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RESEARCH STAFF

Officers-in-Charge

Ghafoorunissa

MSc, PhD
NCLAS

B.Sivakumar

MSc, PhD
NIN/FDTRC

K.Vijayaraghavan

MBBS, MSc (AN), M.Sc (Comm.Hlth.)
NNMB (Upto Dec.2003)

CLINICAL DIVISION

MATERNAL AND CHILD HEALTH

Veena Shatrugna, MD

(Deputy Director)

B.A. Ramalakshmi, MBBS, DGO

K. V. Radhakrishna, MBBS, DCH

G. Jagjeevan Babu, MBBS

Bharati Kulkarni MBBS, DCH

G. Amarendra Reddy, MA, MPhil

Prabhavati Paranjape, BSc

PATHOLOGY AND MICROBIOLOGY

L. Singotamu, MSc, PhD

(Deputy Director-Sr-Gr)

B. Sesikeran, MD

(Deputy Director)

P. Uday Kumar, MD

R. Hemalatha, MD

P. Yashodhara, MD

SSYH. Qadri, MVSc

E.P. Ramachandran, BSc

L.A.Ramaraju

BIOCHEMISTRY DIVISION

Ghafoorunissa, MSc, PhD

(Deputy Director-Sr.Gr)

V.Vijayalakshmi, MSc, PhD

Arjun Khandare, MSc, PhD

Ahmed Ibrahim, MSc, PhD

C. Suresh, MSc, PhD

S.Hemalatha, MSc, PhD

N.Saravanan, MSc

MOLECULAR BIOLOGY

A. Vajreswari, MSc, PhD

(Deputy Director)

Nasreen Zafar Ehtesham, MSc, PhD

M. Kaladhar, MSc, PhD

Sudip Ghosh, MSc, PhD

Vijaya Banu, MSc, PhD

Neelam, MSc, PhD

S. M.Jeyakumar, MSc, MPhil

Abdul Haseeb, MSc

B.Aruna, MSc

BIOPHYSICS DIVISION

B. Sivakumar, MSc, PhD
(Deputy Director-Sr.Gr)
K. Madhavan Nair, MSc, PhD
Y. Venkataramana, MSc, PhD
S. Ranganathan, MSc, PhD
Meenakshi Subramanian, BSc
P. Ravinder, MSc, PhD
B.Sreedhar, MSc
Komila Pareek, MSc

FOOD CHEMISTRY DIVISION

T. Longvah, MSc
(Deputy Director)
S. Bapu Rao, MSc, PhD
P. Amrutha Rao, MBBS, DPH
P. Sujata, MSc, PhD
K. Bhaskarachary, MSc, PhD
P. Ramulu, MSc, PhD
Indira Ravindranath

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M. Raghunath, MSc, PhD
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Rita Saxena, MSc
G. Bhanu Prakash Reddy, MSc, PhD
P. Suryanarayana, MSc, PhD
C. Vijayakumar Reddy, MSc, PhD
S. Chennaiah, MSc, PhD
D. Sreeramulu, MSc, PhD
L. Venu, MSc
M.Satish Kumar, MSc
P.Anil Kumar, MSc
Megha Saraswat, MSc
T.Mrudula, MSc
Y.Durgakishore, MSc

FIELD DIVISION

K.Vijayaraghavan, MBBS, MSc (AN), M.Sc (Comm.Hlth.)
(Deputy Director-Sr.Gr & Officer-in-Charge, NNMB, upto Dec.2003)
G.N.V. Brahmam, MBBS, DPH
(Deputy Director)
Shahnaz Vazir, MA, PhD
A. Laxmaiah, MBBS, DPH
R. Harikumar, MBBS, DPH
N.Arlappa, MBBS
Ch. Gal Reddy, MA, MPhil
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Sharad Kumar, MA, MPhil
M. Ravindranath, MA

STATISTICS DIVISION

A. Nadamuni Naidu, MSc
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K. Venkaiah, MSc
T. Prasanna Krishna, MSc, PhD
M. Vishnuvardhan Rao, MSc, PhD
N. Balakrishna, MSc, PhD
Grace Maria Antony, MSc, PGDCA

