CHAPTER – V

SUMMARY AND CONCLUSION

School children constitute a major segment of the Aligarh city whose health and nutritional status will indicate the trend of changing nutritional profile of this region. They constitute a large proportion and therefore have a significant effect on the overall health status of the population of Aligarh city. It was revealed that only one third of the school children that too from higher socio-economic spectrum were apparently healthy. This fact serve as an eye opener as any deviation from normal health in this age group is likely to have serious consequence in future health and well being of people.

5.1 The Study

The research work ‘A Study of Nutritional Assessment of Urban School Children of Aligarh City’ was undertaken among 2582 children (1218 boys and 1364 girls) aged 5 to 15 years studying in 1st to 10th classes in the selected schools of Aligarh city. It was designed with the following aims. To assess the status of growth and development of school children both boys and girls by using anthropometric measurements. To evaluate age and sex wise prevalence of underweight, stunting and wasting among school children. To assess the differences in nutritional status by child, family and social factors. To study the dietary habits and nutritional intake and examine association of food intake and nutritional status. To assess the magnitude of nutritional deficiency diseases among school children by general clinical observation. To assess the prevalence of Iodine deficiency disorders by clinical and biochemical examination of urine iodine excretion level. To study the association between the prevalence of Iodine deficiency disorders by child, family and social factors.

The study related to first objective yielded information on anthropometric measurements. It identified anthropometric variations in children, which is indicative of under nutrition. It also helped to ascertain the different grades of nutritional status
prevailing in children to fulfill the need of second objective. The relevant data on child, family and social status served to reveal the degree and extent of cause effect relationship of these variables on nutritional status of the children. The clinical examination of children helped to reveal the extent of various deficiency diseases prevailing in children. The in-depth clinical examination facilitated identification of goitre used for screening the children for the presence of different grades of goitre prevalence. The clinical data collected has also helped in correlating the various social factors that influenced the goitre prevalence. The biochemical analysis for iodine content in urine of the children helped in assessing the current iodine status of the children. The children were screened for anthropometric measures and for other child, family and social status related information.

The study revealed that the majority of children were either first or second born and had family size of four members or less. The families of the children were mostly nuclear. The per capita monthly income of the majority group was less than Rs1000 per month. Most fathers of the children were college educated and belong to the service class. A very low percentage of mothers of the children had college education and percentage of the working mothers was also low.

5.2 Anthropometrical Measures

The mean weights of the boys in the study were consistently lower than ICMR well to do children differing by 2.5 kg to 9.43 kg across the ages. When compared with ICMR standard, the boys weighed about 71.4 to 87.01 percent of ICMR standards.

The mean weight of girls was lower than ICMR well to do children differing by 3.43 kg to 13.97 kg across the ages and they weighted about 67.43 per cent to 89.72 per cent of ICMR standards. Mean weight of the boys was marginally better than that of the girls.

Boys were found to be heavier than girls up to 9 years and from 10 to 12 years, the differences between boys and girls were very marginal and then from 13 years onward boys surpassed girls in weight.
Results on height of boys indicated that boys were shorter than well-to-do boys of ICMR by 2.95 cm to 9.33 cm from 5 to 15 years and were measuring 93.03 to 98.31 per cent of ICMR standard.

Girl's stature differed on the negative side of the ICMR standard ranging from 2.18 to 12.79 cm and showed 88.6 to 96.61 percent of ICMR standard statures. On comparison between the mean height of boys and girls, the result indicated that boys have significantly higher height than girls except for the age group 7, 8, 9, 11 and 12 years. Adolescent spurt of growth appeared from the 9th year onwards in girls and from 10th year onward in boys. Maximum gain in height occurred between 10 to 12 years in girls and from 13 to 15 years in boys.

On comparison between the mid arm circumference of girls and boys of the study, the results revealed that the boys had significantly higher mid arm circumference than the girls at age 8, 9, 11, 12, 14 and 15 years.

The result of the triceps skin folds thickness of the girls showed significantly greater values than those of boys for all ages except at age group 10 years, where the triceps skin fold of girls were marginally lower than boys which may be attributed to the onset of pre-adolescent period which occurred earlier in girls than boys.

The study depicts a meaningful health status of school children of Aligarh. The children had lower height and weight as compared to most international and national studies. Their growth standards, however, were equally comparable to figures only from very few studies reported.

