

RESEARCH HIGHLIGHTS

ICMR-National Institute of Nutrition

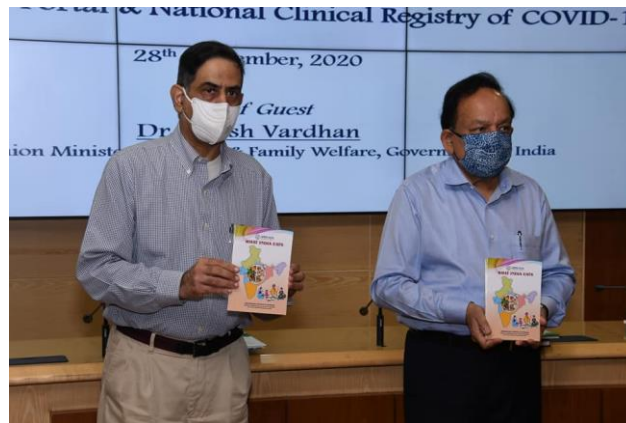
2020-21

- (i) **Nutrient Requirements for Indians - Recommended Dietary Allowances (RDAs) and Estimated Average Requirements (EARs):** In view of the changing food habits, physical activity patterns, nutrition transition and health status of various groups, ICMR-NIN, this year released the latest Nutrient Requirements for Indians and Recommended Dietary Allowances. For the first time, the report includes the Estimated Average Requirements (EAR) and Tolerable Upper Limits (TUL) of nutrients alongside RDAs. While RDAs are daily dietary nutrient intake levels which would be sufficient to meet the nutrient requirements of nearly all healthy individuals, EARs are the average daily nutrient intake levels of population. These recommendations are the basis for defining the nutrient levels in policies and programs. The EARs and TUL are not only useful in evaluating the nutritional status of populations or groups but also in defining the regulation on food fortification and nutrient supplementation etc. Hon'ble Union Minister for Health and Family Welfare Dr Harsh Vardhan released this document in ICMR in Sept 2020



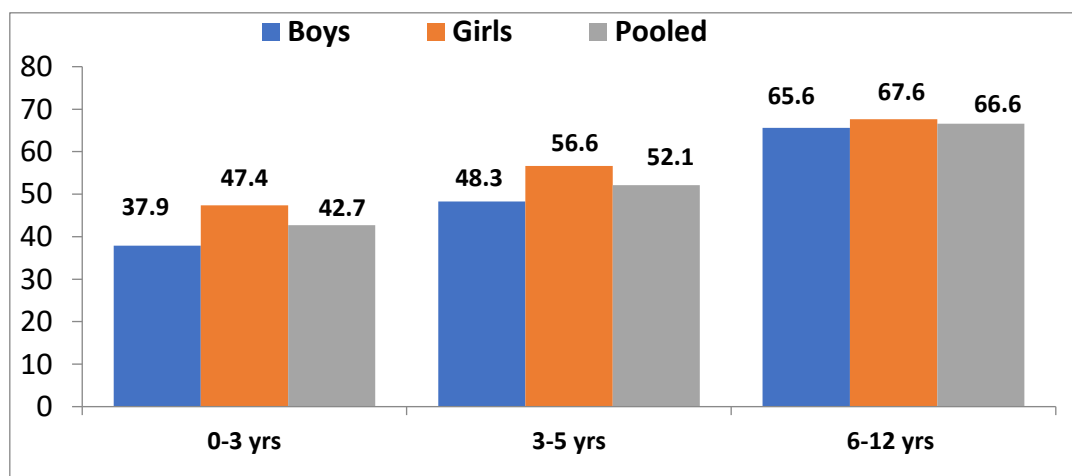
- (ii) **What India Eats - Report:** The report, for the first time, analyses the data from earlier diet surveys and gives an overview of the dietary patterns across the country projected based on food groups. This report gives details of 'Regional Dietary Pattern of Indian Population. Dietary data analysis of adults in urban and rural India showed that an average adult from urban India consumed 1943 Kcal/day, 289 g carbohydrates, 51.6 g fat and 55.4 g protein. In rural region, an average adult consumed 2081 kcal/day, 368 g of carbohydrates, 36 g of fat and 69 g of protein. As per food groups, the total energy (E) intake from cereals contributed to 998 Kcal/day, while visible fats and pulses & legumes contributed to 265 Kcal/day and 119 Kcal/day respectively in urban areas. In contrast, the total energy intake from cereals was much higher (1358) Kcal/day, and considerably lower from fats (145 Kcal/day), pulses and legumes (144 Kcal/day) in rural areas. Milk and milk products contributed almost similar in urban (99