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T. Vijaya Pushpam, MA, MPhil
G. M. Subba Rao, MA, PGDJ, PGDT
Anilkumar Dube, MA, MCJ, DPM
R. Nageswara Rao, MSc, BJ

LIBRARY

K. Sampathachary, BSc, MLISc, PhD
M. Devidas, MA, MLISc

INSTRUMENTATION

R. Subramanian, MSc, PhD
(Deputy Director)
Ramachander Chowgule

FOOD & DRUG TOXICOLOGY RESEARCH CENTRE (FDTRC)

B.Sivakumar, MSc, PhD
(Deputy Director-Sr.Gr & Officer-in-Charge)

FOOD TOXICOLOGY

V. Ramesh Bhat, MSc, PhD, DPEM
(Deputy Director-Sr.Gr)
S. Babu, MSc, PhD
(Deputy Director)
J. Padmaja, MSc, PhD
V. Sudershan Rao, MSc, PhD
S. Vasanthi, MSc, PhD

DRUG TOXICOLOGY

V. Jagadeesan, MSc, PhD
(Deputy Director-Sr.Gr)
Kalpagam Polasa, MSc, PhD, MBA
Deputy Director

M.P. Rajendra Prasad, MBBS, MSc(AN)
B. Dinesh Kumar, MSc, PhD
V.K. Goud, MSc, PhD
T.Manjula, MPharm

NATIONAL CENTRE FOR LABORATORY ANIMAL SCIENCES (NCLAS)

Ghafoorunissa, MSc, PhD
(Deputy Director-Sr.Gr & Officer-in-Charge)
S. Hariharan, MSc
(Deputy Director-Sr-Gr)
N.V. Giridharan, MSc, PhD
(Deputy Director)
S. Kalyanasundaram, MSc
P. Suresh Babu, MVSc
N. Hari Shanker, MSc, PhD
A.Uma Devi, MSc
Kiran Kumar, MSc

PRE-CLINICAL TOXICOLOGY

Ghafoorunissa, MSc, PhD
(Deputy Director-Sr.Gr & Officer-in-Charge)
NCLAS

B.Sivakumar, MSc, PhD
Deputy Director-Sr.Gr & Officer-in-Charge)
NIN/FDTRC

B. Sesikeran, MD
(Deputy Director)
Kalpagam Polasa, MSc, PhD, MBA
(Deputy Director)
N.V. Giridharan, MSc, PhD
(Deputy Director)
T. Prasanna Krishna, MSc, PhD
S. Kalyanasundaram, MSc
P. Uday Kumar, MD
P. Suresh Babu, MVSc
R. Hemalatha, MD
P. Yashodhara, MD
B. Dinesh Kumar, MSc, PhD
SSYH. Qadri, MVSc

ADMINISTRATION

K.C.Sankaran Kutty
A.V.Lakshmi, MA
G. Krishna Reddy, B.Com
Alexander Verghese
M.J.Radha Bai

MAINTENANCE

P.Rajamohan Rao, LCE, PGDCPEMM

HIGHLIGHTS

Being at the forefront of Nutrition Research in the country, the research endeavours of National Institute of Nutrition (NIN) encompassed a wide range of areas in food and nutrition related issues of national importance. The problems that have been dogging the nutritional well-being of population and the emerging epidemiological issues were given considerable importance. While some clinical studies laid emphasis on issues like osteoporosis among women, the lab-based studies looked into a plethora of areas such as, molecular mechanisms of cataract, insulin resistance, ageing process, food compositions, cancer and xenobiotics. On the other hand, efforts were initiated to start a National Dried Blood Spot Facility for vitamin A estimation at NIN, while the community studies looked into different aspects of public health interest like the prevalence of micronutrient deficiencies, iodine deficiency disorders, nutritional status of population in drought-hit states and adolescent obesity.

