

(62 %), followed by vitamin C (43 %), total fat (35 %), folic acid (22 %), riboflavin (14%) and energy (9%). The prevalence of clinical forms of vitamin A deficiency such as conjunctival xerosis (17.6%) and Bitot spots (8.3%) among preschool children was observed to be much higher than that reported for the State of Rajasthan (0.3%). The overall prevalence of underweight (weight for age < Median -2SD) was 72%, while that of severe grade (weight for age < Median -3SD) was 24%. The overall prevalence of stunting was 68% and that of wasting was 13%. The prevalence of chronic energy deficiency (CED) among adults was higher (56%) as compared to that reported for the State (45%).

Verbal autopsy of the deaths reported during the previous six months revealed that none of them were attributable to starvation. The study highlighted the need for strengthening of health and nutrition programmes such as RCH, ICDS and MDM.

## 2. CLINICAL AND PHYSIOLOGICAL STUDIES

A study on 'Body composition measurement by Dual Energy X-ray Absorptiometry (DEXA) in women from a slum of Hyderabad revealed that Indian women from low-income group have high levels of body fat % at comparatively lower body mass index (BMI) levels than other ethnic groups. Even women in the adequate BMI category (18.5 - 23) had unacceptable high levels of body fat. Increase in weight and BMI was associated with increase in body fat % whereas increase in height was associated with increase in lean mass but not fat %.

Another study on pregnancy induced hypertension showed that pregnant women with pre-eclamptic toxemia had decreased levels of antioxidants (vitamin C, E and  $\beta$ -carotene) as compared to the control group. Vitamin C was further decreased significantly in women with severe pre-eclampsia compared to mild to moderate groups.

## 3. BASIC STUDIES

A state-of-the-art facility 'National Facility for Dry Blood Spot Technology for vitamin A estimation' was established with the financial support from MI and MOST, New Delhi. This facility is expected to help achieve the goal of elimination of vitamin A deficiency in the country by 2010 AD, by providing data on extent of sub-clinical Vit. A deficiency in the community and by capacity building of other institutes in the methodology of assessment of the problem.

On the request from the DWCD, the draft country investment plan entitled "Country investments plan (CIP) for micronutrient fortification of food supplements of ICDS and mid day meal in the States of Orissa and Rajasthan" has been prepared and submitted to DWCD, Govt. of India. Instead of Andhra Pradesh and Rajasthan originally considered and approved earlier the proposal envisages implementation of the CIP in the States of Orissa and Rajasthan for supplementation of micronutrients - iron, zinc, iodine, vitamin A, thiamin, riboflavin, folic acid and ascorbic acid at RDA level to the beneficiaries. The plan requires an investment of Rs. 43.8 cores for a period of 3 years.

Type 2 diabetes and obesity-related metabolic disorders are rapidly emerging as major health risk factors in the Indian population. Epidemiological observations suggest a strong correlation between type 2 diabetes and obesity, however, the mechanisms by which increased adiposity causes insulin resistance is poorly understood. Resistin, a cysteine rich polypeptide, specifically secreted by the adipocytes in mouse has been implicated to be the link between type 2 diabetes and obesity. However, in humans, its role appears to be highly controversial. Therefore, the major focus has been to understand the role of resistin in human physiology. Earlier, the human resistin purified from *E.coli*

mellitus, such as cataract. Hence, the role of antiglycating agents delaying the onset or progression of diabetic complications has gained considerable importance. Preliminary data indicate that dietary agents (code names; MYB1, MYB2, MB1 and MYB3) are found to be the effective inhibitors of protein glycation in vitro, MYB1 being the most potent. Hence, studies are underway to exploit the antiglycating potential of these dietary agents in the management of secondary complications of diabetes.

