Research Highlights

Prevalence and predictors of vitamin B12 deficiency - Genetic associations for low vitamin B12 levels – A multi-center pan India study:

Iron – folic acid fortification without considering B_{12} level in the individuals may cause adverse events and this could perhaps be one of the rate-limiting factors in national iron folic acid supplementation programme. The current study was taken up to map the B12 deficiency in India, to estimate the contribution of B12 deficiency to the burden of anemia.

Improving Health and Nutritional Status of Vulnerable Segment of population by implementing multi-component Health and Nutrition Education intervention as a sustainable model of Intervention – Andhra Pradesh, Gujarat, Jharkhand and Telangana:

Nutrition status data were collected from 14 districts in 4 states, and based on the baseline, formative research findings district specific multi-component health and nutrition education intervention strategies were developed and implemented in 3 phases in 7 Districts of Gujarat, 5 districts of Jharkhand, one district each in Andhra Pradesh and Telangana. Education materials such as posters, flip charts, table calendars, banners, which were developed and finalized after pre-testing were used for creating nutrition awareness to the adolescent girls, pregnant women and lactating mothers. The mode of education was person-to-person, focus group meetings and counselling. The project staff contact with each of the beneficiary in the target areas was about 7-10 for counselling. There was significant improvement in all nutrition indicators and IYCF practices. The number of children with stunting, wasting and undernutrition decreased in all districts except one.

A community-based intervention on maternal and new-born care among the migrant urban poor living in non-notified slums through Janani Suraksha Yojana (JSY) and Home-based New Born Scheme in Hyderabad city:

The survey was done as a case control study with those mothers who delivered under JSY program compared to those who were under the new KCR-kit program. It was observed that KCR-kit increased the awareness of the government services leading to increased uptake and improved maternal and child health indicators.

Comprehensive National Nutrition and Health Survey (CNHS) - district level survey (Pilot study):

This survey was carried out in the district of Nalgonda in Telangana to explore the possibility of conducting a comprehensive data collection, including essential biomarkers on health and nutritional status of the population by establishing a field lab. It is feasible to conduct similar trials and will be cost-effective if done simultaneously in many districts, and more so, if periodic monitoring of health and nutrition status has to be done to study the effectiveness of national programs and reduction in disease burden, as well as to suggest mid-course corrections in program implementation.

Correlation of Prakruti (ayurgenomics) with dietary patterns, HLA-DRB1 genes and disease severity in rheumatoid arthritis (RA) patients:

Vata prakriti was associated with Rheumatoid arthritis patients whereas Pitta and Pitta *kapha prakriti* were protective for RA patients. Vata prakriti subjects had more severity in terms of anti CCP titres, disease duration and DAS sores than other prakriti subjects. HLA-DRB1 *04 gene was associated whereas HLA-DRB1*07 and 14 genes were protective for RA patients. High consumption of red and organ meat, plain rice and less consumption of green leafy vegetables, fruits in RA cases were observed. Consumption of a healthy balanced diet has beneficial effect on development as well as progression of RA.

Relative telomere length and mitochondrial DNA copy number variation with age: Association with plasma folate and vitamin B12:

Telomere attrition and mitochondrial DNA variations are implicated in the biological aging process and genomic stability can be influenced by nutritional factors. In this study we assessed the relative telomere length (rTL) and mitochondrial DNA copy number (mtCN) in aged individuals and their association with plasma folate and vitamin-B12 (B12) levels. The subjects in the ≥60 years age group have significantly shorter telomeres and lower mtCN compared to the <60 years age group. A significant positive correlation was observed between the rTL and mtCN, and both of them were positively associated with plasma folate and vitamin B12 levels. The study revealed a decline of rTL and mtCN with age in the Indian population and their association suggests that they may co-regulate each other with age. Futher, folate and B12 may delay aging by preventing the reduction in rTL length and mtCN.

