20 & Fig.17**).

Adult female literacy

A relatively higher proportion of children from households with illiterate adult woman had low blood vitamin A levels (62.8%) compared those with literate woman (60.6%). However, the difference was not statistically significant (**Table 21 & Fig.18**).

Sanitary Latrine

Significantly (p<0.05) less proportion of children (60.9%) from households not having sanitary latrine had low blood vitamin A levels compared to those having (64.6%) (**Table 22 & Fig.19**).

Fig. 14 DISTRIBUTION (%) OF 1-5 YEAR CHILDREN WITH BLOOD VITAMIN A LEVELS OF < 20 µg/dl – BY RELIGION

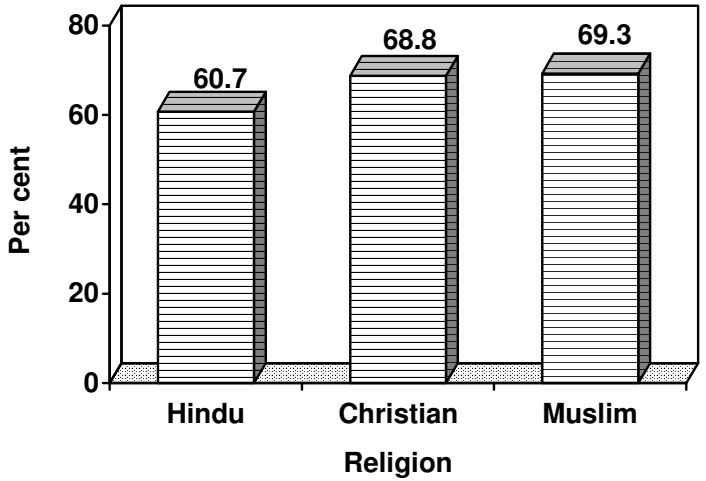


Fig. 15 DISTRIBUTION (%) OF 1-5 YEAR CHILDREN WITH BLOOD VITAMIN A LEVELS OF < 20 µg/dl – BY COMMUNITY

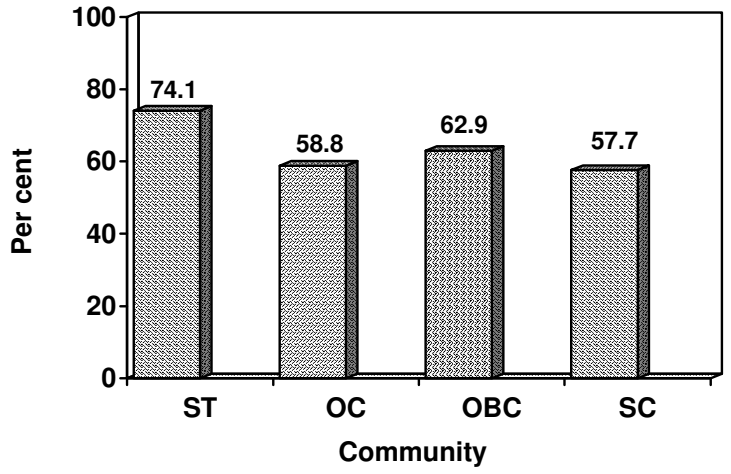


Fig. 16 DISTRIBUTION (%) OF 1-5 YEAR CHILDREN WITH BLOOD VITAMIN A LEVELS OF < 20 µg/dl – BY OCCUPATION OF HEAD OF THE HOUSEHOLD

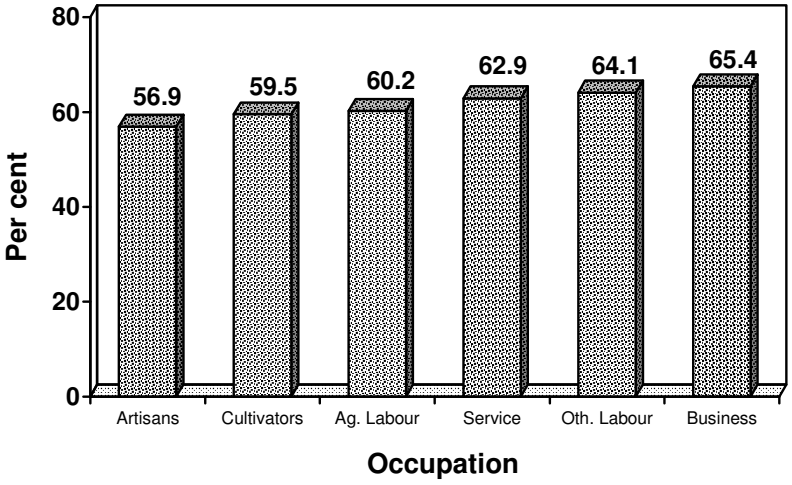
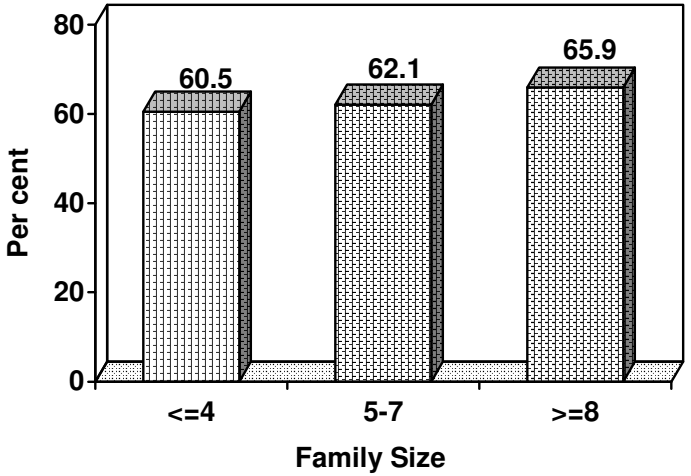


Fig. 17 FREQUENCY DISTRIBUTION (%) OF 1-5 YEAR CHILDREN ACCORDING TO BLOOD VITAMIN A LEVELS <20 µg/dl – BY FAMILY SIZE



4.3.3. Low Blood Vitamin A levels Vs clinical signs of VAD

The proportion of children with low blood vitamin A levels (<20 μg/dL) was highest among those who had night blindness (83.3%), followed by those with Bitot spots (68.4%) and conjunctival xerosis (67%). The proportion of blood vitamin A < 20 μg/dL was about 62% among the normal children, while it was 65.3% among those with one or more signs/symptoms of vitamin A deficiency (**Table 23 & Fig. 20**).

4.3.4. Blood Vitamin A levels Vs Receipt of massive dose vitamin A

The proportion of children with sub-clinical vitamin A deficiency was relatively higher (66.7%) among those children who did not receive of massive dose of vitamin A during past 12 months, compared to those who received one (61.6%) or two (56.3%) doses. However, these differences were not statistically significant (**Table 24 & Fig. 21**).

4.3.5. Association between Dietary intakes of Vitamin A & Coverage for Massive Dose Vitamin A and Sub-clinical vitamin A deficiency

The proportion of children with blood vitamin A levels of <20μg/dL, the extent of coverage for supplementation of massive dose vitamin A and the proportion of children with dietary intakes of vitamin A of <50% of RDA is provided in **Table 25**.

It was observed that, in the State of Kerala, the proportion of children with low blood vitamin A levels was high, the proportion of children with dietary intake of vitamin A of <50% RDA was also high and the extent of coverage for massive dose vitamin A was least. Such a pattern, however, was not observed in the rest of the States.

4.3.6 Odds ratios of variables and blood vitamin A levels

Logistic regression analysis was carried out to study the association of blood vitamin A levels (<20 and ≥ 20μg/dl) with socio-economic status, signs of clinical deficiency for vitamin A and receipt of massive dose vitamin A. The results revealed that the odds ratios were significantly ($p<0.05$) associated with blood vitamin A levels (Table 26). The Odds ratio was 2 for the Scheduled tribe children (95% CI: 1.6-2.6) while it was 1.5 for Muslims (95% CI: 1.2-1.8); 1.3 (95% CI: 1.0-1.6) for households with family size of ≥ 8; and 1.5 (95% CI: 1.0-2.3) in case of children who did not receive massive dose of vitamin A.

