During the year under report, a number of studies on community nutrition, malnutrition, anaemia, nutrition levels in pregnant women and children, nutrition and diabetes and food and drug toxicology were carried out at Councils National Institute of Nutrition (NIN), Hyderabad.

**COMMUNITY STUDIES**

**Assessment of Current Scenario of Food Labelling in India**

A study was conducted with financial support from WHO-India, on labelling regulations and community studies, as well as qualitative and quantitative market surveys, to examine the current scenario of food labeling in the country. The study revealed that food labelling regulations in India are at par with those of developed countries; that food labels are not usually read by consumers while making food choices, which may be either due to low literacy rates or lack of nutrition knowledge and awareness; Market survey showed that food packages were 100% in compliance with displaying the basic regulatory requirements like name of the food, net weight, languages used etc. The study highlighted the need to undertake nation-wide studies to understand the consumer knowledge, practices and behaviour related to food labels for formulating strategies to make food labels user-friendly.

**Health and Nutrition Profile of Bharia Tribe in M. P.**

Study was undertaken by RMRC, Jabalpur in Tamia block of Chhindwara district (M. P) in 570 individuals from 230 households for assessing their health and nutrition status. Scabies was found to be the most common morbidity, followed by fever, upper respiratory tract infection and dysentery. The overall prevalence of anaemia among males was about 89.8% with 37% having moderate and 2.8% severe anaemia. H. nana was the commonest parasite followed by E. histolytica, Ascaris lumbricoides and Ancylostoma duodenale. In the school age children the prevalence of vitamin A deficiency in the form of conjunctival xerosis and Bitot's spot was high. The overall prevalence of goiter was 2.6% in women > 40 yr old. The proportion of children with underweight was 53.7%, while that of severe underweight was 13.9%. The extent of stunting among pre-school children was 44.8%, while that of severe stunting was 17.4%. The wasting in pre-school children was about 32.2%, while in 7% there was severe wasting. The average energy and protein intake was 1895 kcal and 46.7 g per CU/ per day. Though the cereals and millets intake was high but energy level was low. The mean intake of calcium and iron was 124 mg and 16.9 mg respectively, while that of vitamin C was 28.1 mg, carotene 1153 µg, thiamin 1.0 mg and riboflavin 0.7 mg. Only 57% children received BCG within one month of birth, while DPT 1st dose was received by 63% and II dose by 24.1%. A total of 83% children received oral polio vaccine. More than 50% pregnant women did not receive any antenatal care and only 62% received tetanus toxoid injection.

**Health and Nutrition Status of Tribal Girls from Orissa**

A study was undertaken by RMRC, Bhubaneswar to find out the efficacy of iron-folic acid and deworming in combination with vitamin B₁₂ supplementation and nutrition education in reducing iron deficiency anaemia in 855 unmarried tribal adolescent girls from Serango sector of Gumma block in Gajapati district.
Majority of study population was ST (88%), while 6% were SC. The mean haemoglobin concentration was found to be 9.73 g/dl. Overall, 95% adolescent girls had anaemia, of which 47%, 37% and 4% respectively had mild, moderate and severe grades of anaemia. The proportion of girls with inadequate iron stores was 36% and iron deficiency was seen in 65%. Mean serum retinol (vitamin A) concentrations declined consistently with severity of anaemia. Subclinical vitamin A deficiency was observed in 38% and a considerable proportion had evidence of marginal vitamin A deficiency.

**Other Studies**

During the year studies were completed on assessment of health profile of population of Nellore (A.P.), consumption pattern of carbonated soft drinks of Indian population and health profile of population of Dhar district. The ICMR Advanced Centre for Nutrition Research at New Delhi completed its activities during the year. The main focus of the Centre was nutrition policy research and analysis and operationalization of newer strategies and capacity building for nutrition and health education. Besides the other ongoing activities, studies were also conducted on effect of calcium and vitamin D supplementation on stunting in early childhood and iron, folate and vitamin B12 levels in pregnant women.

