Research in the field of nutrition was continued by the Council mainly through its institutes, the National Institute of Nutrition (NIN) and Food and Drug Toxicology Research Centre both located at Hyderabad. During the year under report, community surveys were undertaken to assess the status of fluorosis in Tamil Nadu and health and nutritional status of tribals of Rajasthan, Madhya Pradesh and Orissa. Studies were also conducted for assessment of women’s nutritional status, anticaataractogenic and antimutagenic properties of dietary components, anticaataractogenic properties of turmeric and genetic studies on obese mutant rats.

**COMMUNITY STUDIES**

**Studies to Control Health Risks of Fluorosis in Tamil Nadu**

A rapid survey carried out in 13 villages of five north-western districts of Tamil Nadu viz., Vellore, Dharmapuri, Krishnagiri, Salem and Erode revealed that the major source of drinking water was bore wells, which had fluoride levels, ranging from 0.5 – 6.6 ppm. The overall prevalence of dental mottling among the total population ranged from a low 17% in Vellore to a high 36% in Dharmapuri. The prevalence was relatively higher among children 10-14 yr. old (30% to 67%) in all the districts surveyed. The overall prevalence of skeletal fluorosis in all age groups was found to be less than 1%. The overall surveyed population with dental fluorosis was about 30 lakhs of which 9 lakhs were in 5-14 yr age group. Creating awareness about fluorosis among the community, discouraging consumption of water from sources with high fluoride content and supply of surface water (such as rivers and tanks) was recommended as a permanent solution to prevent and control the problem of fluorosis.

**Fluorosis in Tribals of Madhya Pradesh**

Effect of intervention was evaluated by RMRC, Jabalpur in two villages (Tilaipani and Hirapur) of Jabalpur, Madhya Pradesh which are worst affected with fluorosis. Fluorosis affected individuals (identified in 1996) were examined for its signs and symptoms. Fluoride level was estimated using fluoride ion selective electrode.

The overall prevalence of genu valgum was found to be 34.2% at baseline (1996), which came down to 1.2% after intervention (2003). The prevalence of dental mottling was 74.4% in 1996, which came down to 70% after intervention. The bowing of lower limbs seen in 1995, disappeared in 2003 (Fig. 1). There was complete reversal of bowing among mild cases and partial reversal in severe cases both in Tilaipani and Hirapur Villages.

Due to intervention, the fluoride levels in water were reduced to less than 1 ppm. Occurrence of new cases has been
There is complete reversal of mild skeletal deformities and partial
reversal in severe deformities, however, there has been no effect of intervention
on dental mottling.

**Diet and Nutritional Status of Saharia Tribals of Rajasthan**

A rapid health and nutritional survey carried out among Saharia tribals in
Shahbad and Kishanganj blocks of Baran district revealed that the average intake
(CU/day) of various foods, except for cereals and millets, was less than
recommended daily intake (RDI), while that of protective foods like pulses, green
leafy vegetables and milk and milk products was grossly inadequate (less
than 40% of the RDI). Though the average intake of protein, calcium, iron, thiamine
and niacin was comparable, the intake of other nutrients was below the RDA. The
extent of deficit was maximum with respect to vitamin A (62%), followed by
vitamin C (43%), total fat (35%), free folic acid (22%), riboflavin (14%) and energy
(9%). The prevalence of clinical forms of vitamin A deficiency such as conjunctival
xerosis (17.6%) and Bitots’ spots (8.3%) among preschool children was much
higher than that reported for 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 the health and nutrition programmes.

**Health and Nutritional Status in Rural Areas of Rajasthan**

Survey of micronutrient deficiency was undertaken by RMRC, Jodhpur in 5 villages
of Jodhpur district. Anaemia was observed

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**Fig. 1. Bowing of lower limbs due to fluorosis reversed to normal.**

1995  Intervention  2003
to be maximum among pregnant women (78.9%) followed by lactating women (77.5%) and was least in control group (66.9%). Pregnant women suffered mostly from severe anaemia (11.6%) in comparison to lactating women (8.1%) and control group (1.5%). Nearly 46 to 50% lactating and pregnant women suffered from mild to moderate iodine deficiency disorder whereas in control group it was only 26.8%. Severe iodine deficiency disorder was observed in 11.1% lactating women.