4.4 KNOWLEDGE AND PRACTICES OF WOMEN ON VITAMIN A DEFICIENCY

Information regarding Knowledge and Practices on VAD among the mothers of index children was provided in **Tables 27.1-27.6**. In general, about 41% of the mothers of index children interviewed were aware of night blindness. Their proportion ranged from a low 21-24% in the States of Madhya Pradesh and West Bengal to a high 57-63% in the States of Andhra Pradesh and Maharashtra. Other manifestations of Vitamin

Fig. 18 FREQUENCY DISTRIBUTION (%) OF 1-5 YEAR CHILDREN ACCORDING TO BLOOD VITAMIN A LEVELS <20 µg/dl – BY ADULT FEMALE LITERACY

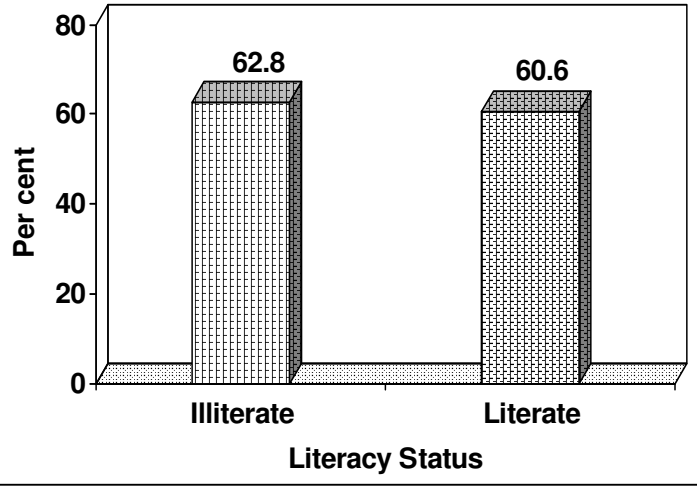


Fig. 19 DISTRIBUTION (%) OF 1-5 YEAR CHILDREN WITH BLOOD VITAMIN A LEVELS OF < 20 µg/dl – BY SANITARY LATRINE

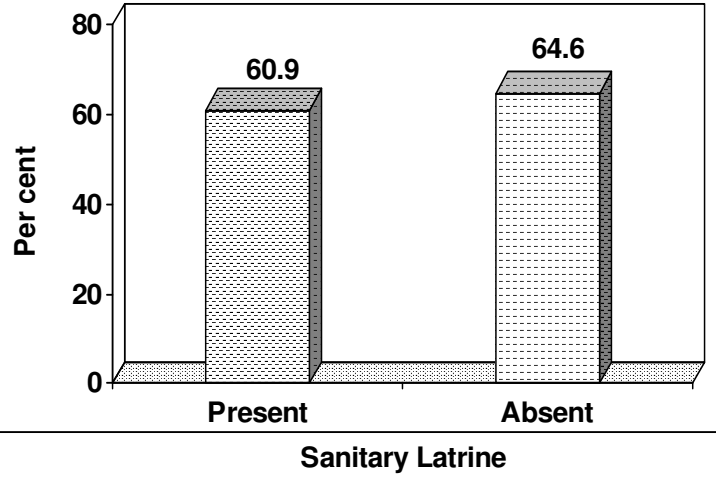


Fig.20 FREQUENCY DISTRIBUTION (%) OF 1-5 YEAR CHILDREN ACCORDING TO BLOOD VITAMIN A LEVELS <20 µg/dl – BY SIGNS & SYMPTOMS OF VIT. A DEFICIENCY

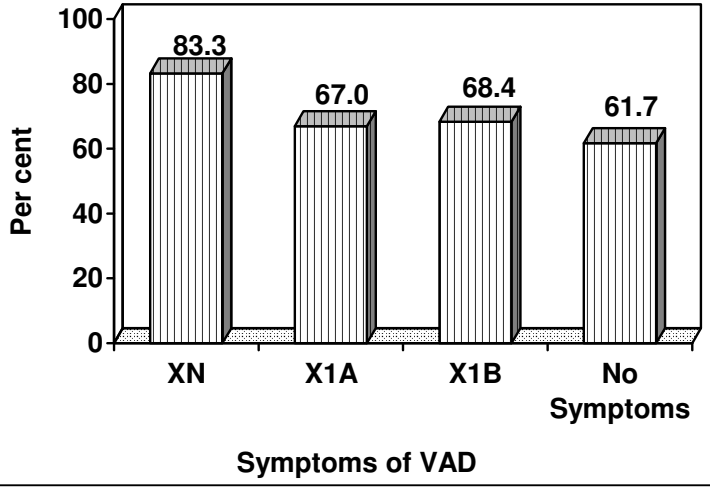
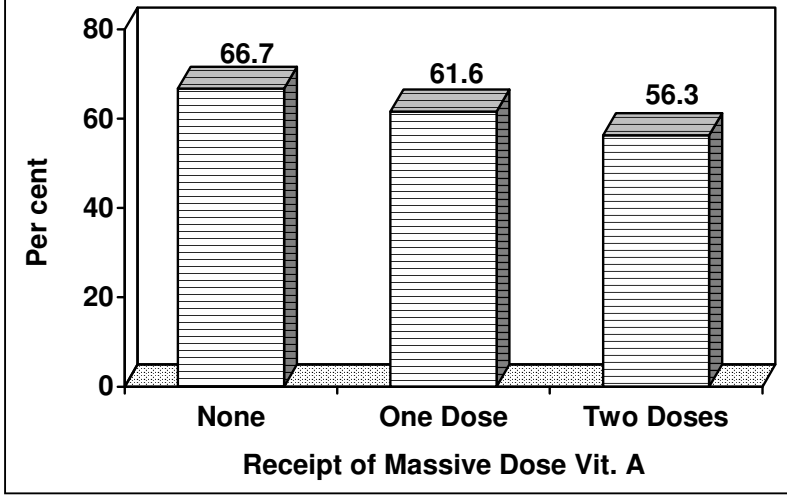


Fig. 21 FREQUENCY DISTRIBUTION (%) OF 1-5 YEAR CHILDREN ACCORDING TO BLOOD VITAMIN A LEVELS <20 µg/dl – BY RECEIPT OF MASSIVE DOSE VIT. A



A deficiency, as perceived by the respondents were permanent blindness (8%), Bitot spots (3.8%), scar in the eye (1%) etc. About 12% and 14% of the mothers attributed these manifestations to vitamin A deficiency and dietary inadequacy, respectively. The awareness about causes of night blindness was relatively better among women in the State of Tamil Nadu.

About a third of the women (32%) stated that they would consult a doctor in case of VAD, while about seven percent said that they would get massive dose of vitamin 'A' administered to the child. While about 3% said that they would use household remedies, none mentioned about consumption of pro-vitamin A rich foods. However, when asked about the role of foods in the prevention of VAD, about 24% responded in affirmative and listed foods such as green leafy vegetables (18.4%), yellow coloured fruits (11.5%), animal foods (11.3%) and nutritious foods (9.3%), those have to be consumed to prevent VAD.

4.4.1. Coverage under Massive Dose Vitamin A Programme

About 58% of the preschool children reportedly received at least one dose of massive vitamin A during the previous one year, while about 8% said that they were not aware of the same (**Table 27.1**). The extent of coverage was maximum in the State of Orissa (80%) (possibly because of implementation of the special project of massive dose of vitamin A supplementation along with polio immunization), followed by Tamil Nadu (63%), Karnataka (56.5%), the States of Andhra Pradesh, West Bengal, Maharashtra and Madhya Pradesh (51-53%), with the least being in Kerala (44%).

Only about 25% had reportedly received two doses, while about 30% had received one dose. Of these, about 36% had received the last dose during the previous 6 months and about 18% received during previous 6-11 months. Massive dose of vitamin A was administered mostly by MPHW (F) (31.7%), followed by AWW (12%) and MPHS-Female (9%), either at AWC (24.7%) or at sub-centre (13.8%) (**Table 27.2**). Of those who received massive dose vitamin A, a negligible proportion of children (about 1%) reportedly experienced side effects, mostly in the form of fever/ vomiting (0.3% each) or nausea (0.1%) (**Table 27.3**).

The most common reasons cited by the mothers for the child not receiving the massive dose of vitamin A were, the same was not offered to their children (52%) or that they were not aware of it (34%) (**Table 27.4**). About two third of the mothers whose children reportedly received massive dose of vitamin A during the previous one-year felt that it was beneficial for the child (60.6%). Of them, about 44% opined that it improved the general health of the child; about 22% felt that the eyes were healthy and about 10% reported that it prevented infections (**Table 27.5**).

Only about 13% of the mothers reportedly had received nutrition education on VAD, and the messages included, the need for regular consumption of GLV (10%) and yellow coloured fruits (6.5%), the beneficial effects of vitamin A supplementation on 9-35 months children (5.7%), signs and symptoms of VAD (5.3%); consequences of severe VAD and growing kitchen garden (4.4% each) (**Table 27.6**).

4.5. Repeat Survey

An expert committee constituted to review the findings, took note of the fact that although the prevalence of Bitot spots among preschoolers in the State of Kerala was nil, the prevalence of sub-clinical form of vitamin A deficiency was maximum. The committee suggested to carry out resurvey on a sub-sample of 50 children of 1-5 year age group (@ 10 children per village, from 5 villages) in the States of Kerala, and Madhya Pradesh (having high prevalence of sub-clinical VAD) and Andhra Pradesh (with low prevalence) by covering one district each of the these States, during the same season, to assess the blood vitamin A levels and prevalence of clinical signs of vitamin A deficiency. It was also suggested that in each of these district, all those villages surveyed during the MND survey to be covered in the repeat survey, by adopting similar sampling procedures.

Results

Repeat surveys were carried out in the districts of *Mallapuram* in Kerala, *Srikakulam* in Andhra Pradesh and *Seoni* in Madhya Pradesh. The children were examined for prevalence of clinical signs of vitamin A deficiency, and blood vitamin A levels were estimated from Finger prick blood samples by DBS method, as was done earlier. The blood vitamin A levels of children observed in the repeat survey were compared with the figures observed for the district in the MND survey.