I. COMMUNITY STUDIES

Several States in India have been experiencing recurring drought conditions during the past few years. The year 2002-03 was no different for many states. On a request from the Ministry of Agriculture, a survey was carried out in nine drought-hit states to assess the impact of drought on diet and nutritional status of the community during May-June 2003. The mean intakes of foodstuffs in almost all the states were low and the households in all these states were not meeting the recommended levels of cereals and millets. Food Security was also not too encouraging among the households. The survey also found that the prevalence of underweight among pre-schools children was more than 50% in all these states, while prevalence of chronic energy deficiency ranged between 26% and 49% among males and 30% and 51% among females.

A large scale, eight-state community based survey was carried out to study the prevalence of micronutrient deficiency disorders involving both clinical and biochemical forms of vitamin A deficiency (Bitot's spots), iodine deficiency disorders and iron deficiency anaemia during this year. The overall prevalence of Bitot's spots was 0.8% and total goiter was 4% (below the WHO cut-off level of 5% to indicate endemicity). About 42% of the households were using non-iodized salt. It was largely lactating and pregnant women, adolescent girls and pre-school children who were found to be affected by anaemia. While IDD registered a decline well below the epidemic level, vitamin A deficiency continued to be a matter of public health concern in many states. The results underscore the need to strengthen the existing national nutrition programmes as well as nutrition education component embedded in them.

An earlier country-wide survey carried out to assess the changes in the prevalence of IDD particularly in the districts with higher levels of endemicity has revealed that the overall prevalence of total goiter registered a significant decline from 14-69% during 1984-94 to 3-40% this year, especially in the North-Eastern region of the country.

The fact that prevalence of obesity among adolescents is increasing, attracted attention and prompted a study to assess the prevalence of over-weight and obesity in urban adolescent school children. The study proved that the prevalence was higher among urban school children than their rural counterparts.

Yet another study established that consumption of breakfast was an important factor affecting cognitive functions especially attention concentration and immediate recall memory of the students. At the same time, it was also observed that the academic performance of regular breakfast eaters was better than the non-eaters.

II. CLINICAL AND PHYSIOLOGICAL STUDIES

Osteoporosis results in increased bone fragility and may lead to fracture of spine, hip and arm which is both an active as well as an early symptom. Research findings have revealed that Indian women experience early onset of osteoporosis as compared to their Western counterparts. Hence, they are more vulnerable to the problem.

Most of the Indian women belonging to the underprivileged sections of the society subsist on a diet low in calories, proteins as well as calcium. These women are seen to breastfeed their infants for prolonged period of time (> 1 year). It is possible that their dietary calcium is inadequate for bone accretion during the recovery period and hence there may be a mobilization of calcium from mother's skeleton leading to transient reduction in bone mineral density (BMD). Studies are being carried out to establish peak BMD reference values for both men and women and also to assess the prevalence of osteopenia and osteoporosis in Indian population groups in a multicentric ICMR Task Force Study. Another study is being conducted to assess the extent of loss of bone mass during post-partum period and also to find out if low calcium intakes are adequate for restoration of bone density. Conservation of calcium seemed to occur either through increased absorption or reduced excretion, or both. These compensatory mechanisms were observed to offset the breast milk calcium loss only in those women who enjoyed better nutritional status (in terms of body weights and BMI). The link between body weight and BMI with peak bone mass will be explored in further studies.

III. BASIC STUDIES

Assessment of vitamin A status in the population groups is a prerequisite to successful prevention and control of vitamin A deficiency disorders. A technology using the process of collecting dried blood spot (DBS) on filter paper and later analyzing for vitamin A using HPLC has been developed and made available at NIN. This National Facility was initiated with the support from Micronutrient Initiative and MOST, New Delhi.

The enzyme, aldose reductase (AR) in lens has been a drug target because of its involvement in the development of secondary complications of diabetes including cataract. A study was carried out to assess the inhibition of AR by the constituents of *Emblica officinalis* *in vitro* and in lens organ culture. It was found that aqueous extract of *E. officinalis* inhibited rat lens AR and recombinant human AR. The hydrolysable tannoids of *E. officinalis* were found to be responsible for AR inhibition. In an alternative approach, antiglycating agents (MAB1) have been worked out for delaying the onset of opacification of lens.

A study was carried out to assess the effect of calorie restriction with/without micronutrient deficiency on oxidative stress and ageing. The findings of the study established the beneficial effect of calorie restriction *per se* in protecting animals against oxidative stress and hyperinsulinemia.