Supplementation vitamin B12 ameliorated retinal lesions in diabetic rats:

Diabetic retinopathy (DR) is a most common complication of diabetes involving microvasculature and neuronal alterations in the retina. Previously we have reported that vitamin-B12 (B12) deficiency could be an independent risk factor for DR in humans. In this study, we investigated the impact of dietary supplementation of B12 on retinal changes in diabetic rats. B12 supplementation to diabetic rats showed to be beneficial by preventing retinal hypoxia, VEGF overexpression, and ER stress-mediated cell death in the retina. Considering the general prevalence of micronutrient deficiency and its contribution to many metabolic and age-related disorders, such as diabetes, and cardiovascular diseases in India, ameliorative effects of B12 on DR merits attention.

To study the effect of legume prebiotic milk on gut microbiota, adiposity and inflammation in obese rat:

Prebiotics have been shown to alter the composition of gut microbiota and metabolic functions through gastrointestinal pathways. Legumes are important food crops, of which carbohydrates constitute the main fraction with smaller but significant amounts of α-galactosides. Our study was proposed to assess the effect of legume prebiotic milk on the prevention of overweight and obesity in obese rat. Blood glucose and lipid profile of raffinose, red gram, green gram, black gram and bengal gram oligosaccharide fed obese rat showed promising results when compared to control obese rat. The serum Cholesterol content in all legume oligosaccharide fed group were decreased when compared to control group. The triglycerides, LDL and VLDL cholesterol were decreased and HDL cholesterol level increased in legume oligosaccharide fed animals when compared to control group. Gain in body weight was significantly lower in legume prebiotic fed group (352.6±90.82) when compared to raffinose fed group (591.9±171.97) and basal diet fed group (635.7±115.32). The body fat percent was much lower in legume fed group (33.96±7.3) when compared to raffinose fed group (53.3±1.92) and basal fed group (57.9±5.4).The ceacum content analyzed for gut bacteria by PCR based detection using genus specific primers (16s rDNA sequences) showed significant increase in *Bifidobacteria* in green gram prebiotic fed group followed by bengal gram prebiotics and red gram prebiotic fed groups. The results indicate that legume prebiotic milk is promising since there was a decrease in blood glucose level, improved lipid profile, and improved body mass composition.

Effect of non-digestible carbohydrate of kidney beans on diet induced metabolic syndrome in a rat model:

The prevalence of metabolic diseases associated with dynamic changes in dietary macro nutrient intake has been studied during the past decades. The present study was undertaken to determine the prebiotic potential of Kidney Beans (*Phaseolus vulgaris* L.) non digestible carbohydrates and also to study its effects on some biochemical and hematological parameters in

obesity and diabetes induced rats. Blood glucose and lipid profile values showed promising results in kidney bean prebiotic fed rat group when compared to high fat and high sucrose fed animals. Weight gain was much lower in kidney bean fed group (277.3±6.1) when compared to raffinose (324.07±26.76) and high fat group (390.17±9.17). Similar results were observed for high sucrose fed animals, kidney bean group showed average weight of 274.43±8.09, raffinose group 359.20±11.76 and high sucrose fed groups 434.77±19.88.

The fasting blood glucose was significantly lower in kidney bean fed group (84.7±3.1) when compared to raffinose fed group (86±4.6), high fat group (99.7±9.3) and similar results were observed for high sucrose fed group animals. The body fat percent was lower in kidney bean group (12.20±3.05) when compared to raffinose group (13.70±2.62) and high fat fed group (25.03±0.75). The ceacum content was analyzed for gut bacteria by PCR based detection using genus specific primers (16s rDNA sequences) showed increase for *Lactobacillus* is significant in high sucrose raffinose fed group followed by high sucrose kidney bean and high fat raffinose group when compared to control, whereas significant fold increase was shown for *Bifidobacteria* in high fat raffinose, followed by high fat kidney bean fed groups.