Kcal/day) and rural areas (87Kcal/day). As per the recommendations, not more than 45% of energy should be contributed by cereals and millets, whereas the actual contribution was 51% in urban region and 65.2% in rural region; while pulses, legumes, meat, poultry and fish contributed to mere 11% of the total energy per day in urban areas and rural areas, as against the recommended minimum intake level of 17% of total energy from these foods. This report was also released by Dr Harsh Vardhan, Hon'ble Union Minister for Health and Family Welfare in Sept 2020



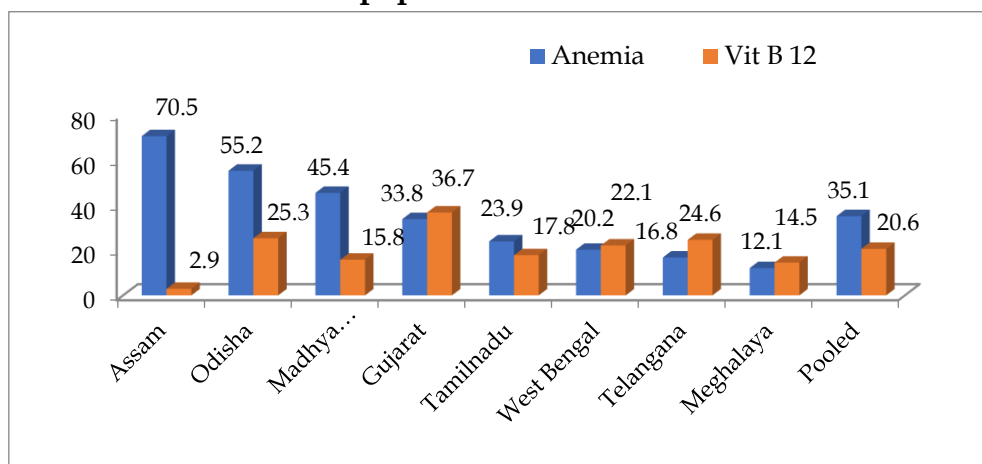
(iii) **Nutritional status of below 12 years Children of Muzaffarpur district, Bihar:**
A Rapid Nutrition Assessment: Periodic outbreaks of Acute Encephalitis Syndrome (AES) resulting in high incidence of morbidity and mortality among children residing in rural areas of Muzaffarpur district, Bihar prompted a study to assess the nutritional status of the children residing in litchi growing and AES affected and non-affected areas. It was found that the intakes of all the nutrients except protein and thiamine were below the recommended levels. The overall prevalence of underweight, stunting and wasting among children (< 5 years) was 29%, 44% and 10%, respectively (Figure 1). The prevalence of anaemia was about 70% in younger children, while it was lower among older children (47%). However, the prevalence of B12 deficiency was 43-67% among younger and older children (Fig.1).