Analysis of data revealed the following:

The median blood vitamin A levels in all the three states during the repeat survey were around 20 μg/dL and were about half of that observed during MND survey (**Table 28**). The proportion of children having blood vitamin A levels of <20 μg/dL was about half of that observed in MND survey in the States of Kerala (52% Vs 93%), Andhra Pradesh (45% Vs 80%) and Madhya Pradesh (50% Vs 100%). The differences observed in the blood vitamin A levels of preschool children in the same area at two points of time, though in the same season, could be attributed to variations over a period and needs to be further investigated. It may be noted that the prevalence of sub-clinical vitamin A deficiency, however continued to be very high.

4.6 Validation of Results

Though, there was a long gap between collection of sample and analysis, most of the samples were analysed around 220 days, the mean period of gap was not different

amongst different States. The steps involved like collection of the sample as dry blood spot, transport, storage and analysis were done properly, under good quality control.

The studies carried out at NIN have shown that there was no significant decrease in blood vitamin A levels, even up to12 months of storage of DBS samples under ideal conditions. Further, analysis of samples for haemoglobin levels in the DBS samples revealed values comparable to those observed during MND survey.

5. DISCUSSION AND COMMENTS

In the recent years, deficiency of micronutrients, which play a crucial role in a host of biological process of the body, has been recognized as significant public health problem, especially among preschool children in India. Several large-scale studies have revealed that VAD is a nutritional problem of public health significance among preschool children. High prevalence of Bitot spots and very low intake of dietary vitamin A have been reported in the MND as well as in district micronutrient survey. The present survey, perhaps for the first time in the country, was carried out to assess the prevalence of sub-clinical forms of VAD among rural preschool children of eight major States in the country, covering statistically adequate sample size for the estimation of blood vitamin A levels. This has become possible by the development of DBS technology of blood collection even from remote areas and for measuring plasma retinal levels by HPLC.

Though the prevalence of severe forms of vitamin A deficiency such as corneal ulcers/ Keratomalacia has in general become very rare, the milder forms such as Bitot spots, conjunctival xerosis and night blindness are prevalent in varying magnitudes in different Sates of the country. The overall prevalence of Bitot spots (0.8%) among preschool children was similar to that observed in earlier surveys (NNMB Repeat survey 1999[8], NNMB Rural survey 2001 [3] and ICMR[6]). The overall, prevalence of Bitot spots was higher than the WHO cut-off level of 0.5% in 6 out of 8 States surveyed, indicating that the VAD continues to be nutritional problem of public health significance. While the prevalence of Bitot spots was nil in the State of Kerala, it was about 0.3% in Orissa. The lower prevalence of Bitot Spots in Orissa, perhaps, could be due to large coverage of children for the supplementation of massive dose vitamin A, along with Pulse polio immunization, during the period of survey.

Assessment of blood vitamin A levels in the community setting is relatively difficult due to specialized techniques involved and logistic issues associated in the collection and transport of samples. To overcome these problems, Craft[5] et al has refined and validated the dried blood spot (DBS) technique for estimation of blood retinal levels. The technology was transferred and validated recently at National

Institute of Nutrition (NIN), Hyderabad and the same was employed for estimating the blood vitamin A levels in the present study.

The study revealed that even though, the prevalence of ocular signs among preschool children in rural areas was relatively low, the sub-clinical prevalence of vitamin A deficiency (< 20μg/dl) was extremely high (62%) in all the States surveyed. This finding is consistent with earlier studies in India[9] and Indonesia[10]. There are many instances in literature where in a high proportion (more than 20%) of children without any appreciable clinical signs are associated with plasma vitamin A levels of lower than 0.35 u mol/L. The sporadic data published earlier from India also support the magnitude of sub-clinical VAD reported here.

A study carried out in Orissa during 2002-03, revealed that the prevalence of sub-clinical vitamin A (< 20μg/dL) deficiency among preschool children was 63.8%, while about 20% had blood vitamin A levels below <10 μg/dL. Similarly, a high prevalence of sub-clinical vitamin A deficiency was also reported in the State of *Jharkhand* (<10μg/dL: 52.5%; 10-20μg/dL: 33.8%)[11]. In the present study the prevalence of low blood vitamin A levels (< 20μg/dL) was very high in the Sates of Kerala (<10μg/dL: 47.7%; 10-20μg/dL: 31.7%) and Madhya Pradesh (<10μg/dL: 53.8%; 10-20μg/dL: 34.2%) compared to the rest of the states. This could be due to low levels of dietary intake of vitamin A (92% with the intakes <50% RDA). The recent data on diet and nutritional status also revealed that low consumption of vitamin A rich foods and high rate of maternal illiteracy were associated with factors for higher prevalence of clinical vitamin A deficiency. It was observed that the prevalence of sub-clinical vitamin A deficiency was high in the States, where the coverage for massive dose vitamin A was low. The prevalence of sub-clinical vitamin A deficiency was relatively higher among less privileged communities such as Scheduled tribes and HHs engaged in labour compared to others communities.

Elimination of VAD is one of the goals set under the National Nutrition Policy (1993) to be achieved through the National prophylaxis programme for control of nutritional blindness in India, which include consumption of locally available vitamin A rich foods through dietary diversification and community participation, and supplementation of massive dose of vitamin A.

Several evaluations of National Nutrition programmes carried out in the past have revealed that they failed in achieving the set objectives[12], largely due to inadequate coverage of the target individuals supplementation and lack of nutrition education in the target groups. These results, thus, reconfirm poor outreach of the programmes.

Nutrition education is considered to be a major component of all the national nutrition programmes. The present study revealed that the nutrition education component was unsatisfactory, covering a mere 14% of the target beneficiaries.

The study thus revealed that the prevalence of sub-clinical VAD among 1-5 year children is very high, the coverage of children for massive dose of vitamin A was low, and the nutrition education component of IEC was poor. The earlier NNMB surveys have shown that the dietary intake of vitamin A of community was grossly inadequate. Given the deleterious consequences of VAD in the community in general and young children in particular, there is an urgent need to strengthen the programme of supplementation of massive dose vitamin A to young children and to extend the same up to 5 years of age. The IEC activities have to be intensified to bring in dietary diversification by encouraging the community to grow kitchen gardens and to include locally available vitamin A rich foods in their daily diets, more frequently. The scope of fortifying foods with vitamin A, wherever possible, also should be explored.

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Table 1

PARTICULARS OF COVERAGE

STATES	No. of Villages	No. of HHs	Individuals (1- < 5Yrs.)		K & P of Mothers of 1-5 year children VAD
			Clinical	Blood Vitamin A	
Kerala	80	10263	8329	407	148
Tamil Nadu	80	10627	9197	482	322
Karnataka	80	8778	8627	559	359
Andhra Pradesh	80	10545	9327	451	402
Maharashtra	78	9024	8646	494	309
Madhya Pradesh	75	7576	8777	407	340
Orissa	80	8948	9460	544	410
West Bengal	80	9839	9228	590	391
Pooled	**633**	**75600**	**71591**	**3934**	**2681**
Target	***640***	**-**	***76064***	***4608***	**-**

Table 2

DISTRIBUTION (%) OF HOUSEHOLDS BY RELIGION

STATES	n	RELIGION			
		Hindu	Muslim	Christian	Others
Kerala	8329	52.9	31.6	15.4	0.1
Tamil Nadu	9197	88.0	2.1	9.9	0.0
Karnataka	8627	90.0	8.0	0.8	1.2
Andhra Pradesh	9327	95.2	4.7	0.1	0.0
Maharashtra	8646	87.3	10.9	0.1	1.7
Madhya Pradesh	8777	95.5	2.8	0.7	1.0
Orissa	9460	95.0	4.1	0.9	0.0
West Bengal	9228	75.9	22.5	1.5	0.1
Pooled	**71591**	**85.3**	**10.6**	**3.6**	**0.5**

Table 3

DISTRIBUTION (%) OF HOUSEHOLDS BY COMMUNITY

STATES	n	COMMUNITY			
		Schedule Tribe	Schedule Caste	Backward Caste	Others
Kerala	8329	1.1	7.0	73.8	18.1
Tamil Nadu	9197	0.2	24.6	75.1	0.1
Karnataka	8627	9.4	15.5	1.4	73.7
Andhra Pradesh	9327	3.2	25.1	51.6	20.1
Maharashtra	8646	8.5	21.9	46.1	23.5
Madhya Pradesh	8777	28.4	12.4	48.6	10.6
Orissa	9460	19.5	19.5	39.7	21.3
West Bengal	9228	12.8	27.5	0.2	59.5
Pooled	**71591**	**10.4**	**19.4**	**42.0**	**28.2**

