

V SUMMARY AND CONCLUSION

The present research entitled, “Assessment of **Health Status of School Children and the Influence of Demographic and Lifestyle Factors**” was conceived with the main objective of assessing the present health status of school children and determine the confounding factors affecting health. The research was conducted in Coimbatore city, Tamil Nadu among 6 to 15 year-old school children from selected Matriculation, Corporation and Panchayat schools. From each category five schools were selected and both boys and girls belonging to classes one to ten were chosen at random for the study. A total of 6190 children were chosen comprising 3098 boys and 3092 girls.

The specific objectives of the study were:

- A. Determine the demographic pattern, socio economic profile, lifestyle practices and family medical history of school children from urban and rural schools of Coimbatore.
- B. Study the influence of child rearing practices on the health status.
- C. Assess the health status of the children in terms of anthropometry, clinical, biochemical and dietary parameters.
- D. Analyze the impact of food service outlets in schools on the health status of children.
- E. Create awareness among students, parents, teachers and food service personnel on nutrition facts, healthy lifestyle and best sanitation and hygienic practices and evaluate the same.

The study was carried out in four phases.

First phase comprised of collection of information on demographic, socio-economic, lifestyle and familial factors of the selected children. A sample of 6190 children with 2180 from Matriculation, 2122 from Corporation and 1888 from Panchayat schools were interviewed to obtain information. This information was collected using well developed interview schedule.

A subsample of 1852 children was chosen to study their birth details and feeding habits during infancy. A questionnaire was administered to the parents to obtain information and the parents were explained the need of the study.

In the second phase, nutritional status of the children was assessed using anthropometry, clinical examination, biochemical estimations and diet survey. Anthropometry comprised of measurement of height, weight, waist circumference

and mid upper arm circumference. This was done for all the 6190 children. Body Mass Index was computed using height in centimeters and weight in kilograms, while waist to height ratio was computed using waist circumference (cm.) and height (cm.). Clinical examination was carried out to identify symptoms of deficiency for the entire sample. Blood pressure was estimated for all the children.

Biochemical estimation was done for a sub sample as only for these children consent was obtained from parents for drawing blood. The subsample of 1852 children was chosen for estimating blood glucose levels. Lipid profile was done for 30 obese and comparable group of 30 non obese children. Blood hemoglobin estimation was carried out for a sub sample of 200 anemic and non-anemic children, comprising of 85 boys and 115 girls.

Utilizing the interview schedule developed, types of foods consumed, meal pattern, menu, skipping of meals, consumption of snacks and junk foods and types of fruits and vegetables consumed were elicited. A three-day dietary recall was used for all the 6190 children to quantify food and nutrient intake. Prevalence of overweight, obesity, underweight and lifestyle disorders was analysed.

In the third phase, impact of food service outlets in selected schools on the health status of children was evaluated. Only three Matriculation schools had food service outlets within their premises and they were taken up for the study. In Corporation and Panchayat schools, there were no food service outlets within the premises. Hence, foods sold outside the school premises in carts and petty shops from where school children bought snacks were evaluated.

Information was collected on functioning of the food service outlets in terms of management, menus offered and type of service followed through a questionnaire. A check list was used to evaluate sanitation of the food service and hygiene of the food service personnel. The same was done for outside eateries also. This information was collected for planning nutrition counseling programmes.

The health status of the regular and occasional customers to the food service was evaluated in terms of height, weight and waist circumference and a comparison was drawn for Matriculation as well as Corporation and Panchayat schools. The food and nutrient intake of the regular and occasional customers to the food service was assessed.

Phase IV comprised of imparting counseling to children, teachers, parents and food service personnel in the selected schools to improve their knowledge, attitude and practices on nutrition, sanitation and hygiene. Various audio-visual aids suitable for the groups were developed and utilized in counseling. The knowledge, attitude and practices of the students, teachers, parents and food service personnel was evaluated using a questionnaire. After nutrition education to the experimental group, the impact of education on knowledge, attitude and practices was evaluated using the same questionnaire.