**ICMR Centre for Nutrition Research and Training**

The Council had established validation laboratory for nutritional assessment of North-East and other inaccessible population to act as a reference laboratory and training centre for strengthening and developing human resource. This has been converted into a centre and renamed as Centre for Promotion of Nutrition Research and Training.

**Behavioural Studies**

**Efficacy of Integrated Feeding in Infants in Andhra Pradesh**

Integrated feeding and care intervention messages developed through comprehensive formative research resulted in behaviour change in infants. This was demonstrated through improved dietary intake of energy, protein, vitamin A, calcium, iron and zinc and improvement in growth (height for age) and development among the infants.

**Clinical Studies**

**Pregnancy Related Changes in Bone Mass in Women**

A study was carried out to understand the pregnancy related changes in bone mass in women from low socio economic group. It was revealed that in undernourished young women bone densities failed to increase during growth phase.

**Vitamin D Status in Infections in Children**

A hospital-based study examined the vitamin D status in common childhood infections and found that overall prevalence of vitamin D deficiency was 45% in pre-school children with various infections.

**Management of Anaemia in Pregnancy**

Study for evaluation of the routine management of anaemia (Hb < 8g) in pregnancy and its effect on outcome revealed that early supplementation of parenteral iron may increase haemoglobin in pregnant women by full term.

**Insulin Resistance and TNFα Levels in Pregnant Women**

Another study that looked into insulin resistance and TNFα levels in normal and high risk pregnant women concluded that the prevalence of insulin resistance was around 50% right from early pregnancy. The prevalence of insulin resistance during pregnancy is associated with adverse pregnancy outcome. So there is need to carry out a prospective study on effect of insulin resistance in early pregnancy on course, complications and outcome of pregnancy.

**Basic Studies**

**Zinc Bioavailability in Caco-2 Cell Model**

Validation of an immunoassay for quantitation of metallothionein for assaying zinc bioavailability in Caco-2 cell model resulted in development
of an indirect competitive ELISA method and an immunoblot assay. The methods were validated by simultaneously measuring $^{65}$Zn uptake in Caco2 cells exposed to varying concentrations of zinc.

**Iron, Folate and Vitamin B Levels in Pregnant Women**

A study was conducted to investigate iron, folate and vitamin B$_{12}$ status in pregnant women with different grades of anaemia and to assess the impact of different intramuscular (im) doses of hydroxycobalamine acetate on biochemical indicators of these three nutrients in pregnant women with moderate anaemia. The study has shown a higher prevalence of iron and folic acid deficiency and relatively low prevalence of vitamin B$_{12}$ deficiency. Following im therapy, there was improvement in mean hemoglobin and serum ferritin, but no change was observed in vitamin B$_{12}$ status.

**Response and Interaction of Iron and Zinc in Caco-2 Cells**

Studies on the response and interactions of iron and zinc in Caco-2 cells revealed that zinc selectively affects iron uptake and its interactions under normal conditions, depletion-repletion and simulated inflammation. Inflammation associated hypoferremia and hypozincemia may be host-protective.

**Maternal Magnesium Restriction and Adiposity in WNIN Rat Offspring**

It was reported earlier that maternal magnesium restriction irreversibly increased body fat percent, more so the visceral adiposity. In the current year, studies assessed whether or not increased stress was associated with increased adiposity. The results indicated that increased gluco-corticoid stress and fatty acid synthesis could probably underlie the increased visceral adiposity in the offspring of Mg restricted rat dams.

**Beneficial Effects of Common Foods in India**

The total phenolic content (TPC) and anti-oxidant activity (AOA) of milk, milk products, oil and sugar was determined. A significant correlation was observed between AOA and TPC in all of them. Among the foods studied, jaggery had the highest AOA, while milk, milk products and oils were poor in AOA and phenolic content.

**Role of Specific Nutrients on Islet Cell Generation from Stem Cells**

Studies were carried out to understand the ability of pancreatic progenitors to proliferate and differentiate into insulin secreting cells by administering specific nutrients as well as growth factors. They have given new insights into understanding the nature of the populating cells.