Table 4

DISTRIBUTION (%) OF HOUSEHOLDS BY MAJOR OCCUPATION OF HEAD OF HH

STATES	n	OCCUPATION						
		Agricultural Labour	Other Labour	Cultivators	Artisans	Service	Business	Others
Kerala	8329	4.0	43.6	2.5	7.6	17.0	20.5	4.8
Tamil Nadu	9197	20.3	40.0	19.6	8.6	5.4	5.0	1.1
Karnataka	8627	18	13.2	40.7	7.8	10.0	9.7	0.6
Andhra Pradesh	9327	32.5	23.6	24.5	6.3	5.6	5.2	2.3
Maharashtra	8646	20.8	20.0	32.9	4.0	11.4	9.0	1.9
Madhya Pradesh	8777	8.4	27.4	49.3	2.8	5.7	5.1	1.3
Orissa	9460	1.3	32.1	39.3	7.1	6.2	13.4	0.6
West Bengal	9228	21.0	35.4	7.2	5.2	16.8	14.1	0.3
Pooled	**71591**	**15.9**	**29.5**	**27.0**	**6.2**	**9.7**	**10.2**	**1.6**

Table 5

DISTRIBUTION (%) OF HOUSEHOLDS BY ADULT FEMALE LITERACY

STATES	n	LITERACY STATUS OF ADULT FEMALE	
		Illiterate	Literate
Kerala	8329	5.9	94.1
Tamil Nadu	9197	45.9	54.1
Karnataka	8627	71.1	28.9
Andhra Pradesh	9327	60.8	39.2
Maharashtra	8646	38.2	61.8
Madhya Pradesh	8777	76.4	23.6
Orissa	9460	60.1	39.9
West Bengal	9228	56.7	43.3
Pooled	**71591**	**52.3**	**47.7**

Table 6

DISTRIBUTION (%) OF HOUSEHOLDS BY FAMILY SIZE

STATES	n	FAMILY SIZE			*Mean*
		< 4	5 - 7	≥ 8	
Kerala	8329	54.6	34.4	11.0	***5.0***
Tamil Nadu	9197	50.5	42.9	6.6	***4.8***
Karnataka	8627	29.7	44.8	25.5	***5.9***
Andhra Pradesh	9327	56.6	40.4	3.0	***4.6***
Maharashtra	8646	31.9	55.1	13.0	***5.4***
Madhya Pradesh	8777	26.7	46.6	26.7	***6.1***
Orissa	9460	47.5	46.0	6.5	***4.9***
West Bengal	9228	66.9	30.9	2.2	***4.3***
Pooled	**71591**	**45.8**	**42.6**	**11.6**	***5.1***

Table 7

DISTRIBUTION (%) OF HOUSEHOLDS HAVING SANITARY LATRINE

STATES	n	SANITARY LATRINE PRESENT
Kerala	8329	93.9
Tamil Nadu	9197	20.0
Karnataka	8627	17.9
Andhra Pradesh	9327	17.4
Maharashtra	8646	16.6
Madhya Pradesh	8777	8.6
Orissa	9460	7.7
West Bengal	9228	17.4
Pooled	**71591**	**24.2**

Table 8

PREVALENCE (%) OF SIGNS AND SYMPTOMS OF VITAMIN A DEFICIENCY AMONG 1 - <5 YEAR CHILDREN

VAD	STATES								Pooled
	Kerala	Tamil Nadu	Karnataka	Andhra Pradesh	Mahara-shtra	Madhya Pradesh	Orissa	West Bengal	
n	**8329**	**9197**	**8627**	**9327**	**8646**	**8777**	**9460**	**9228**	**71591**
Night Blindness (XN)	0	0.1 (0.04 - 0.16)	0.2 (0.11 - 0.29)	0.2 (0.11 - 0.29)	1.1 (0.88 - 1.31)	0.8 (0.61 - 0.99)	0.1 (0.04 - 0.16)	0.2 (0.11- 0.29)	0.3 (0.26 - 0.34)
Conjunctival Xerosis (X1A)	0.1 (0.03 - 0.17)	0.2 (0.11- 0.29)	2.2 (1.89 - 2.51)	1.3 (1.07 - 1.53)	1.3 (1.06 - 1.54)	4.9 (4.45 - 5.35)	0.3 (0.19 - 0.41)	3.7 (3.31 - 4.09)	1.8 (1.70 - 1.90)
Bitot Spots (X1B)	0	0.5 (0.36 - 0.64)	0.7 (0.52 - 0.88)	1.2 (0.98 - 1.42)	1.3 (1.06 - 1.54)	1.4 (1.15 - 1.65)	0.3` (0.19 - 0.41)	0.6 (0.44 - 0.76)	0.8 (0.73 - 0.87)

Figures in the parentheses indicate confidence intervals

Table 9

PREVALENCE OF VITAMIN A DEFICIENCY AMONG 1-<5 YEAR CHILDREN BY SOCIO-ECONOMIC VARIABLES

SOCIO-ECONOMIC PARTICULARS		n	VAD		
			NIGHT BLINDNESS	CONJUNCTIVAL XEROSIS	BITOT SPOTS
Religion	Hindu	61083	0.4[a]	1.8[a]	0.8[a]
	Muslim	7598	0.1[b]	1.5[a]	0.3[b]
	Christian	2564	0.0[b]	0.2[b]	0.2[b]
	Others	346	0.6[a]	1.4[a]	1.2[a]
Community	ST	7468	0.6[a]	4.2[a]	1.2[a]
	SC	13886	0.7[a]	2.4[b]	1.4[a]
	OBC	30023	0.2[b]	0.9[c]	0.6[b]
	Others	20214	0.1[c]	1.6[d]	0.4[c]
Occupation	Agri. Labour	11372	0.6[a]	2.4[a]	1.3[a]
	Other Labour	21090	0.3[bc]	2.0[b]	0.9[b]
	Cultivators	19361	0.4[b]	1.8[b]	0.6[c]
	Artisans	4435	0.2[c]	1.1[cd]	0.5[c]
	Service	6925	0.2[c]	1.4[c]	0.4[c]
	Business	7282	0.0[d]	0.9[d]	0.3[c]
	Others	1126	0.2[abc]	0.5[d]	0.4[bc]

Values in the same column with different superscripts are significantly ($p<0.05$) different for the given variable. (Contd…)

Table 9 (Contd..)

PREVALENCE OF VITAMIN A DEFICIENCY AMONG 1-<5 YEAR CHILDREN BY SOCIO-ECONOMIC VARIABLES

SOCIO ECONOMIC PARTICULARS		n	VAD		
			NIGHT BLINDNESS	CONJUNCTIVAL XEROSIS	BITOT SPOTS
Family size	≤4	32807	0.2 [a]	1.4 [a]	0.6 [a]
	5 – 7	30496	0.4 [b]	2.1 [b]	1.0 [b]
	≥ 8	8288	0.5 [b]	2.1 [b]	0.7 [a]
Adult Female Literacy	Illiterate	37406	0.5 [a]	2.6 [a]	1.1 [a]
	Literate	34124	0.2 [b]	0.8 [b]	0.4 [b]
Sanitary Latrine	Absent	54242	0.4 [a]	2.1 [a]	0.9 [a]
	Present	17349	0.0 [b]	0.5 [b]	0.2 [b]
Pooled		**71591**	**0.3**	**1.8**	**0.8**

Values in the same column with different superscripts are significantly ($p<0.05$) different for the given variable.

Table - 10

MEAN BLOOD VITAMIN A LEVELS (µg/dl) AMONG 1-5 YEAR CHILDREN - BY AGE GROUP

STATES	1-3 YEARS				3-5 YEARS				POOLED			
	n	Mean ± SD	Median	Range	n	Mean ± SD	Median	Range	n	Mean ± SD	Median	Range
Kerala	175	13.3±8.7	10.0	5.0 - 41.8	232	12.9±8.2	10.7	3.6 - 47.0	407	13.1±8.4	10.5	3.6 - 47.0
Tamil Nadu	172	22.5±11.0	20.8	5.4 - 78.6	310	21.6±10.8	19.7	4.1 - 89.2	482	21.9±10.9	20.1	4.1 - 89.2
Karnataka	240	21.6±10.3	20.3	4.6 - 58.6	319	20.2±8.5	19.3	3.7 - 57.0	559	20.8±9.4	19.5	3.7 - 58.6
Andhra Pradesh	131	19.3±9.1	18.3	5.0 - 48.1	320	17.8±8.7	16.6	1.8 - 43.6	451	18.2±8.8	17.0	1.8 - 48.1
Maharashtra	178	20.1±9.9	18.0	5.0 - 48.1	316	19.4±9.3	18.8	1.8 - 57.4	494	19.7±9.5	18.7	1.8 - 57.4
Madhya Pradesh	136	11.3±7.6	8.6	5.0 - 43.8	271	11.7±7.7	9.1	1.8 - 49.2	407	11.6±7.6	9.0	1.8 - 49.2
Orissa	226	18.7±10.5	17.8	3.7 - 90.5	318	19.8±9.5	18.3	2.7 - 59.4	544	19.3±9.9	18.1	2.7 - 90.5
West Bengal	233	19.1±10.1	18.1	3.9 - 62.6	357	18.2±8.9	16.3	4.4 - 60.0	590	18.6-9.3	16.6	3.9 - 62.8
Pooled*	**1491**	**18.6±10.4**	**17.2**	**3.7 - 90.5**	**2443**	**18.0±9.5**	**16.6**	**1.8 - 89.2**	**3934**	**18.2±9.9**	**16.8**	**1.8 - 9.5**