An intervention programme was planned and implemented for obese children. The intervention consisted of training in aerobic exercise, yoga and junk food restriction. Children were divided into three groups, comprising of 40 children in each group with equal number of boys and girls. The first group was made to perform aerobic exercises. The second group was involved in yoga and the third group was counselled to restrict junk foods and monitored continuously by the investigator. The intervention was carried out for nine months. The effect of intervention was assessed by measuring the weight, height, waist circumference and mid upper arm circumference for the three groups of children. Physical exercise and yoga were conducted daily for one hour by the investigator with the help of physical education trainers in the school.

All the results obtained were statistically analyzed. Mean, standard deviation, student's 't' test, ANOVA, correlation co-efficient and 'Z' test were involved in analysis wherever appropriate and conclusions were drawn.

The salient findings of the study were:

PHASE I: DEMOGRAPHIC, SOCIO-ECONOMIC AND LIFESTYLE OF CHILDREN AND INFLUENCE OF CHILD REARING PRACTICES

- Out of total number of 6190 children selected, 2180 belonged to private Matriculation schools (urban area), 2122 were from Government Corporation (urban area) and 1888 were from Panchayat schools (rural area). Though equal number of boys and girls were selected from the three types of schools, due to drop outs in Corporation and Panchayat schools, the final number varied.
- Children from Matriculation schools belonged to upper socio-economic status while those from **Corporation and Panchayat schools were from comparatively lower socio-economic status.**

- Nuclear family system was predominant in urban area comprising of Matriculation and Corporation schools while joint family was predominant in Panchayat schools which belonged to rural area. **The difference between nuclear and joint family system in urban and rural areas was significant at 90 per cent confidence level** (using Z test of significance).
- Parents of Matriculation school children had better educational status and hence their occupation and income were also better compared to parents of Corporation and Panchayat school children, where six and seventeen per cent fathers and seven and 12 per cent mothers were illiterate. **Illiteracy was more predominant in rural and poor socio-economic strata of urban areas.**
- The leisure time activities of the children were mostly centered on television viewing, computer games and internet browsing. As computers were still not popular in rural areas, the children were involved in outdoor games after school hours. **Outdoor games were rarely seen in urban areas due to space constraints.**
- Among the sub sample of children, more pre-term births were noticed in Panchayat schools (21%) compared to Matriculation and Corporation school children. Similarly, low birth weight was more in rural area (21%). On statistical analysis it was found that **BMI had direct correlation with term of birth and birth weight.**
- Panchayat school children were breastfed for longer duration compared to Matriculation and Corporation school children. Analysis of correlation coefficient revealed that **duration of breastfeeding was indirectly correlated with BMI, with greater BMI found among children who were least breastfed.** Introduction of weaning foods was done earlier (one month onwards) in urban area compared to rural area where weaning foods were introduced only from the fourth month.
- Health status of family members revealed that fathers, mothers, uncles and aunts as well as grandparents were afflicted with diabetes, cardiovascular disease, cancer and osteoporosis. There was a significantly greater prevalence of diabetes mellitus in urban area. However, with regard to cardiovascular disease and cancer, the difference in prevalence between urban and rural areas was not statistically significant.

PHASE II: ASSESSMENT OF NUTRITIONAL STATUS OF CHILDREN IN TERMS OF ANTHROPOMETRY, CLINICAL EXAMINATION, BIOCHEMICAL PARAMETERS AND FOOD AND NUTRIENT INTAKE

- A comparison of the mean heights and weights of the children from the three types of schools revealed that Matriculation school children were taller and heavier compared to the children from the other two schools. On comparing with reference values, it was found that the mean heights of the Matriculation school boys were greater than the ICMR (2010) values (95th percentile) and comparable to the 75th percentile values of CDC (2010). The mean heights of both Corporation and Panchayat school boys were lesser than both ICMR and CDC values. **ICMR has proposed that values beyond 95th percentile indicate overweight and obesity, while values above 75th percentile of CDC standards indicate overweight and obesity.**
- In Matriculation schools, girls showed a mean height greater than ICMR values beyond eight years, but lesser than CDC values in all age groups. However, among Corporation school girls though the values were lesser than both standards, after the age of 12 years, the mean heights were greater than that of ICMR values. In Panchayat school girls, the mean height values were lesser than both standards in all age groups.
- The mean body weights were also greater for Matriculation school children compared to children from Corporation and Panchayat schools. Comparison with ICMR 95th percentile values revealed that for boys from both Matriculation and Corporation schools, the mean weights were higher. Panchayat school boys showed lesser values. **However, boys from all three types of schools showed values lesser than the CDC (2010) 75th percentile values. In case of girls, the mean weights were more than the ICMR in all the three types of schools while it was lesser than CDC values.**
- The mean waist circumference values of Matriculation school boys were lesser than the NHANES (2004) study but were comparable to that of PEACH (2011) study. However, the waist circumference values of boys in Corporation and Panchayat schools showed lesser values compared to both the standards considered. Among girls, both Matriculation and Corporation schools showed greater values except at six years in Corporation schools, while girls from Panchayat schools recorded a lower waist circumference compared to the