Increased birth order, literacy and educational level of mothers, ignorance of health knowledge, occupational status of mothers, poor hygienic conditions, occupational level of both fathers and mothers and income level which in turn affects the socio-economic conditions were the main factors that have significant bearing on the growth status of the children in the city of Aligarh.

It can be concluded from the study that Aligarh children were lagging behind physical development when compared to ICMR and NCHS standards. The lagging is more in weight than in stature and hence, there is a considerable room to improve the school children physical status.
For assessing the nutritional status of each age group by sex, the weight and height measurements were converted into weight for age (underweight), height-for-age (stunting) and weight for height (wasting) for each child into different nutritional grades.

The percentage of boys showing normal weight for age after statistical analysis was found to be 18.6 per cent with 81.4 percent underweight children. When grade I, II and III were considered together for boys the prevalence ranged from a minimum 57.9 per cent in 15 years to a maximum of 96 per cent for 7 year old.

In case of girls subject of 5 to 15 years, 15.7 per cent were found to be in the normal grade with 84.3 per cent underweight girls. When grade I, II and III undernourished children were clubbed together the prevalence of overall undernourished children ranged from a minimum of 54.8 per cent in 14 and 15 years to 96.7 per cent for 7 year old girls. The overall prevalence of underweight for both boys and girls were 82.9 per cent.

The age wise analysis revealed that for both boys and girls, a higher rate of prevalence of undernourishment was observed for the younger age group up to 12 years of age and from 13 years onwards a comparatively lower prevalence was noticed in the children studied.

On comparison of overall prevalence of under nutrition between boys and girls, again the girls showed a high prevalence of 84.33 per cent as against 81.4 per cent for boys. The prevalence of underweight in the study was higher among the girls than the boys. The higher prevalence in girls than boys may be attributed to the fact that the child rearing practices for male children is more careful than female children in our male dominated society. The preferential treatment and feeding of male children over female has been commonly observed.

It was also observed that out of 1218 boys, 56 per cent fall within normal range of height for age with 36.8 per cent in grade I, 6.7 per cent in grade II of stunting. Only 0.41 per cent of stunting was found in grade III category of stunting.

The analysis revealed that in case of girls, out of 1364 subjects, 36.2 per cent were found in the normal grade, with 50.1 per cent in grade I nutritional status, 12.8
per cent in grade II nutritional status and 0.9 per cent in grade III nutritional status. The overall analysis revealed that the total prevalence of stunting was 54.5 per cent with 43.88, 9.95 and 0.6 percent in grade I (mild), grade II (moderate) and grade III (significant) stunted children.

In comparing the growth status of Aligarh children in this study sample with other growth studies in India the findings were not in total agreement. It was observed that with regard to some studies there was a similarity and for others a high prevalence rate was observed in the present study.

On age wise analysis, the study observed that as in case of underweight a higher prevalence of stunting for both boys and girls was found in young children in the age group of 5, 6 and 9 years with a minimum prevalence in 14 and 15 years.

It was reported that as long as height-for-age is stable after the minimum age of school enrolment (6 years) then there is little or no catch-up growth and heights for age at 8 or 9 years reflects the effect of early childhood nutrition. In the present study, the children in the age group of 5, 6 and 9 years were found to be suffering from higher rates of stunting, thus reflecting the nutritional deprived condition during the early years of life.

On comparison between girls and boys the overall prevalence of stunting showed that more girls than boys were experiencing different forms of stunting.

With respect to wasting of boys 85.5 percent were found to be in normal grade with 12.3, 1.8 and 0.3 per cent in grade I, II and III respectively with overall prevalence of 14.5 per cent wasting.

The result relating to prevalence of wasting in girls revealed that 87.5 per cent were in normal range with 10.3, per cent in grade I category of wasting, 1.46 per cent and 0.73 percent in II and III category of wasting with the overall prevalence of 12.5 per cent wasting in girls.

When the prevalence for all the three nutritional grades are considered together, the over all prevalence was found to be highest for 12 years with 34.7 per cent followed by 15 years with 20.2 per cent and a nil prevalence for 8 years.
The higher proportion of malnutrition in children observed in the study calls for greater vigilance and more immediate solutions. To strengthen relevant intervention programmes for combating the malnutrition among children, it is suggested that focused targeting be emphasized. Nutrition education programmes should be imparted to schoolchildren. More importantly nutrition advocacy to policy makers should be intensified.

5.3 Personal and Social Factors

The percentages of children with normal nutritional status were slightly higher in children having two siblings 22.18 percent in comparison to 8.1 percent in 7\textsuperscript{th} and above born children. The prevalence of undernourishment was 84.2 per cent in children with three or more siblings in comparison to 81.8 per cent in children having less than two siblings.