* Mean Blood Vitamin A levels are comparable (p > 0.05) between genders

Table - 11

MEDIAN BLOOD VITAMIN A LEVELS (µg/dl) BY AGE

STATES	AGE (in Years)									
	1+		2+		3+		4+		1-5 Years	
	n	µg/dL	n	µg/dL	n	µg/dL	n	µg/dL	n	µg/dL
Kerala	66	12.0	109	9.9	112	11.3	120	10.0	407	10.5
Tamil Nadu	58	20.8	114	20.9	153	21.0	157	19.0	482	20.1
Karnataka	108	20.6	132	20.0	155	19.7	164	19.2	559	19.5
Andhra Pradesh	45	18.0	86	18.4	118	17.2	202	16.4	451	17.0
Maharashtra	62	17.8	116	18.4	138	19.2	178	18.2	494	18.7
Madhya Pradesh	45	7.5	91	9.4	120	9.1	151	9.2	407	9.0
Orissa	96	18.7	130	17.0	146	18.4	172	18.3	544	18.1
West Bengal	82	18.4	151	17.0	154	16.9	203	15.6	590	16.6
Pooled*	**562**	**17.6**	**929**	**16.8**	**1096**	**17.4**	**1347**	**16.0**	**3934**	**16.8**

Table - 12

MEAN BLOOD VITAMIN A LEVELS (μG/DL) AMONG 1-5 YEAR CHILDREN - BY GENDER

STATES	BOYS				GIRLS				POOLED			
	n	Mean ± SD	Median	Range	n	Mean ± SD	Median	Range	n	Mean ± SD	Median	Range
Kerala	189	13.0 ± 8.3	10.5	3.6 - 41.8	218	13.3±8.6	10.5	5.0 - 47.0	407	13.1±8.4	10.5	3.6 - 47.0
Tamil Nadu	247	22.6 ±11.3	20.9	4.1 - 81.2	235	21.3±10.4	19.4	5.0 - 68.7	482	21.9±10.9	20.1	4.1 - 89.2
Karnataka	291	21.1±9.3	19.6	3.7 - 58.8	268	20.6±9.5	19.5	4.6 - 58.6	559	20.8±9.4	19.5	3.7 - 58.6
Andhra Pradesh	243	18.3±9.3	17.1	1.8 - 48.1	209	18.3±8.4	17.0	5.0 - 47.2	451	18.2±8.8	17.0	1.8 - 48.1
Maharashtra	267	19.7±9.7	18.9	1.8 - 48.1	227	19.6±9.4	18.1	5.0 - 57.4	494	19.7±9.5	18.7	1.8 - 57.4
Madhya Pradesh	203	11.9±8.1	8.7	1.8 - 43.8	204	11.5±7.3	9.4	5.0 - 49.2	407	11.6±7.6	9.0	1.8 - 49.2
Orissa	263	19.8±10.8	18.1	2.7 - 90.5	281	19.0±19.2	18.1	5.0 - 52.4	544	19.3±9.9	18.1	2.7 - 90.5
West Bengal	282	18.7±9.4	16.7	4.4 - 62.6	308	18.5±9.4	16.6	3.9 - 60.0	590	18.6-9.3	16.6	3.9 - 62.8
Pooled*	**1985**	**18.5±10.2**	**17.2**	**1.8 - 19.5**	**1949**	**18.0±9.6**	**16.5**	**3.9 - 68.7**	**3934**	**18.2±9.9**	**16.8**	**1.8 - 9.5**

* Mean Blood Vitamin A levels are comparable (p > 0.05) between genders

Table - 13

FREQUENCY DISTRIBUTION (%) OF 1-5 YEAR CHILDREN ACCORDING TO BLOOD VITAMIN A LEVELS

STATES	N	BLOOD VITAMIN A LEVEL (µg/dl)					
		<10	10-20	20-30	30-40	40-50	≥ 50
Kerala	407	47.7	31.7	15.2	4.4	1.0	0.0
Tamil Nadu	482	9.1	39.6	32.2	14.5	2.7	1.9
Karnataka	559	9.5	42.6	33.3	11.6	1.8	1.3
Andhra Pradesh	451	17.7	43.9	28.4	8.4	1.6	0.0
Maharashtra	494	15.0	39.7	30.4	11.3	3.4	0.2
Madhya Pradesh	407	53.8	34.2	7.9	2.9	1.2	0.0
Orissa	544	17.1	40.6	30.5	7.9	3.6	1.3
West Bengal	590	14.7	46.4	27.3	8.3	1.9	1.4
Pooled*	**3934**	**21.5**	**40.3**	**26.4**	**8.9**	**2.1**	**0.8**

Table - 14

DISTRIBUTION (%) OF 1-5 YEAR CHILDREN WITH BLOOD VITAMIN A LEVELS OF < 20 µg/dl – BY AGE

STATES	AGE (in Years)									
	1+		2+		3+		4+		1-5 Years	
	n	%	n	%	n	%	n	%	n	%
Kerala	66	75.8	109	79.8	112	76.8	120	83.3	407	79.4
Tamil Nadu	58	43.1	114	45.6	153	45.1	157	56.7	482	48.8
Karnataka	108	47.2	132	49.2	155	51.6	164	57.9	559	52.1
Andhra Pradesh	45	57.8	86	55.8	118	60.2	202	65.8	451	61.5
Maharashtra	62	54.8	116	55.2	138	51.4	178	56.7	494	54.7
Madhya Pradesh	45	95.6	91	99.0	120	85.8	151	86.8	407	88.0
Orissa	96	57.3	130	60.0	146	56.2	172	57.6	544	57.7
West Bengal	82	52.4	151	57.0	154	63.0	203	66.5	590	61.2
Pooled*	**562**	**58.2**	**929**	**60.4**	**1096**	**60.1**	**1347**	**65.6**	**3934**	**61.8**

Table - 15

DISTRIBUTION (%) OF 1-5 YEAR CHILDREN WITH BLOOD VITAMIN A LEVELS OF < 20 µg/dl – BY AGE GROUP

STATES	BLOOD VITAMIN A (<20 µg/dl)								
	1-3 YEARS			3-5 YEARS			Pooled		
	n	(%)	CI	n	(%)	CI	n	(%)	CI
Kerala	175	78.3	72.2 - 84.4	232	80.2	75.1 - 85.3	407	79.4	75.5 - 83.3
Tamil Nadu	172	44.8	37.4 - 52.2	310	51.0	45.4 - 56.6	482	48.8	44.3 - 53.3
Karnataka	240	48.3	42.0 - 54.6	319	54.9	49.4 - 60.4	559	52.1	48.0 - 56.2
Andhra Pradesh	131	56.5	48.0 - 65.0	320	63.8	58.5 - 69.1	451	61.6	57.1 - 66.1
Maharashtra	178	55.1	47.8 - 62.4	316	54.4	48.9 - 59.9	494	54.7	50.3 - 59.1
Madhya Pradesh	136	91.2	86.4 - 96.0	271	86.3	82.2 - 90.4	407	88.0	84.8 - 91.2
Orissa	226	58.8	52.4 - 65.2	318	56.9	51.5- 62.3	544	57.7	53.5 - 61.9
West Bengal	233	55.4	49.0 - 61.8	357	65.0	60.1 - 69.9	590	61.2	52.3 - 65.1
Pooled*	**1491**	**59.6**	**57.1 - 62.1**	**2443**	**63.1**	**61.2 - 65.0**	**3934**	**61.8**	**60.3 - 63.3**

* Prevalence of sub-clinical Vitamin A deficiency was significantly different ($p < 0.05$) between age groups.