Fig.1 Prevalence (%) of vitamin B12 deficiency among Children in Muzaffarpur



- (iv) **Prevalence and predictors of vitamin B12 deficiency: genetic associations for low vitamin B12 levels - multi-centre a pan India study:** The objective of the study was to evaluate the contribution of vitamin B12 deficiency to the burden of anaemia independently and/or in conjunction with iron and folate deficiency and also to identify the genetic factors associated with vitamin B12 levels in Indian population. This study was carried out in 8 states covering a total of 4613 individuals. The overall prevalence of anaemia was 35%, while B12 deficiency was 21%. The prevalence of anaemia was highest in Assam (70%) and lowest in Meghalaya (12%), while prevalence of B12 deficiency was lowest in Assam (3%) and highest in the state of Gujarat (36.7%) (Fig-2)

Fig.2 Prevalence (%) of vitamin B12 deficiency and anemia among adult population in India



- (v) **Investigation of Eluru Mysterious disease break out:** An Epidemiological Investigation of an Acute Neurological Outbreak in Eluru, Andhra Pradesh was conducted. In this comprehensive analysis, 10 heavy metals, 37 pesticides from blood, urine, water, foods including vegetables, rice, pulses, and 37 herbicides, mycotoxins and bacteriological from food samples were analysed. From these tests and investigations, we confirmed that the outbreak was due to pesticide organophosphate (Triazophos) contamination of water.
- (vi) **Impact evaluation of “screen and treat” approach for anaemia reduction: a cluster randomized trial in rural Telangana:** Developed and field tested a customised software to coordinate study activities. Telephonic interviews were conducted in 300 frontline workers to understand the feasibility of resuming study activities as well as delivery of health and nutrition services post COVID lockdown. Developed behaviour change communication materials to address the barriers for program uptake. Initiated a sub-study to assess ASHA workers’ perception of using electronic decision support system to distribute IFA supplementation. Field-tested the implementation of awareness campaign based on the Health belief model.
- (vii) **Adaptations to health and nutrition service delivery in COVID-19 in India:** The study helped in enhancing understanding of the extent of health and

nutrition service deliveries disrupted during Covid-19 lockdown and the facilitators and barriers for resuming the services.

- (viii) **Convening the maternal nutrition technical e-dialogues (monthly webinars):** Funded by UNICEF, this is an initiative to conduct a yearlong series of webinars, three webinars have been conducted during Jan, Feb and March 2021. This series of monthly webinars has been initiated to strengthen the maternal nutrition status by bringing clinicians, public health practitioners and nutrition researchers on a common platform to discuss the ways to improve maternal nutrition.
- (ix) **Developing Micro-greens (MG) Start-ups for Promoting Livelihood and Nutritional Security in Urban Areas:** MGs are nutrient rich foods with a variety of digestible vitamins, minerals and phytonutrients. They enclose living enzymes and nutrients along with good flavor, color and texture. Recommendation about more nutritious MGs for propagation and agriculture exploitation as well as economic gain while meeting the nutritional requirements of the population are being explored in association with ICMR-MANAGE.
- (x) **Vitamin A deficiency (VAD) among under-five year children in India:** As per the Comprehensive National Nutrition Survey (CNNS 206-18) data the national prevalence of biochemical VAD in 1-4 y children was 15.7%; and only 3 states had significant prevalence of >20%. Based on the dietary intakes from NNMB and NSSO data, the cumulative intake of vitamin A along with the universal VAS might exceed the upper limit considering the overlap with the ongoing fortification (Fig-3). This raises the need for considering a targeted state-based VAS program in place of the nation-wide universal VAS program (**policy document submitted**)
- (xi) **Amelioration of insulin resistance by TLR-2 ligands from *Mycobacterium tuberculosis*.** Several lines of evidences suggest a role of proinflammatory signals emanating from Toll-like Receptors (TLRs) play a role in the development of insulin resistance and diabetes. However, it has been found that the dichotomous signaling responses to the downstream of TLR2 activation is dictated by the nature of interaction of TLR ligands to its leucine rich regions (LRR motifs) located on the TLR2 ectodomain resulting in either pro- or anti-inflammatory responses. Using homology modeling we identified some proteins which can interact with the human TLR2 ectodomain. One of the proteins, PPE18, belonging to the PE/PPE family was found to induce IL10 production and could significantly ameliorate palmitate-induced insulin resistance in 3T3-L1 cells.
- (xii) **Characterization of reproductive function and epigenetic changes during omega-3 (n-3) fatty acid deficiency in pregnant mice:** Maternal intakes of n-3 PUFAs are far from optimal during pregnancy and lactation in India. Moreover, the requirement of n-3 increases due to an excess intake of n-6 PUFA. The current study found that maternal n-3 PUFA deficiency alters uterine artery remodeling and placental epigenome in the mice.