The children belonging to small families show comparatively lower prevalence of malnutrition. The prevalence of underweight by family size shows an increasing trend with increase in number of family members from 81.4 per cent to 84.25 per cent.

Nutritional status progressed with increase in mothers as well as fathers educational level. The study also found three-time higher prevalence of severe grade of malnutrition in children of illiterate mothers. The positive correlation of education and the nutritional status, thus emphasize the fact that education is a catalyst of change and its role in the process of human resource development cannot be ignored. Women’s education is also critical for meeting the region specific, demographic and health goals in growing urban centers like Aligarh city.

The lack of basic amenities and awareness about importance of health, hygiene and sanitation as well as rearing practices and unhealthy behavior etc. could be the cause of association of under nourishment with parental education. Besides the socio economic disparities between the children of educated and uneducated parents may be a contributory factor for the differences observed. Generally speaking low
income and large family size go hand in hand. The effect of these two factors is very much expected to influence the nutritional status of the young children.

Nutritional status of children increase with increase in parental occupational level. Further on comparison of prevalence of malnutrition in children between paternal and maternal occupation, it was observed that children of occupational mothers suffers lesser degree of malnutrition, about 60.16 percent of children in comparison to 82.67 percent of malnourished children of paternal occupation.

With regard to the prevalence of severe degree of malnutrition the analysis revealed that there were no children in severe grade of mothers who were engaged in professional, service and skilled occupations, but with regard to father's occupational level, only professional and service categories did not show any severe grade malnourished children.

An inverse trend was noticed in nutritional status of the children as the income decreased. The prevalence of malnutrition in the lower income group was the highest in comparison to other income groups.

It was found that relatively low percentage 56.90 percent children of working mothers were found to be suffering from malnutrition against 94.56 percent in children of non-working mothers.

The overall prevalence of malnutrition was found to be somewhat high in the vegetarian children 84.36 percent in comparison to 81.7 percent in non-vegetarian children.

No significant relationship was seen between the prevalence rate and religion in this study.

The observations of the study revealed that ordinal position contributes the most to the nutritional status followed by education of mother, occupation of father, occupation of mother (housewives or working status of mother) and socio-economic status. As the problem of malnutrition amongst school children should also be addressed at home level, the factors identified in the study are important for the development of relevant interventions at the domestic plane. The higher prevalence of malnutrition with increasing birth order highlights the need for limiting the family
size to improve the nutritional status of these children. Measures like maintenance of proper birth spacing between two children, as well as limiting the family size with one or two children should be emphasized on urban educated families too. Measures like improving the educational level of girl child (would be mother) removal of gender discrimination, providing job opportunities to girls so as to improve their financial conditions are also the priority issues to improve the nutritional status of children. Appropriate multifaceted community based programmes are also required for stimulating growth and development of school children.

5.4 Food Intake

On comparison of food intake between normal and underweight children it was found that dietary intake of cereal differ significantly. The study revealed that the average consumption of cereal, pulses, meat and other food groups except roots and tubers and fats were substantially below the recommended allowances. Between boys and girls the consumption of milk and meat products were found to be higher for boys as compared to girls.

The average calorie intake was found to be deficient for all age groups except 5-6 year age group children. The result revealed that the average intake were inadequate for the entire nutrient except for calcium, thiamine and riboflavin and were below the recommended daily allowances.

5.5 Nutritional Deficiencies

Statistical analysis showed that overall prevalence of anemia in Aligarh children was 29.86 percent with 32.33 percent in girls and 27.09 percent in boys.

In contrast to highest prevalence of under weight, stunting and wasting and other nutritional deficiency signs, the prevalence of vitamin- A deficiency was low. The total overall prevalence was found to be 13.86 with 12.64 per cent in boys and 14.95 per cent in girls.

The signs of vitamin B complex deficiency like angular stomatitis, chieliosis and glossitis were observed in 15.82 percent children. In girls the prevalence of
vitamin B complex was 19.10. It was observed to be higher than the boys figure of 13.13 percent.

Statistical analysis revealed that 37.02 percent of children had shown clinical sign of dental carries.

5.6 Iodine Deficiencies

Eighty five children out of 1218 boys (6.97%) and two forty nine girls (18.25%) out of 1364 were found with the sign of different grades of goiter with total prevalence of 12.93 per cent, signifying the existence of iodine deficiency in Aligarh.