Under nutrition was very high in preschoolers (94.2%). Main morbidities observed in population were acute respiratory infection (9.6%) and fever (8.5%) followed by diarrhoea (1.7%). Both the morbidities i.e. acute respiratory infection and fever were higher in females than males. Discoloration of hair, a sign of protein calorie malnutrition was observed to be high i.e. 7.2%, (higher in females than males). Angular stomatitis, cheliosis and glossitis ranged from 0.6 to 1.3%. Prevalence of dental caries (36.1%) and dental fluorosis (18.5%) were also observed. Females suffered more from dental caries and dental fluorosis than males. Koilinichia, a sign of anaemia, was observed only in females (2.0%).

**Health and Nutritional Profile of Preschool Children from Jabalpur District**

Health and nutrition profile of preschool children from ICDS (511) and non-ICDS (617) villages of Kundam block, Jabalpur district was studied by RMRC, Jabalpur. Severe undernutrition (grade-III as per Gomez classification) was noticed in non-ICDS villages (17%) as compared to ICDS villages (8.4%). Immunisation coverage among the ICDS villages (59.7%) was significantly higher than non-ICDS villages (32.9%). Acute respiratory infections were the commonest morbidity observed in both ICDS and non-ICDS villages followed by worm infestations. In general, the prevalence of morbidities was less in ICDS villages as compared to non-ICDS villages. The study showed that ICDS has definite impact on health and nutritional status of preschool children in tribal areas.

**Health and Nutrition Status of Tribals from Orissa**

A health and nutrition survey was undertaken by RMRC, Bhubaneswar in four primitive tribes Bondo, Didayi, Kandha and Juanga of Orissa. Majority of the population studied amongst these tribes presented with anaemia as an important clinical presentation and the blood picture was found to be microcytic-hypochromic indicating nutritional anaemia. Prevalence of vitamin A deficiency in the form of night blindness and Bitot’s spot among preschool children was found to be 5.8% and 8.6%. Scabies was detected in 22% children and 34% adults which decreased by 25%-35% after intervention. The study indicated that most of the diseases are preventable in nature and timely intervention, health education and social awareness can reduce morbidity and promote good health.

Another study conducted for nutritional status of Dongria Kondh primitive tribe and Domb schedule caste population of Orissa indicated high prevalence of iodine deficiency disorders in the population. The study on iodine deficiency anaemia in three districts of
Orissa comprising 1937 non-school going adolescent girls revealed anaemia to be prevalent (ranging from 94-99%) amongst girls with under weight (40%) and stunting 32%. Only 15% girls were aware of anaemia.

**Prevalence of Overweight and Obesity among School Children in Andhra Pradesh**

A study carried out among urban adolescent school children (12-17 yr) in 13 schools of urban agglomeration of Ranga Reddy district revealed that the overall prevalence of overweight and obesity was 11%. The prevalence was significantly higher in private (17.2%) and private aided schools (12.7%) as compared to government schools (3%).

The prevalence of overweight and obesity was marginally lower among children participating in household activities and higher among children who spent long hours in sedentary activities like watching television. There is a need to impart health and nutrition education for the school children to encourage participation in physical work in the form of games and sports and to develop healthy food habits and life styles.

**Assessment of Nutrition Knowledge and Impact of Nutrition Education on Adolescent Girls in Urban Slums of Hyderabad**

Adolescent girls living in slums are reported to be highly vulnerable to undernutrition. They are also found to lack adequate knowledge on family life education as well as on sound nutrition. A study was undertaken in slum of Hyderabad city to assess the KAP of girls on nutritional issues. Collection of data from 450 school going adolescent girls living in urban slums by administering a questionnaire was completed. The questionnaire consisted of 96 questions including few open-ended questions. Codebook was developed and coding the questionnaires is in progress. Similarly, food frequency questionnaire (FFQ) was also administered to these girls. Based on the data analysis, various communication materials are being developed. The communication material (including print media such as pamphlets, folders and posters and multimedia including audiovisual aids, interpersonal communication aids and educational CDs) are also being used in the study.