Table - 16

DISTRIBUTION (%) OF 1-5 YEAR CHILDREN WITH BLOOD VITAMIN A LEVELS OF < 20 µG/DL – BY GENDER

STATES	GENDER								
	BOYS			GIRLS			POOLED		
	n	(%)	CI	n	(%)	CI	n	(%)	CI
Kerala	189	79.4	73.6 - 85.2	218	79.4	74.0 - 84.8	407	79.4	75.5 - 83.3
Tamil Nadu	247	44.9	38.7 - 51.1	235	52.8	46.4 - 59.2	482	48.8	44.3 - 53.3
Karnataka	291	52.6	46.9 - 58.3	268	51.5	45.5 - 57.5	559	52.1	48.0 - 56.2
Andhra Pradesh	243	62.1	56.0 - 68.2	208	61.1	54.5 - 67.7	451	61.6	57.1 - 66.1
Maharashtra	267	54.3	48.3 - 60.3	227	55.1	48.6 - 61.6	494	54.7	50.3 - 59.1
Madhya Pradesh	203	86.2	81.4 - 90.9	204	89.7	85.5 - 93.9	407	88.0	84.8 - 91.2
Orissa	263	57.8	51.8 - 63.8	281	57.7	51.9 - 63.5	544	57.7	53.5 - 61.9
West Bengal	282	60.3	54.6 - 66.0	308	62.0	56.6 - 67.4	590	61.2	52.3 - 65.1
Pooled*	**1985**	**60.8**	**58.7 - 62.9**	**1949**	**62.8**	**60.7 - 64.9**	**3934**	**61.8**	**60.3 - 63.3**

* Prevalence of sub-clinical Vitamin A deficiency was comparable ($p > 0.05$) by Gender

Table - 17

DISTRIBUTION (%) OF 1 - 5 YEAR CHILDREN WITH BLOOD VITAMIN A LEVELS OF < 20 μG/DL - BY RELIGION

STATES	RELIGION									
	HINDU		MUSLIM		CHRISTIAN		OTHERS		POOLED	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Kerala	232	79.9	127	80.3	48	79.2	-	-	407	79.4
Tamil Nadu	423	48.2	4	25.0	55	54.5	-	-	482	48.8
Karnataka	517	51.6	38	57.9	3	66.7	1	-	559	52.1
Andhra Pradesh	427	61.6	23	60.9	1	100.0	-	-	451	61.6
Maharashtra	449	54.6	33	60.6	-	-	12	41.7	494	54.7
Madhya Pradesh	390	87.4	10	100.0	4	100.0	3	100.0	407	88.0
Orissa	516	57.4	20	65.0	8	62.5	-	-	544	66.7
West Bengal	452	59.5	139	65.2	6	100.0	-	-	590	61.2
Pooled*	**340**	**60.7[a] (55.5 - 65.9)**	**387**	**69.3[b] (64.7 - 73.9)**	**125**	**68.8[ab] (60.7 - 76.9)**	**16**	**50.0[ab] (25.5 - 74.5)**	**3934**	**61.8**

Figures in the parentheses indicate Confidence Intervals (CI)

* Values with different superscripts are significantly ($p < 0.05$) different

Table - 18

DISTRIBUTION (%) OF 1 - 5 YEAR CHILDREN WITH BLOOD VITAMIN A LEVELS OF < 20 μG/DL - BY COMMUNITY

STATES	COMMUNITY									
	SCHEDULED TRIBES		SCHEDULED CASTES		OTHER BACKWARD COMMUNITIES		OTHER COMMUNITIES		POOLED	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Kerala	7	100.0	36	72.2	306	80.4	58	75.9	407	79.4
Tamil Nadu	2	-	84	54.8	395	47.6	1	100.0	482	48.8
Karnataka	58	60.3	106	49.1	11	45.5	384	51.8	559	52.1
Andhra Pradesh	13	53.8	100	63.0	237	60.8	101	63.4	451	61.6
Maharashtra	32	87.5	103	52.4	244	52.0	115	53.4	494	54.7
Madhya Pradesh	110	85.5	39	92.3	216	88.0	42	90.5	407	88.0
Orissa	94	59.6	85	50.6	237	57.4	128	61.7	544	57.7
West Bengal	54	87.0	123	56.9	-	-	413	59.1	590	61.2
Pooled*	**370**	**74.1[a] (69.6 - 78.6)**	**676**	**57.7[b]** (54.0 - 61.4)	**1646**	**62.9[c]** (60.6 - 65.2)	**1242**	**58.8[b] (56.1 - 61.5)**	**3934**	**61.8**

Figures in the parentheses indicate Confidence Intervals (CI)

* Values with different superscripts are significantly ($p < 0.05$) different

Table - 19

DISTRIBUTION (%) OF 1 - 5 YEAR CHILDREN WITH BLOOD VITAMIN A LEVELS OF < 20 µG/DL - BY OCCUPATION OF HEAD OF THE HHOUSEHOLD

STATES	OCCUPATION OF HEAD OF HOUSEHOLD															
	Agricultural Labour		Other Labour		Cultivators		Artisans		Service		Business		Others		Pooled	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Kerala	17	82.4	175	81.7	7	85.7	36	69.4	77	83.1	79	73.4	16	81.3	407	79.4
Tamil Nadu	87	46.0	209	48.8	99	49.5	42	57.1	17	29.4	20	60.0	8	37.5	482	48.8
Karnataka	113	56.6	77	63.6	202	49.0	48	43.8	56	44.6	60	53.3	3	33.3	559	52.1
Andhra Pradesh	152	63.2	98	58.2	125	57.6	24	62.5	20	60.0	22	90.9	10	60.0	441	61.6
Maharashtra	108	56.5	84	59.5	176	55.1	23	56.5	53	41.5	42	52.4	8	62.5	494	54.7
Madhya Pradesh	28	92.9	119	91.6	190	84.2	13	84.6	26	88.5	24	95.8	7	85.7	407	88.0
Orissa	5	100.0	161	63.4	225	54.2	37	48.6	38	52.6	73	61.6	5	40.0	544	57.7
West Bengal	113	61.1	210	54.3	54	66.7	25	56.0	101	72.3	85	62.4	2	100.0	590	61.2
Pooled*	**623**	**60.2 (56.4-64.0)**	**1130**	**64.1 (61.3 - 66.9)**	**1078**	**59.5 (56.6 - 62.4)**	**248**	**56.9 (50.7-63.1)**	**388**	**62.9 (58.1-67.7)**	**405**	**65.4 (60.8-70.0)**	**59**	**64.4 (52.2-76.6)**	**3934**	**61.8**

Figures in the parentheses indicate Confidence Intervals (ci)

* Prevalence of sub-clinical VAD is similar between Occupation Groups

Table - 20

DISTRIBUTION (%) OF 1 - 5 YEAR CHILDREN WITH BLOOD VITAMIN A LEVELS OF < 20 µG/DL - BY FAMILY SIZE

STATES	FAMILY SIZE							
	≤ 4		5-7		≥ 8		POOLED	
	n	(%)	n	(%)	n	(%)	n	(%)
Kerala	207	77.3	155	80.6	46	84.4	407	79.4
Tamil Nadu	242	49.2	209	50.2	31	35.5	482	48.8
Karnataka	153	51.0	275	50.5	131	56.5	559	52.1
Andhra Pradesh	270	64.4	165	58.2	16	50.0	451	61.6
Maharashtra	146	50.0	291	57.7	57	50.9	494	54.7
Madhya Pradesh	102	86.3	201	87.6	104	90.4	407	88.0
Orissa	272	56.6	235	57.9	37	64.9	544	57.7
West Bengal	403	59.6	174	64.9	13	61.5	590	61.2
Pooled*	**1795**	**60.5 (58.2 - 62.8)**	**1705**	**62.1 (59.8 - 64.4)**	**434**	**65.9 (61.4 - 70.4)**	**3934**	**61.8**

Figures in the parentheses indicate Confidence Intervals (CI)

* Prevalence of sub-clinical Vitamin A deficiency was comparable by family size

Table - 21

DISTRIBUTION (%) OF 1 - 5 YEAR CHILDREN WITH BLOOD VITAMIN A LEVELS OF < 20 µG/DL – BY ADULT FEMALE LITERACY

STATES	ADULT FEMALE LITERACY					
	Illiterate		Literate		Pooled	
	n	(%)	n	(%)	n	(%)
Kerala	27	74.1	380	79.7	407	79.4
Tamil Nadu	225	49.3	257	48.2	482	48.8
Karnataka	395	57.0	164	40.2	559	52.1
Andhra Pradesh	280	55.7	171	71.3	451	61.6
Maharashtra	175	61.1	319	51.1	494	54.7
Madhya Pradesh	304	88.2	103	87.4	407	88.0
Orissa	320	60.9	224	53.1	544	57.7
West Bengal	311	63.7	279	58.4	590	61.2
Pooled*	**2037**	**62.8 (60.7 - 64.9)**	**1897**	**60.6 (58.4 - 62.8)**	**3934**	**61.8**

Figures in the parentheses indicate Confidence Intervals (CI)

* Prevalence of sub-clinical Vitamin A deficiency was comparable by Adult female literacy status.