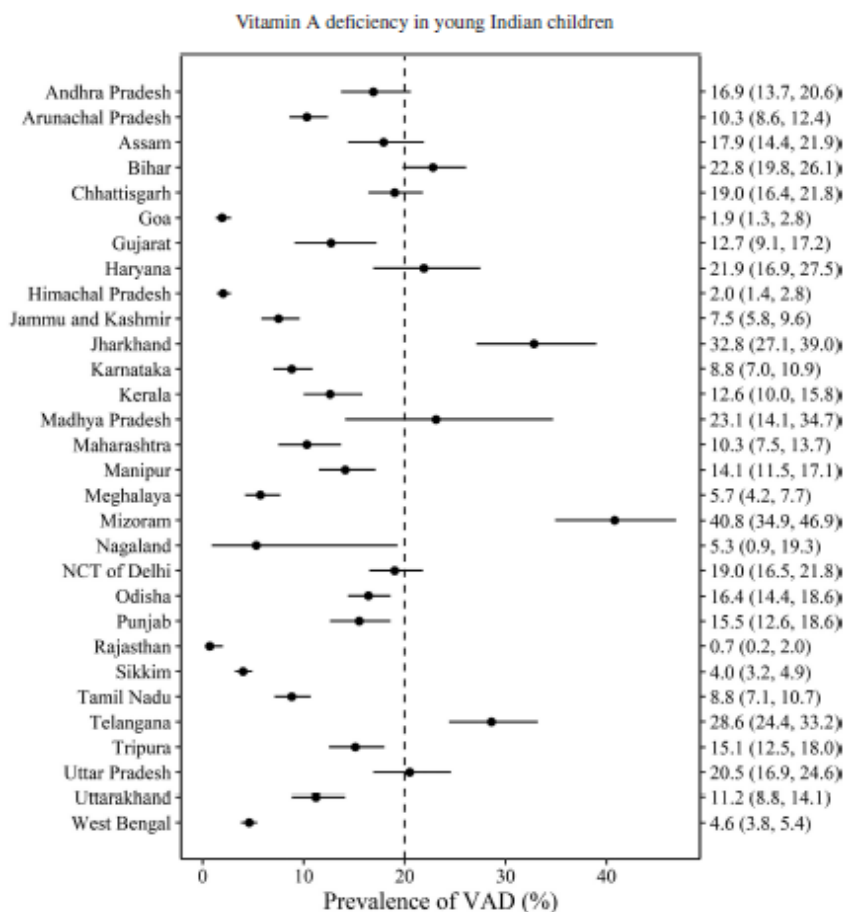


Fig-3: Prevalence of vitamin A deficiency among children (1-5y) across geographical states of India

- (xiii) **Impact on the maternal exposure of Bisphenols: implication to developmental programming of metabolic and reproductive functions in offspring:** An *in vivo* study that assessed the impacts of maternal exposure of Bisphenol A (BPA) and its safer substitute showed that Plastic-derived compounds profoundly alter body fat accumulation and male fertility parameters in the adult offspring.
- (xiv) **Dermal penetration of pesticide residues in farm women workers: Assessment of cost-effective protective gear as a preventive measure (DST SEED) :** A cost effective Personal protective equipment (PPE) was designed and developed under the project and were provided to the farming community. Pesticide residues were significantly lower in washing of hands/wipes/patch samples. Residual metabolites in blood/urine samples were also lower among those who used the cost effective PPEs. Inflammation markers, such as serum CRP, IL-6, TNFa, IL-1b and Cortisol were low and Vitamin A, E and total protein levels were better among those who used the NIN PPE, compared to those who were not using PPEs. The absorption through skin, thereby in to the blood seems to have been less among those who are /were using cost effective PPEs, hence the levels of residual metabolites viz., DMP and DETP in urine/blood samples was found to be less as compared to those who have used commercially available PPEs and those who have not used any PPEs.