The research revealed that though prevalence was high in the deteriorating condition of nutritional status, with highest prevalence 58.97 percent in grade III of nutritional status, children with normal category status were not spared as 7.72 percent children of normal category were also found with symptoms of OB grade of goitre, thus calling for an immediate intervention programme to control and prevent the iodine deficiency disorder in children irrespective of their nutritional status.

A slight increase in the rate of prevalence with decreasing income group was observed. The high prevalence of goitre in low socio economic status may be due to the intake of non iodized salt, faulty food habits (prolong high intake of goitrogenic food), ignorance about ill effects of iodine deficiency disorder, and ionization of salt. It was observed that socio economic status of people is also related with the general awareness regarding iodine deficiency disorder. It is felt that improvement in the socio economic status will lead to greater awareness regarding the problem.

When overall goitre prevalence rate was analyzed according to the food habits, it was found that the vegetarians showed higher goitre prevalence 17.53 percent than the non-vegetarians with 9.18 percent of goitre prevalence.

On analysis it was observed that the overall prevalence of goitre was low (9.94%) in children taking iodized branded salt in comparison to children (19.94%) taking non-iodized branded coarse or open salt.
Result revealed that 75.27 percent of the iodized salt had an iodine content of 15 ppm and more whereas none of the crystalline salt samples had iodine content of 15 ppm and more. About 35.27 percent of crystalline salt had no iodine content at all.

On comparison between iodine content of salt and prevalence of goitre, it was observed that almost all the children (194) who were consuming salt with nil content of iodine showed different grades of goitre with 25.25 percent on OB grade, 54.12 percent in grade II and 20.61 percent in grade III category.

On analyses for urinary iodine excretion, only 5 girls (1.83%) were found to have UIEL of <2.0 μg/dl (severe iodine deficiency). It was found that 3.66 per cent and 8.05 per cent have UIEL of 2.0-4.9 μg/dl and 5.00-9.9 μg/dl respectively. The overall median urinary iodine excretion of the girls studied was found to be 11.65 μg/dl.

Out of 244 boys studied it was found that only 1 boy (0.40%) showed urinary excretion level of <2, and 3 (1.22%) and 6 (2.45%) had 2-4.9, and 5-9.9 μg/dl urinary excretion level respectively. The median urinary iodine excretion level of boys studied was found to be 14.60 μg/dl.

When the total iodine urinary excretion level for both boys and girls (517 children) was analyzed, it was observed that 6 (1.16%), 13 (2.51%) and 28 (5.41%) of the children had urinary iodine excretion level <2, 2-4.9, and 5-9.9 μg/dl respectively. In the present study, the median urinary iodine excretion of the children studied was 12.64 μg/dl indicating that there was no biochemical deficiency of iodine in the subjects studied.

The total goitre prevalence rate of 12.93 percent found signifies the existence of iodine deficiency in Aligarh city, necessitating corrective intervention on priority basis. These findings indicate that to achieve elimination of iodine deficiency disorder from the city, there is a need for appropriate multifaceted community-based programmes such as monitoring the quality of iodized salt, improving nutrition education about the ill effects of dietary goitrogen and the importance of iodized salt.

The study revealed that in children the major clinical conditions encountered were anemia, dental carries and vitamin A deficiencies. Infection of skin and eyes...
were observed to be more common. The higher prevalence of anemia in younger age group makes a strong case for continuing iron tablet supplementation from preschool to school age group also. The overall higher incidence of dental caries apart from poor hygienic care of teeth in children probably reflects fluoride content of drinking water and hence necessitates further exploration of this problem. The intervention programme of supplementary vitamin and minerals that are mainly focused on preschool children should also be imparted to the school age children. The observations of the present study suggest that the nutritional status of school children in the city of Aligarh is unsatisfactory. Majority of the children were underweight and were suffering from various nutritional deficiencies. The overall health condition of children was poor and necessitate a routine thorough health checkup for diseases, which result in ill health and poor classroom performance. The appalling state of health of school children as revealed in this study emphasize the need for establishing proper school health clinics in Aligarh city.

5.7 Limitations

➢ No intensive follow up studies could be undertaken.
➢ School performance correlates could not be studied.
➢ The biochemical correlate like blood spot and TSH could not be studied.
➢ Factors such as birth weight, physical activity, and psychosocial aspects could not be undertaken.
➢ The accuracy of the estimates of nutrient contents of foods consumed was based on ICMR tables and other values and could not be individually determined in a laboratory.
➢ Iodine estimation of water could not be done for samples from all the subjects.
➢ Ultrasonography could not be done for assessment of IDD.