Table - 22

DISTRIBUTION (%) OF 1 - 5 YEAR CHILDREN WITH BLOOD VITAMIN A LEVELS OF < 20 µG/DL - BY SANITARY LATRINE

STATES	SANITARY LATRINE					
	Present		Absent		Pooled	
	n	(%)	n	(%)	n	(%)
Kerala	30	66.7	377	80.4	407	79.4
Tamil Nadu	390	47.9	92	52.2	482	48.8
Karnataka	456	55.3	103	37.9	559	52.1
Andhra Pradesh	382	61.3	69	63.8	451	61.6
Maharashtra	425	56.5	69	43.5	494	54.7
Madhya Pradesh	359	88.6	48	83.3	407	88.0
Orissa	501	58.5	43	48.8	544	57.7
West Bengal	461	61.8	129	58.9	590	61.2
Pooled*	**3004**	**60.9[a] (59.2 - 62.6)**	**930**	**64.6[b] (61.5 - 67.7)**	**3934**	**61.8**

Figures in the parentheses indicate Confidence Intervals (CI)

* Values with different superscripts are significantly ($p < 0.05$) different

Table - 23

DISTRIBUTION (%) OF 1 - 5 YEAR CHILDREN WITH BLOOD VITAMIN A LEVELS OF < 20 µG/DL BY SIGNS AND SYMPTOMS OF VIT. A DEFICIENCY

STATES	N	SYMPTOM/SIGN OF VAD								No Symptoms/ Sign	
		Night Blindness (XN)		Conjunctival Xerosis (X1A)		Bitot Spots (X1B)		Children with one or more of XN/X1A/XIB			
		n	(%)	n	(%)	n	(%)	n	(%)	n	%
Kerala	407	0	0	1	100.0	0	0.0	1	100.0	406	79.3
Tamil Nadu	482	0	0	5	40.0	6	66.7	8	50.0	474	48.7
Karnataka	559	2	50.0	13	69.2	3	66.7	17	64.7	542	51.7
Andhra Pradesh	451	2	50.0	12	33.3	12	41.7	18	33.3	433	62.8
Maharashtra	494	9	100.0	11	90.9	9	88.9	15	86.7	479	53.7
Madhya Pradesh	407	4	75.0	20	85.0	6	83.3	27	81.5	380	88.4
West Bengal	590	1	100.0	32	62.5	2	100.0	32	62.5	558	61.1
Pooled*	**3934**	**18**	**83.3 (66.1 - 100)**	**94**	**67.0 (57.5 -76.5)**	**38**	**68.4 (53.6 - 83.2)**	**118**	**65.3 (56.7 - 73.9)**	**3816**	**61.7**

Figures in the parentheses indicate Confidence Intervals (CI)

* sub-clinical VAD was not associated with prevalence of different Signs and Symptoms of VAD.

Table - 24

DISTRIBUTION (%) OF 1 - 5 YEAR CHILDREN WITH BLOOD VITAMIN A LEVELS OF < 20 µG/DL - BY RECEIPT OF MASSIVE DOSE OF VITAMIN A DURING PREVIOUS 12 MONTHS

STATES	NUMBER OF MASSIVE OF VITAMIN 'A' DOSES RECEIVED					
	One Dose		Two Doses		None	
	n	<20 µg/dl	n	<20 µg/dl	n	<20 µg/dl
Kerala	1	100.0	0	0.0	6	83.3
Tamil Nadu	1	0.0	8	25.0	14	42.9
Karnataka	35	45.7	8	75.0	14	50.0
Andhra Pradesh	12	83.3	31	48.4	71	64.8
Maharashtra	10	90.0	10	50.0	23	69.6
Madhya Pradesh	19	94.7	24	95.8	39	92.3
Orissa	47	61.7	53	45.3	21	47.6
West Bengal	26	38.5	1	100.0	22	63.6
Pooled*	**151**	**61.6** (53.8-69.4)	**135**	**56.3** (47.9-64.7)	**210**	**66.7** (60.3-73.1)

Figures in the parentheses indicate confidence intervals

* No significant association was observed between prevalence of sub-clinical VAD and number of doses of vitamin a received

Table - 25

DISTRIBUTION (%) OF 1-5 YEAR CHILDREN ACCORDING TO LOW BLOOD VITAMIN A LEVELS Vs DIETARY INTAKE OF VITAMIN A (AS % RDA) AND RECEIPT OF MASSIVE DOSE VITAMIN A DURING PREVIOUS ONE YEAR

STATES	Blood Vitamin A < 20 µg/dl	Dietary intake of Vitamin A <50% of RDA	Number of Doses Received		
			1 Dose	2 Doses	1 or 2 Doses
Kerala	79.4	91.8	28.4	10.1	38.5
Tamil Nadu	48.8	81.9	20.2	30.4	50.6
Karnataka	52.1	90.4	42.1	14.5	56.6
Andhra Pradesh	61.5	92.9	14.2	35.1	49.3
Maharashtra	54.7	88.8	29.4	22.7	52.1
Madhya Pradesh	88.0	87.4	19.1	33.2	52.3
Orissa	57.7	77.5	38.8	41.2	80.0
West Bengal	61.2	80.6	46.8	3.8	50.6
Pooled*	**61.8**	**86.3**	**30.3**	**25.1**	**55.4**

Table - 26

ODD'S RATIOS OF LOW BLOOD VITAMIN A (<20 µg/dL) WITH SOCIO-ECONOMIC VARIABLES AND CLINMICAL SIGNS OF VAD

VARIABLE	CATEGORY	ODDS RATIO	CONFIDENCE INTERVAL (95%)
Religion	Hindu	1.0	
	Muslim	1.5*	1.16-1.83
	Christian	1.4	0.97-2.10
	Others	0.7	0.24-1.73
Community	OC	1.0	
	ST	2.0*	1.55-2.59
	SC	1.0	0.79-1.16
	OBC	1.2*	1.02-1.39
Female Literacy	Literate	1.0	
	Illiterate	1.1	0.97-1.25
Family Size	1-4	1.0	
	5-7	1.1	0.93-1.22
	>=8	1.3*	1.01-1.57
Occupation	Service+Business	1.0	
	Labour	0.9	0.79-1.12
	Cultivation	0.8*	0.68-0.99
	Artisan+Others	0.6	0.60-1.02
Sanitary Latrine	Absent	1.0	1.0
	Present	1.2*	1.01-1.37
XN	Absent	1.0	
	Present	3.1	0.9-10.8
X1A	Absent	1.0	
	Present	1.3	0.8-1.9
X1B	Absent	1.0	
	Present	0.7	0.4-1.5
Vitamin A Received	Yes	1.0	
	No	1.5*	1.0-2.3
Number Of Vit A Doses	Two	1.0	
	One	1.2	0.78-2.00
Receipt of Last Dose	<6 months Ago	1.0	
	≥ 6 Months Ago	1.7	0.99-2.82

* $p < 0.05$

Table 27.1

DISTRIBUTION (%) OF MOTHERS OF INDEX CHILDREN BY THEIR KNOWLEDGE* ABOUT VITAMIN A AND VAD

Particulars	STATES								Pooled
	Kerala	Tamil Nadu	Karna -taka	Andhra Pradesh	Mahara-shtra	Madhya Pradesh	Orissa	West Bengal	
N	**148**	**322**	**359**	**402**	**309**	**340**	**410**	**391**	***2681***
Aware of Night blindness	27.7	50.6	32.9	57.0	62.5	21.2	48.5	24.0	***41.4***
Causes of Night Blindness									
Deficiency of Vitamin A	9.5	32.3	7.2	6.0	17.8	11.8	12.0	3.3	***12.1***
Dietary Inadequacy	9.5	33.9	9.7	29.4	17.2	3.5	5.4	5.4	***14.3***
Others	1.4	0.6	0.3	2.5	1.0	3.8	2.9	0	***1.6***
Other Signs of VAD									
Bitot spot	0	12.1	1.1	3.2	8.1	4.7	1.2	0	***3.8***
White Scar	0	3.4	1.4	0.2	1.6	0	0.7	0	***0.9***
Total Blindness	0	31.1	4.7	1.7	10.4	7.1	8.0	1.3	***8.1***
Others	0	0.3	0.3	0.2	0.6	0.3	3.7	0	***0.8***
Mode of treatment for VAD									
Consult Doctor	23.6	41.0	24.2	46.5	55.0	14.7	34.9	11.5	***31.7***
Supplement Vitamin A	5.4	25.5	2.5	3.5	11.0	7.9	3.9	1.5	***7.3***
Use of HH Remedies	0	1.9	0.8	5.7	10.7	2.1	1.2	1.3	***3.1***
Others	1.4	1.2	0.3	3.5	1.0	0.9	0.7	2.0	***1.4***

* Multiple responses

(Contd…)

Table 27.1 (Contd…)

DISTRIBUTION (%) OF MOTHERS OF INDEX CHILDREN BY THEIR KNOWLEDGE* ABOUT VITAMIN A AND VAD

Particulars	STATES								Pooled
	Kerala	Tamil Nadu	Karna -taka	Andhra Pradesh	Mahara- shtra	Madhya Pradesh	Orissa	West Bengal	
n	**148**	**322**	**359**	**402**	**309**	**340**	**410**	**391**	***2681***
Prevention of VAD by Dietary modifications									
Yes	16.2	34.2	18.4	34.8	39.2	14.1	25.9	6.4	***23.9***
Type of Foods to be consumed to prevent VAD									
Green leafy vegetables	7.4	33.5	10.6	29.9	35.6	8.5	13.7	5.1	***18.4***
Yellow coloured fruits	3.4	27.0	13.1	7.5	26.5	4.1	8.3	2.0	***11.5***
Animal foods	10.1	23.0	0.8	18.9	21.7	0.9	14.6	1.0	***11.3***
Nutritious foods	6.1	23.3	0.8	9.7	20.1	7.6	6.8	2.0	***9.3***
Others	0.7	4.0	0.6	0.7	2.9	0.9	2.0	0	***1.5***