Studies on nitrate and nitrite in Indian foods:

Nitrate and nitrite ions are ubiquitous in the environment and naturally found in plant foods as a part of the nitrogen cycle. There are several studies related to the beneficial effect of nitrate, nitrite and nitric oxide consumption, and nitrites are also known to cause methemoglobinemia in infants and cancer, hypotension in adults and therefore its consumption is restricted. The World Health Organization (WHO) recommended the upper limit of concentration of daily nitrate and nitrite uptake to be 3.7 mg/kg and 0.06-0.07 mg/kg, respectively. Due to the growing concern of N-nitroso compounds, accurate and robust methods are necessary for long-term monitoring of nitrate and nitrite concentrations in foods for susceptible populations. The study indicates that green leafy vegetables were high in nitrite and nitrate content as compared to the other food samples analyzed. Among the non-vegetarian foods analyzed chicken was found to have more nitrates as compared to fish. It was observed that in most of the samples in cooked form the nitrite and nitrate content reduced significantly except for a few, which could be due to the addition of other ingredients. The nitrite and nitrate content in green leafy vegetables ranges from 0.36 to 6.63 mg/kg (spring onion and amaranth) and 78.96 to 388 mg/kg (spring onion and sorrel), vegetables 0.04 to 14.43 (cabbage round head and French bean) and 2.35 to 132.73 mg/kg (capsicum green and cabbage round head), roots 0.00 to 0.91mg/kg (beetroot and potato), 33.94 to 149.46 mg/kg (potato and carrot) non-vegetable foods ranges from 0.00 to 16.82 (chicken salami and chicken sausage) and 12.52 to 36.48 (chicken sausage and chicken fries).

Development of e-learning modules on nutrition and health under *Poshan Abhiyaan* initiative of Government of India:

Twelve Nutrition and Health Education (NHE) e-learning modules were developed and uploaded on ICMR-NIN website www.nin.res.in by providing cross-link to ICMR-DHR, MWCD and SWAYAM portals in order to provide access to the community from different parts of the country. The e-learning modules on various nutritional themes are expected to educate general public and girls & boys in adolescent age group and master trainers (paramedics, *Anganwadi* workers, and others). The e-learning module is currently available in Hindi and has had over 60000 registrations and 5.9 lakh certificates have been generated online

Impact of Salmonella killing lytic bacteriophages on probiotic microflora was initiated in January 2019, in which no spots and inhibition zone were observed both in the test assay and the agar well diffusion assays while results of turbidometric assay showed that even after incubation up to 24h the growth of probiotic microflora remained unaffected.

Ameliorative potential of tamarind fruit extract on the NaF - induced alterations in the bone related parameters in Saos-2 cell line:

Tamarind fruit extract treatment showed ameliorative potential and prevented NaF induced alterations in bone related parameters in Saos-2 cell-line.

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:

Dental fluorosis was 5% among 5-18 years age in category I villages (8 villages; <1.00 ppm fluoride in drinking water), 13.1% in category II (7 villages; 1.5-3.0 ppm fluoride in drinking water) and 16.2% in category III (9 villages; >3.00 ppm fluoride in drinking water) in Prakasam district, Andhra Pradesh. g). The fluoride levels in the food samples were higher in category II & III compared to category I.

As expected, the urinary fluoride was significantly higher in category III (>3.00 ppm fluoride) as compared to category I (<1.00 ppm fluoride) and category II (1.5-3.0 ppm fluoride in drinking water). The T3 levels significantly increased in the category III as compared to category I and category II. The TSH levels were significantly decreased in the category III and category II compared to category I.

Toxicokinetics of common organophosphate compounds in acute poisoning cases:

Toxicokinetic study of pesticide showed that monocrotophos and dimethoate were more absorbed and toxic than other pesticides. A negative correlation was obtained between pesticide concentration and the acetylcholinesterase enzyme. The time for treatment to the survival of patients ingested monocrotophos and dimethoate was observed to be less than 12h. However, for pesticides like chlorpyrifos, propanil, triazophos and acephate treatment time was between 36 and 72h.