- (xv) **Prevalence of fluorosis in the community of selected districts of India (Prakasam district from Andhra Pradesh) and development of an appropriate intervention model for prevention and control of fluorosis (ICMR Taskforce Project):** Dental fluorosis screening was done in 60,000 population from 30 villages of Prakasam District as part of the ICMR Taskforce. The results revealed that the percentage of dental fluorosis in 5-18 years age group was 5.11% in category I (8 villages; <1.00 ppm fluoride in drinking water), 13.07% in category II (7 villages; 1.5-3.0 ppm fluoride) and 16.19% in category III (9 villages; >3.00 ppm fluoride). The urinary fluoride was significantly higher in category III as compared to category I and category II. The T3 levels significantly increased and TSH levels were significantly lower in category III as compared to category I and category II. There was a significant increase in SGOT in the category II & III compared to category I. The fluoride levels in the food samples were higher in category II & III than in category I.
- (xvi) **Development of New Bio-Marker for Quantification of Acetylcholinesterase (Ache) Enzyme Activity, Organophosphate, Carbamates, and Nerve Agent in Biological and Ambient Matrices:** A series of experiments were performed varying the concentration of blood and substrate with optimal sensitivity using 50- μ mole substrate and 50- μ L blood. The reaction was complete within 30 minutes. Further trials to reduce volume of blood to 25- μ L and reaction time to 15 minutes have also shown positive results, validation for the same is in progress. This method was validated on blood drawn from OP poisoning patients admitted in Osmania hospital, Hyderabad, Telangana and method was found sensitive, accurate and less time consuming for determination of AChE.
- (xvii) **Oral toxicity study of a new Salmonella killing bio-control agent NINMB 13076 bacteriophage:** Oral toxicity study of the phage NINP13076 provided data on safety of using Salmonella killing lytic bacteriophages. Thus the study revealed that the lytic bacteriophages are specific to *Salmonella* and will not harm the probiotic microbiota and are likely to be safe for use in food preservation.
- (xviii) **Development of e-learning modules on nutrition and health under Poshan Abhiyaan initiative of Govt. of India:** The Institute in association with the Ministry of Women and Child Development (MWCD), Government of India had developed 12 e-learning modules. These are uploaded on ICMR-NIN website (<https://www.nin.res.in/paelm.html>) providing cross-links MWCD and SWAYAM portals. These are useful for general public and also frontline functionaries like Anganwadi Workers. As in March, 2021, more than 8,00,420 hits have been recorded on the ICMR-NIN website and around 73,315 candidates (27,059 females and 46,162 males) have registered and downloaded more than 5,93,957 certificates.

- (xix) **Targeted nutrition communication for promoting consumption of micronutrient rich foods among rural households by developing dietary diversity score:** Developed a contextually relevant methodology to assess dimensions of the rural food environment using a novel 5A's approach i.e., availability, affordability, accessibility, acceptability and accommodation. A Diet Diversity Score was developed and validated. This can provide a quick assessment of micronutrient intake status of the households. Of the 13 food groups if a household scores 10 their diets could be considered diverse enough to meet the basic micronutrient requirements. For promoting knowledge and practice of consuming micronutrient rich foods, innovative multi-component nutrition communication materials in the form of videos, annual calendar, pamphlets, and booklets were designed and disseminated in the study villages.
- (xx) **Promoting Nutrition and Health of Corporate Employees with Workplace Intervention- A Study Using Communication for Behavioral Impact (COMBI) Approach:** This ongoing study aims to develop a multi-component Workplace Health Programme (WHP). The formative research has identified the opportunities and barriers of introducing a WHP at worksites of varied operational sizes. A checklist has been developed to capture the food and physical activity environment of the workplace. The health and nutritional status (Biochemical assessment, diet recall, anthropometry, KAP questionnaire) of corporate employees have been assessed. A theoretical framework of a multi-component, flexible workplace intervention programme model has been developed based on COMBI approach.