* Multiple responses

Table 27.2

DISTRIBUTION (%) OF INDEX CHILDREN ACCORDING TO PARTICULARS OF RECEIPT OF MASSIVE DOSE VITAMIN A DURING THE PREVIOUS ONE YEAR

Particulars	STATES								Pooled
	Kerala	Tamil Nadu	Karna -taka	Andhra Pradesh	Mahara- shtra	Madhya Pradesh	Orissa	West Bengal	
n	148	322	359	402	309	340	410	391	*2681*
Received massive dose vitamin A during previous one year									
Yes	43.9	63.0	56.5	50.7	52.4	52.6	80.0	51.9	***57.7***
No	39.2	24.8	38.4	36.1	35.9	43.8	13.9	46.8	***34.4***
Do not know	16.9	12.1	5.0	13.2	11.7	3.5	6.1	1.3	***7.9***
Total number of doses received									
One dose	28.4	20.2	42.1	14.2	29.4	19.1	38.8	46.8	***30.3***
Two doses	10.1	30.4	14.5	35.1	22.7	33.2	41.2	3.8	***25.1***
Do not know	5.4	12.4	0	1.5	0.3	0.3	0	1.3	***2.3***
Time of receipt of last dose									
<6 months	11.5	43.8	26.7	18.4	39.8	27.9	69.3	34.3	***36.0***
6-11 months	12.8	5.6	29.8	30.1	12.0	22.1	10.5	15.6	***17.9***
Do not know	14.2	1.2	0	0.7	0.3	2.4	0.2	0.8	***1.5***

(contd..)

Table 27.2 (contd..)

DISTRIBUTION (%) OF INDEX CHILDREN ACCORDING TO PARTICULARS OF RECEIPT OF MASSIVE DOSE VITAMIN A DURING THE PREVIOUS ONE YEAR

Particulars	STATES								Pooled
	Kerala	Tamil Nadu	Karna -taka	Andhra Pradesh	Mahara-shtra	Madhya Pradesh	Orissa	West Bengal	
n	148	322	359	402	309	340	410	391	***2681***
Place of administration of massive dose of Vitamin A									
Home	0	16.1	7.5	2.7	3.9	5.3	15.9	2.0	***7.2***
AWC	11.5	30.4	30.4	21.9	22.3	42.6	31.5	1.8	***24.7***
Sub-centre	5.4	2.2	5.0	17.7	13.3	0.9	10.2	46.0	***13.8***
PHC	7.4	0.3	12.3	4.2	9.7	0.3	6.6	0	***4.9***
Others	0	0.3	1.4	2.0	2.6	0.9	15.6	0	***3.3***
Massive dose of Vitamin A administered by									
AWW	5.4	31.4	4.2	1.5	2.3	11.8	32.9	2.3	***12.0***
MPHW (F)	7.4	14.9	24.8	42.3	48.9	34.4	43.7	21.7	***31.7***
MPHS (F)	1.4	3.1	27.6	3.7	0.3	2.9	2.0	25.8	***9.2***
Others	0	0	0	0.7	0.3	0.0	1.2	0.	***0.3***
Do not know	10.1	0	0	0.2	0	0.9	0	0	***0.7***

Table 27.3

DISTRIBUTION (%) OF INDEX CHILDREN WHO RECEIVED MASSIVE DOSE VITAMIN A ACCORDING TO THE NATURE OF SIDE EFFECTS* EXPERIENCED

Particulars	STATES								Pooled
	Kerala	Tamil Nadu	Karna -taka	Andhra Pradesh	Mahara- shtra	Madhya Pradesh	Orissa	West Bengal	
n	148	322	359	402	309	340	410	391	***2681***
Experienced side effects									
Yes	0	0	0	0.5	1.3	0.9	1.0	2.0	***0.8***
Nature of side effects									
Headache	0.	0	0	0.2	0.0	0.0	0.0	0.0	***0.0***
Fever	0	0	0	0.2	1.3	0.9	0	0.3	***0.3***
Nausea	0	0	0	0	0	0	0	0.8	***0.1***
Vomiting	0	0	0	0	0	0	1.0	0.8	***0.3***
Loose motions	0	0	0	0	0	0	0	0.3	***0.0***
Others	0	0	0	0	0	0	0.2	0	***0.0***

* Multiple responses

Table 27.4

DISTRIBUTION (%) OF INDEX CHILDREN* ACCORDING TO REASONS FOR NON-RECEIPT OF MASSIVE DOSE OF VITAMIN A

Particulars	STATES								Pooled
	Kerala	Tamil Nadu	Karna -taka	Andhra Pradesh	Mahara- shtra	Madhya Pradesh	Orissa	West Bengal	
n	148	322	359	402	309	340	410	391	***2681***
Reasons for non-receipt of massive dose Vitamin A									
Not aware	50.0	53.8	12.3	51.0	32.4	55.0	28.1	9.8	***34.2***
Not offered	43.1	38.8	62.3	31.7	60.4	33.6	61.4	76.0	***52.0***
Time & place not convenient	0	3.8	19.6	4.1	0.0	1.3	5.3	6.0	***5.6***
Others	5.2	3.8	5.8	11.7	7.2	10.1	3.5	4.9	***7.1***
Refused because of fear of side effects/ harmful	1.7	0	0	1.4	0	0	1.8	3.3	***1.1***

*Those who reportedly not received massive dose Vitamin A during previous one year

Table 27.5

DISTRIBUTION (%) OF RESPONDENTS* ACCORDING TO THEIR OPINION ABOUT THE BENEFICIAL EFFECTS OF SUPPLEMENTATION OF MASSIVE DOSE OF VITAMIN A TO INDEX CHILDREN

Particulars	STATES								Pooled
	Kerala	Tamil Nadu	Karna -taka	Andhra Pradesh	Mahara- shtra	Madhya Pradesh	Orissa	West Bengal	
n	148	322	359	402	309	340	410	391	***2681***
Consumption of massive dose of vitamin A is beneficial									
Yes	58.5	77.3	93.1	56.9	74.1	38.5	68.0	12.8	***60.6***
Beneficial effects+									
Improved Health	50.8	55.7	70.9	39.7	51.2	22.9	54.9	4.9	***44.3***
Absence of Infections	0	37.4	19.2	6.9	6.8	0.6	4.3	0.5	***10.1***
Eyes are healthy	3.1	63.1	9.4	19.6	42.6	19.6	6.4	9.9	***21.6***
Others	4.6	3.9	0	2.9	1.2	1.1	4.9	0	***2.4***

* Mothers of children who received at least one dose of massive Vitamin A during previous 1 year

+ Multiple responses

Table 27.6

DISTRIBUTION (%) OF RESPONDENTS ACCORDING TO PARTICULARS OF NUTRITION EDUCATION RECEIVED* ON VAD

Particulars	STATES								Pooled
	Kerala	Tamil Nadu	Karna -taka	Andhra Pradesh	Mahara- shtra	Madhya Pradesh	Orissa	West Bengal	
n	148	322	359	402	309	340	410	391	***2681***
Received Nutrition education on VAD									
Yes	1.4	37.6	11.7	19.2	16.2	12.1	3.7	1.3	**13.2**
Messages Received*									
Signs & symptoms	0.7	16.8	8.4	3.2	12.0	0.3	1.7	0	***5.3***
Consequences of severe VAD	0	20.2	4.7	0.7	10.4	0	0.5	0	***4.4***
Prevention & control	0	14.9	2.2	1.7	11.3	0.3	0.5	0.3	***3.8***
Suppl. of Vit. A to 9-35 months children	0	18.6	2.8	4.0	12.6	7.4	1.0	0	***5.7***
Consumption of GLV	1.4	33.5	3.3	15.9	14.2	5.3	1.7	1.0	***9.7***
Consumption of Yellow Colored fruits	0	29.2	4.7	5.5	10.0	1.5	0.2	1.0	***6.5***
Growing kitchen garden	0	27.6	1.1	2.2	1.6	2.1	1.0	0.3	***4.4***
Others	0	7.1	0.6	0.7	0	0.6	0.5	0	***1.2***

* Multiple responses

Table 28

DISTRIBUTION (%) OF CHILDREN ACCORDING TO BLOOD VITAMIN A LEVELS BY PERIOD OF SURVEY

Particulars	n	BLOOD VITAMIN A LEVEL (µg/dL)							Median Value
		<10	10-20	20-30	30-40	40-50	≥50	<20	
KERALA									
Resurvey - 2005	50	14.0	38.0	32.0	16.0	0.0	0.0	52.0	19.7
MND 2002-03	44	61.4	31.8	6.8	0.0	0.0	0.0	93.2	9.1
ANDHRA PRADESH									
Resurvey - 2005	49	10.2	34.7	44.9	6.1	4.1	0.0	44.9	20.5
MND 2002-03	25	16.0	64.0	20.0	0.0	0.0	0.0	80.0	14.1
MADHYA PRADESH									
Resurvey - 2005	50	2.0	48.0	32.0	16.0	2.0	0.0	50.0	20.4
MND 2002-03	30	43.3	56.7	0.0	0.0	0.0	0.0	100.0	11.3