Preliminary results of the study indicated that most of the children are not aware of the functions of foods, balanced diet and micronutrient deficiency disorders such as iron deficiency anaemia and coding deficiency disorders and, therefore, developing communication material in these aspects is envisaged. Similarly, preliminary observation of the FFQ data indicated more consumption of aerated drinks, bakery items and fast foods and less consumption of leafy vegetables and fruits. Hence, education on ill effects of aerated drinks and fast foods and the importance of micronutrients during this phase is being emphasized.

**Study of Nutritional Factors in Positive Deviance in Young Children**

Positive deviance deals with the study of healthy children born in poor socio-economic societies who, despite the presence of negative factors for proper growth and development, continue to remain normal and healthy, whereas a
majority of other children in the same community get affected by negative factors and become undernourished and hence are referred to as negatively deviated. A pilot study was conducted in the rural ICDS project area of Ibrahimpatnam *mandal* of Ranga Reddy district, Andhra Pradesh to study the nutritional factors in positive deviance in young children. Young children (6-24 month old) belonging to families below poverty line were included. The serial weight recordings of these children were collected from the *Anganwadi* centres. The prevalence of positive deviance was 16% in this group of children. It was seen that of the total children (408) studied, 22% were positive deviants. There was no gender difference in the percentage of deviance, whereas the effect of age was clearly seen in the number of children being positive deviant. It was observed that as the age advanced (more than 12 months) the rate of growth falterings increased.

**Implementation of FAO’s Feeding Minds, Fighting Hunger Programme**

FAO and a group of organizations launched a global nutrition education initiative “Feeding Minds, Fighting Hunger” (FMFH) for school children. A study was conducted during 2002 and 2004 to evaluate the efficacy of FMFH lesson plans in improving nutrition-related knowledge levels of the school children in Hyderabad. The schools in experimental and control groups were randomly chosen from the member schools of a collaborating voluntary organization, Confederation of Voluntary Associations (COVA). At baseline, the knowledge levels of VIII and IX class children and teachers in both the groups were measured. A significant improvement in the knowledge levels of the teachers was observed in experimental schools after two workshops, in which FMFH lesson plans were introduced to teachers and topics for development of communication material were identified. The intervention with communication material such as posters, skit and classroom activities, in the classroom setup through teachers resulted in a significant improvement in the knowledge levels of pupils in experimental group. Significant improvement in nutrition related knowledge was also observed in control group. Effect size indicated that the improvement of the knowledge-levels in experimental schools over control group was medium indicating the efficacy of FMFH programme in improving nutrition-related knowledge of school children. No significant decrease in the knowledge levels was observed after two months, indicating retention of the knowledge acquired through the programme.

**NUTRITION AND INFECTION**

**Obstetric Outcome and Proinflammatory Cytokine Response in Women with Genital Tract Infections**

Intrauterine growth retardation (IUGR) and prematurity are major determinants of postnatal survival and morbidity and are major public health problems that have not changed much in developing countries during last few decades. While the subject of maternal nutrition and its effects on IUGR received considerable focus, intrauterine infection, yet another important environmental
MAJOR ICMR RESEARCH PROJECTS IN NUTRITION
factor contributing to IUGR received very little attention in developing countries.

Significant association was found between chorioamnionitis and high concentration of IL-8 with IUGR, smaller babies and smaller head circumference. Infection and inflammatory response in the gestational tissues could adversely affect the intrauterine fetal growth. Identifying the specific bacterial agent responsible for gestational tissue infection will be critical in controlling IUGR.