5.8 Future Research Areas

➢ The present study should form the basis for a larger, location specific survey in the Aligarh district and other regions of Uttar Pradesh and India.
This cross sectional study also open up a basis for further investigation in cross sectional as well as longitudinal studies in school children as this area needs regular monitoring.

Studies need to be undertaken in school children on nutritional assessment and environmental correlates in other parts of India. This would reaffirm the findings of the existing study and identify other environmental factors that relates to nutritional status of children.

Multiple factor dietary intervention strategies and their impact is an area that requires serious exploration.

Studies on environmental factors and nutritional status at family level could add to the understanding of interaction of genetic and environmental factors and hence deserves the attention of the future researchers.

Studies on role of micro and macronutrient in various nutritional deficiency diseases are other important areas suggested for further research.

Biochemical correlates of nutritional status if thoroughly investigated may add to our further understanding.

Role of education and intervention programmes on knowledge awareness and practices of school children about nutritional status are other variables that needs further scientific probing.

Investigation on emotions, anger, hostility, low self-confidence, low cognitive achievements with nutritional status in boys and girls can also be an area of research importance.

Research on girls and goitre prevalence as girls are more severely affected is a phenomenon that deserves expanded attention of future researchers.

The higher rate of prevalence from 5 to 12 years needs further investigation.

The findings higher prevalence of under nourishment in girls open new vistas for future research.
5.9 Proposed Measures

The study suggests the importance of modern healthy living styles in the young. Meaningful programmes that promote awareness in school children about the positive and negative implications of nourishment and under-nourishment, effects of the developmental process on the changing environment and other vital health aspects are indispensable. Such awareness would bring realization to the children as to how the nutritional status controls their growth and personality, their living pattern, aspirations, opportunities and their physical and mental health. These programmes could help to create confidence in children and build healthy relationships in them. Children would then be serious about their diet and equip themselves adequately in various spheres of skills, good health and behavior in changing social settings. Investments made now would pay later. A more effective human resource would developed for the future progress of the country. This could be done with both short and long term perspectives through school-based programmes.

5.10 Short Term Programmes

➢ Awareness campaigns in school highlighting nutritional status as a major risk factor that causes both physical and mental growth retardation.

➢ Focusing on relation of good nutrition and health. Importance of maintaining normal anthropometrical standards.

➢ Diffusion of information on the known genetic and environmental risk factors in children.

➢ Relation of IDD and educational achievements.

➢ Awareness about nutrition deficiency disease and malnutrition implication.

5.11 Long Term Programmes

The long-term programme should be aimed at control and prevention of malnutrition in children. This could be achieved firstly, by detecting such children
and secondly, by modifying the environmental factors causative of underweight and other complications. For this the following suggestions are proposed.

- Medical health checks of children annually in the schools. These should be compulsory and the State Government should support such a programme.

- Monitoring and follow up of children with underweight.

- Counseling services to be introduced in schools. These services shall function in multiple areas. Firstly for identifying the children at risk, children to be tapped are those with underweight, stunting, poor academic achievers, obese children and those with goitre symptoms.

- Creating awareness about small family norms in families having more than two children.

- The promotion of birth spacing method can also help to reduce family size.

- Counseling on importance of maternal employment and providing guidance and correlating opportunities at family level.

- School meals programme diet to be modified to overcome nutritional deficiencies by supplementing additional iodine, iron, vitamin A, B and C and other vital nutrients, based on city specific nutrition deficiencies surveys.

- The school children should be encouraged to take up kitchen gardening and poultry rearing as a hobby and extra curricular activity so that family as a whole can have access to fresh and nutritional fruits and vegetables, eggs and meat.

The services of expert psychiatrists to be used for vocational guidance, particularly for those children who are underachievers and those who fear school and studies. Counseling system on general health issues pertaining to nutritional disorders, overweight and obesity should be introduced in every school. Dietary counseling could create normal, regular and healthy eating habits in children thus ensuring better health and growth.
Short term and long term programmes thus help to minimize the environmental factors associated with malnutrition in children. Implementation of the suggested measures would release the stress in children and build confidence in them. Proper guidance could help the children to equip themselves with suitable skills, according to their own interest and capability. All these measures would help children to develop a healthy style of living so necessary for coping with the changing environment of a developing world.