Resistin, a cysteine rich adipocytokine, has shown to be implicated as a link between obesity and type 2 diabetes in mouse. Role of resistin in human was debatable. A study was carried out to characterize the structure of human resistin which revealed a reversible shift in secondary structure as a function of concentration and time. The level of expression of resistin gene in human will modulate the higher order structure and by implication its function.

Studies were carried out to investigate the effects of increasing dietary long chain n-3 PUFA from fish oil on membrane lipid composition and insulin sensitivity in skeletal muscle and adipose tissue of sucrose induced insulin-resistant rats. The results showed that replacement of 0.5% long chain n-3 PUFA (n-6/n-3 ratio = 10) prevented sucrose induced insulin resistance by increasing peripheral insulin sensitivity.

IV. FOOD COMPOSITION AND NUTRIENT AVAILABILITY

Rice, being the staple food in many parts of India, research guidelines for improvements in yield is an important process. As a result, new varieties are produced by the scientists and subsequently they enter the markets. The protein quality depends on their essential amino acid composition, hence a study was conducted on varieties of rice by analysing them for protein and amino acids content before and after polishing and were compared to the values documented in NIN's publication Nutritive Value of Indian Foods (NVIF). Results indicated that 8-10% polishing of rice decreased protein content by about 5%. In most cases, it was observed that the protein values of new rice varieties were higher than the earlier values reported in NVIF, with out any change in lysine content.

V. CANCER AND XENOBIOTICS

Antimutagenic and antigenotoxic potential of ginger was clearly established in a study. Another study was conducted on the patients suffering from upper gastrointestinal tract cancers. Estimation of *in vivo* nitrosation potential after administering proline was carried out. The metabolites of nitroproline were found to be significantly higher.

In the field of social drug epidemiology, an educational intervention strategy comprising both print and traditional folk-form in Andhra Pradesh (Harikatha) was used to sensitize general public on the issues of Rational Usage of Drugs. Also, a rapid screening procedure (*in vitro* and *in vivo*) was developed to assess the antioxidant activity of some herbal medicines.

VI. FOOD SAFETY

The institute is frequently approached by various agencies including governmental organizations to carry out community-based studies on public health issues. A rapid survey carried out in the villages of Bhandara district of Madhya Pradesh has revealed that several people were affected with toxicity-related illness on consuming Khesari dal (*Lathyrus sativus*). Another study in the tribal districts of Orissa showed that food samples were contaminated with aflatoxins and some other heavy metals including lead, cadmium, arsenic and mercury. In yet another study carried out in some villages of Nawadha district of Bihar, it was found that high fluoride concentration in drinking water was leading to vitamin D deficiency causing bone deformities in young children. Appropriate strategies to combat the problem were suggested.

VII. PATHOLOGY

A study was carried out to determine the effect of vitamin A restriction and supplementation on drug induced apoptosis of rat intestinal mucosal cells. It was observed that riboflavin and folic acid supplementation helps in preventing DNA damage, mutations and the occurrence of cancer as well as chemotherapy restricted adverse effects.

VIII. NCLAS

DNA finger printing of the obese mutant rats using random primers yielded a fairly constant DNA fingerprint for the GR-Ob strain. Similar pattern was not found in WNIN/Ob strain and hence alternative techniques to obtain results are being explored. Also, genetic typing of obese mutant rats using microsatellite markers was carried out. Out of 100 markers proposed to be screened, 60 primers spanning a majority of the chromosomes have been completed.

IX. PRE-CLINICAL TOXICOLOGY

The existing Pre-clinical Toxicology expertise in the Institute gained new emphasis and continued to carry out various service activities assigned to it. A research study was also taken up to carry out toxicity and allergenicity evaluation of recombinant Hepatitis B vaccine in mice and guinea pigs.

Thus research studies carried out in a wide array of fields epitomise the Institute's consistent zest in exploring newer frontiers in the field of nutrition, while addressing the current issues in a holistic approach. These research achievements would not have been possible without the co-operation extended by all the staff of NIN, with whose unstinted support the institute forges ahead to face newer challenges.