PEACH study. Girls from all the three schools showed lower waist circumference values compared to the NHANES, U.S. study. This shows that **compared to U.S. standards, the children from the present study had lower waist circumference while it was comparable to the PEACH study in India.**

- Mean Body Mass Index of both Matriculation and Corporation school children were higher than WHO (2007) standard but lesser than the CDC (2010) values in all age groups. In case of boys from Panchayat schools, the BMI values were lesser than both the standards. In Matriculation school girls, the BMI values were higher than WHO values in all age groups. When compared with CDC values, the BMI values were lesser up to the age of nine years beyond which there was a significant increase. Girls from Corporation schools showed mean BMI values which were lesser than CDC values up to the age of nine years and lesser than WHO values up to the age of seven years, beyond which the mean values were higher than both the standards. Panchayat school girls showed lesser values than CDC but their mean BMI values were higher than WHO values from the age of 10 years. This shows that **adiposity was found more among girls than among boys.**
- **A salient feature was that the BMI values of both boys and girls in Matriculation schools were greater than that of Corporation school children. Matriculation and Corporation school children had values greater than that of children from Panchayat schools.**
- **The prevalence of overweight (18%) and obesity (8%) was more among Matriculation school children. However, in rural area prevalence of underweight was more (18.5%)** when BMI percentiles were considered according to the CDC (2010) standards.
- The mean waist to height ratio of the Matriculation and Corporation school boys was greater than that of BSI (British Standard Institute) standards but lesser when compared to PEACH study. However, the mean waist to height ratio of rural boys was lesser than both the standards considered. In Matriculation school girls, the mean waist to height ratio was greater than the BSI study and lesser than the PEACH study. A similar trend was observed among Corporation school girls. In Panchayat school girls, the same trend was observed with regard to PEACH study but with regard to BSI standards,

lower values were observed up to the age of seven years while the mean waist to height ratio was greater than BSI values. **This brings out the prevalence of greater abdominal obesity among Indian boys and girls compared to British children, the exception being boys in rural areas.**

- The prevalence of obesity was found to be higher when waist to height ratio was considered with the boys and girls in the present study showing greater prevalence (**48.5 % in urban area and 27.5% in rural area**). This shows that abdominal obesity was more among children of the present study compared to British standards. **The prevalence of obesity as per waist to height ratio was more among girls compared to boys proving that girls were shorter and fatter than the boys in all the three schools. However, an urban rural difference was also observed with more urban children falling under the obese category.**
- Mid upper arm circumference values led to the conclusion that none among the Matriculation school children was malnourished, while **mild to moderate malnutrition was present among 1.5 per cent in Corporation and 4 per cent in Panchayat school children.**
- Iron deficiency anaemia was the major deficiency recognized among the children, the girls being affected more than the boys (45% vs. 40.7%) and **greater prevalence of anaemia was observed among Corporation school children compared to Matriculation and Panchayat schools.**
- Higher blood glucose values were observed among 3.5, 2.5 and 1.5 per cent of Matriculation, Corporation and Panchayat school children respectively. **These children were classified under pre-diabetics, as recommended by the American Diabetes Association (U.S) and an Indian study by Mohan et al. (2007). These children showed signs of metabolic syndrome like obesity (> 85th percentile for age), hypertension (systolic or diastolic BP >95th percentile for age) and evidence of dyslipidemia (low HDL levels or elevated triglyceride levels) in addition to being pre diabetic with blood glucose levels ≥ 125 mg/dl.** These symptoms have been identified jointly by the ATP III and WHO for detecting metabolic syndrome in children.
- Metabolic syndrome characterized by symptoms of high blood glucose levels, elevated lipid profile, obesity and increased blood pressure was observed more among Matriculation school children.