*Effect of methylglyoxal on  $\alpha$ -crystallin:* Methylglyoxal (MGO), a major dicarbonyl compound, is present in high concentrations in lens compared to plasma or any other tissue and its levels increase several folds during diabetes. Compared to other agents, MGO is very potent in terms of forming advanced glycation end products (AGE). With the given importance of molecular chaperone function of  $\alpha$ -crystallin in maintaining transparency, the study investigated the effects of MGO on  $\alpha$ -crystallin structure and function. It was shown that MGO has unfavorable effects on  $\alpha$ -crystallin chaperone-like activity, as MGO-modified  $\alpha$ -crystallin showed decreased hydrophobicity, altered secondary/tertiary structure and increased oligomeric size. Further, non-enzymatic browning of  $\alpha$ -crystallin by MGO leads to decrease in its stability and unfolding that in turn leads to the exposure of buried proteolytic sites causing enhanced proteolytic degradation. ATP could not protect the glycated  $\alpha$ -crystallin from proteolytic degradation as observed with native  $\alpha$ -crystallin. Results of the present study provide the basis for the role of non-enzymatic glycation on  $\alpha$ -crystallin chaperone activity in age-related brunescence and diabetic cataracts.

#### 4. PATHOLOGY

Maternal malnutrition and hyperglycemia during pregnancy as well as foetal undernutrition in long term, in experimental animals, are known to affect the development of foetal pancreas and the structure & function of the islets, particularly the  $\beta$ -cells.

A study was therefore carried out to look into the status of pancreatic islets with respect to morphological changes in aborted human fetuses, aged 16 to 20 weeks, obtained by MTP, from undernourished mothers (BMI < 18) and compare them to those obtained from adequately nourished mothers (BMI > 20). There were no significant differences in the number, size or density of the islets as well as the beta and acinar cell counts between the pancreas of aborted fetuses belonging to undernourished and adequately nourished mothers.

Micronutrient status of children during acute respiratory infection and its association with local cytokine (Th1, Th2) response was determined. Also impact of large dose vitamin A on Th1 and Th2 modulation and cytokine response was studied. It was found that vitamin A suppresses Th1 response (IL2) which may be mediated by down regulation of IL12, indicating that vitamin A could be anti-inflammatory.

It was also found that vitamin A might alter the course of immune response in acute respiratory infections like URTI, pneumonia and bronchiolitis and thus influence the outcome of such infections. However, weight-for-age, haemoglobin and zinc did not show any association with Th1 or Th2 cytokines.

#### 5. EXTENSION AND TRAINING

FAO and a group of organizations launched a global nutrition education initiative "Feeding Minds, Fighting Hunger" (FMFH) for school children. A study was conducted between October 2002 and 2004 to evaluate the efficacy of FMFH lesson plans in improving nutrition-related knowledge levels of the schoolchildren in Hyderabad. The schools in experimental and control groups were ran-

laboratory animals was carried out with a larger sample size this year. Most of the infections seen were among from the older animals.

The centre has been carrying out basic research work on the obese rat model developed at its experimental facilities for the past few years. DNA finger printing of the obese mutant rats using random primers yielded a fairly constant DNA fingerprint for the GR-Ob strain. The PCR products generated (360 bp, 390 bp, 400 bp, and 600 bp) are cloned in suitable vector and sequenced and were found to have homology with sequences on rat chromosome no.3, 8 and partially with X chromosome. Further, when the clone containing the 360 bp insert was used as a probe, it showed hybridization with WNIN/GR-Ob samples, indicating that the cloned region is a part of the rat genome. With respect to WNIN/Ob, all the attempts to generate an elusive fingerprint remained unsuccessful.

The extramural project (funded by DBT) on genetic typing of the obese mutant rats (WNIN/Ob and GR-Ob) using microsatellite markers concluded this year. Out of the 96 markers screened, 62 markers showed successful amplifications. The cluster analysis of the data generated showed two distinct clusters of rats, the parental WNIN along with mutants forming one cluster and WKY, F-344, forming the second. This clearly shows that the mutants have indeed originated from WNIN and there is no contamination from other strains.

The study also revealed 9 markers which in combination can be used for identifying the three standard rat strains - WNIN, WKY and F-344. Amongst the 9 markers, the primer for leucosianin seems to be very promising as it can distinctly identify all the three strains as well as mutants. A detailed analysis of this marker is now planned.

Baseline data with respect to body composition, physical activity, clinical chemistry and physiology of laboratory animals was initiated and studies on WNIN, SD and F-344 rats were completed. The study showed significant differences between the 3 strains of rats and the study is now extended to other three rat strains (WKY, CFY and Holtzman) as well.

Constant and continuous research pursuits of the Institute not only helped in understanding the newer facets of the nutrition research but also provided appropriate guidelines for National level policy making on Nutrition.