**Persistent/ Recurrent Bacterial Vaginosis and its Effect on Preterm Delivery in relation to Maternal Nutritional Status**

Bacterial vaginosis (BV) is common in women of reproductive age group and is associated with preterm delivery, late miscarriages and post partum infection. Although amenable to antibiotics, recurrences occur in 30-50% women. A study was initiated to determine the factors that place women with BV at risk of preterm delivery like persistent BV, increased proinflammatory cytokines, IGF BP-1 and low micronutrient levels. Preliminary results indicate that 48% women tested positive for BV which persisted in 60% women after treatment. TNFα & IL-1β levels were significantly higher in those with BV. Percentage of premature deliveries was significantly higher among the positives.

**WOMEN’S NUTRITIONAL STATUS**

A study on body composition measurement by dual energy X-ray absorptiometry (DEXA) in women from an urban slum 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 the women in the optimal BMI category (18.5 – 23) have unacceptably high levels of body fat. Increasing weight and BMI is associated with increase in body fat % levels whereas increase in height is associated with increase in lean mass but not fat %.

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

A task force study has been ongoing since 2002 at four centres-AIIMS, New Delhi, NIN, Hyderabad, SGPGIMS, Lucknow and NIRRH, Mumbai with the objectives to establish peak bone mineral density (BMD) reference values for Indian men and women and to assess the prevalence of osteopenia and osteoporosis in Indian population. So far 3642 subjects have been enrolled. Preliminary analysis of data has shown that prevalence of osteopenia varied between 38.8-55.8 % in males and 37.5-54.0 % in females. Further, prevalence of osteoporosis was found to vary between 16.6-49.2 % in males and 18.3-51.1 % in females.

**NUTRITION AND CATARACT**

*Turmeric delays Diabetic Cataract:* Turmeric is a widely used spice in Indian
cuisine. Curcumin, the active principle of turmeric, has been shown to have numerous beneficial properties such as anti-inflammatory, anticarcinogenic, antiviral and antiinfectious. Another beneficial property of turmeric, i.e. delaying of diabetic cataract has been observed in rats. Studies done at NIN suggest that curcumin and turmeric prevent aggregation and insolubilization of lens proteins due to hyperglycemia by minimizing the oxidative and osmotic stress. The results demonstrate that turmeric or curcumin may provide a viable food-based, as well as pharmacological approach in the treatment of cataract.

Modulation of Chaperone Activity of α-crystallin in diabetic cataract by curcumin: Impaired chaperone function of α-crystallin could be involved in the formation of diabetic cataract. It has been demonstrated that in diabetic cataract, α-crystallin chaperone activity is diminished. Dietary curcumin delayed progression and maturation of diabetic cataract by modulating the chaperone activity of α-crystallin possibly through antioxidant effect.

**DRUG TOXICOLOGY**

**Cancer and Xenobiotics**

Antimutagenic property of ginger was observed in *in vitro* and *in vivo* experiments probably due to its antioxidant property. *In vivo* study in rats showed that ginger intake through diet can result in improved antioxidant status. A study conducted on people in high risk area for developing upper gastro intestinal cancer indicated that nitrosation potential was higher in these individuals as compared to those from low risk area. An intervention programme to sensitise and educate the public on rational use of drugs was developed for educating the masses.

**OTHER STUDIES**

**DNA Fingerprinting of Obese Mutant Rats**

Studies continued at Council’s National Centre for Laboratory Animal Sciences (NCLAS), Hyderabad for DNA fingerprinting of the obese mutant rats using random primers yielded a fairly constant DNA fingerprint for the GR-Ob strain. The PCR products (360 bp, 390 bp, 400 bp, and 600 bp) were 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.

**Genetic Typing of Obese Mutant Rats**

The DBT funded study carried out at NCLAS on genetic typing of the obese mutant rats (WNIN/Ob and GR-Ob) using microsatellite marker concluded this year. Out of the 96 markers screened, 62 markers showed successful amplifications. The 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 showed that the mutants have indeed originated from WNIN and there is no contamination from other strains. The study also revealed 9 markers which in
A 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.