**Characterization and Proliferation of Pancreatic Progenitor Cells**

Studies on role of nutrients in characterization and proliferation of pancreatic progenitor cells/stem cells to insulin secreting cells focused on inducing differentiation of the pancreatic progenitors such as nestin positive cells (NPC) to insulin secreting cells (ISC) in presence of all trans retinoic acid (RA) with combination of other mature factors in two weeks and its in vivo efficacy in reversing diabetes in STZ induced mice model. In vivo transplantation of neoislets in diabetic mice restored the body weights and blood glucose and plasma insulin values. The data suggest its efficacy in the management of diabetes.

**Role of Recombinant Epidermal Growth Factor in Cell Proliferation**

A study conducted at NIN revealed the beneficial effects of recombinant epidermal growth factor (rhEGF) in management of gastric ulcer induced with the use of anti-inflammatory drugs such as NSAID.

**Inhibition of Aldose Reductase by Curcumin**

Another study revealed that curcumin, a major active principle from turmeric, inhibits aldose reductase (ALR2) in a non-competitive manner.
Further, curcumin was reported to suppress sorbitol accumulation in human erythrocytes under high glucose conditions. These results suggest that curcumin holds promise as an agent for preventing or treating diabetic complications.

**Cataract and WNIN –Obese Rats**

Studies in ocular biochemistry have shown that WNIN-Ob and WNIN-GR/Ob rats are more sensitive to streptozotocin and galactose-induced cataract due to accumulation of sorbitol levels in their eye lens. Increased susceptibility of WNIN-Ob and WNIN-GR/Ob rats to galactose- and streptozotocin-induced cataract indicates that WNIN-Ob and WNIN-GR/Ob rats could be employed as osmotic stress-induced cataract models.

**Importance of αCrystallin Heteropolymer**

In an ongoing study rationale has been provided for the existence of α-crystallin as a heteropolymer with 3:1 (αA to αB) ratio in the eye lens in terms of chaperone function, structural stability and susceptibility to post translational modifications. The study indicated that heteropolymer might be vital for eye lens transparency under diverse conditions to prevent cataract.

**Food and Drug Toxicology**

**Andhra Pradesh Total Diet Study**

The total diet study in Andhra Pradesh analysed 22 types of most commonly consumed foods belonging to 11 food categories for fluoride, toxic metals, pesticide residues and mycotoxins. The estimated levels of fluoride in foods were within safe limits. Twelve food items were analysed for 19 pesticide residues. All the samples including water had one or the other of the 19 pesticides analysed. Analysis for mycotoxins revealed that in selected food items (Jowar, groundnut oil, red chillies and milk) they were present in significantly low levels or were below detectable levels. Sorghum had highest concentration of lead and amaranth had highest level of cadmium.

**Development of PCR based Diagnostic Kit**

A study that aimed to develop PCR and RT-PCR based diagnostic kits for detection and identification of food and water borne pathogens used primers to *E.coli*, *V. cholerae*, *V. parahaemolyticus*, *Salmonella*, *S. aureus* and *B. cereus* to develop PCR based uniplex detection method.

**Biomarkers for Transplacental Genotoxicity**

In *in vivo* antigenotoxicity of turmeric feeding through diet was studied in NIN Wistar rats treated with single dose of carcinogen. There was significant reduction of DNA damage and malondialdehyde in rats given turmeric indicating protective effect of turmeric against genotoxicity.

**Environmental Lead Exposure and Infection**

In a study that assessed effect of environmental lead exposure in infection and immunity among children, majority of the subjects were found to be anaemic with low Zn and Fe levels. Lead toxicity was found to be one of the important causative factors of anaemia in children.

**Detoxification of Mycotoxins**

The study on detoxification of mycotoxins by lactic acid bacteria isolated from fermented sorghum and *Cassia tora* was initiated. The study indicated that *Lactobacillus rhamnosus* strain GG has good potential to reduce aflatoxin levels in contaminated grains such as sorghum. The extent of removal of aflatoxin by lactobacillus species isolated from fermented sorghum was observed to be comparable to that observed with *L. rhamnosus* strain GG.