- A significant difference at one per cent level was observed between the blood lipid levels of obese and non-obese children with obese children having greater levels compared to non-obese.
- The prevalence of anaemia was more among girls compared to boys. The mean hemoglobin values were significantly different between the boys and girls.
- Prevalence of hypertension was seen among urban adolescents at the rate of three per cent among boys and one per cent among girls.
- Dietary pattern among the children revealed that majority were non vegetarians. Only 0.05 to three per cent vegans were found among children of all the three schools. Among Matriculation school children, both rice and wheat based breakfast foods were consumed, while rice based items were predominant among Corporation and Panchayat school children. In addition, Panchayat school children consumed millets. Milk was consumed by majority of Matriculation school children while it was coffee or tea among Corporation and Panchayat school children.
- Rice based packed lunch was the norm in Matriculation schools for lunch, while the Corporation and Panchayat school children ate lunch in the mid-day meal programme of the Tamil Nadu government. For dinner, Matriculation school children consumed rice based preparations while Panchayat school children ate millet based foods. In Corporation schools, eating outside was more preferred for dinner among children.
- Skipping of breakfast was commonly observed among all the three schools.
- Less consumption of fruits and vegetables was also found.
- Consumption of snacks was commonly present among all the children, with school breaks and at home. Fried snacks were the most preferred. Also carbonated beverage consumption was found to be more, especially in urban area.
- **Non vegetarian food consumption was greater in rural area.** Children in the noon meal scheme in Corporation and Panchayat schools ate egg five times a week. The consumption of meat, fish and poultry was also more among Panchayat and Corporation school children followed by Matriculation school.

- Quantity of food intake by Matriculation school children revealed excess of cereals, fats and oils, meat, fish and eggs and sugar and jiggery in all age groups. Other food groups such as pulses, green leafy vegetables, other vegetables, roots and tubers, fruits and milk were found to be deficient in the diets of these children.
- In Corporation school children, cereals, fats and oils, meat, fish and eggs and sugar and jaggery (except in the age group of 10-12 years) were consumed in excess, while other groups like pulses, green leafy vegetables, other vegetables and roots and tubers, fruits and milk were deficient compared to the recommended allowances in all the age groups.
- From the food intake of the Panchayat school children it could be seen that cereals, fats and oils, meat, fish and eggs and sugar and jaggery (except in the age groups of 10-12 years and 13-15 years) were consumed in excess while all other food groups were found to be deficient compared to the ICMR recommended allowances (2010).
- In all the three schools, nutrient intake revealed that children had excess energy and fat intake and all other nutrients were deficient in their diets.

**PHASE III: EVALUATION OF THE IMPACT OF FOOD SERVICE OUTLETS IN THE
SELECTED SCHOOLS ON HEALTH STATUS OF CHILDREN**

- A major influencing factor in the junk food consumption among Matriculation children was the presence of school food service outlets. In Corporation and Panchayat schools, children ate from outside eateries.
- One of the school food services in Matriculation schools was managed by the school authority while the other two were privately managed. Waiter and counter service methods were followed in the service of food. In the school food service where cooking was elaborate, more food service personnel were involved.
- Corporation and Panchayat school children ate snacks from outside eateries which were petty shops or carts.
- The types of foods sold in the Matriculation school food service outlets ranged from snacks and beverages to South Indian meals, while in outside eateries it was mainly fried foods, boiled gram, cut fruits and high fat sweets.
- Due to the availability of greater pocket money, Matriculation school children made it a habit to consume snacks and beverages in the school food service

while the quantity consumed by Corporation and Panchayat school children was less and they also had lesser variety of foods.

- A comparison of the mean height, weight and waist circumference between regular and occasional customers to the food service revealed that there was a significant difference in mean weight and waist circumference, but no statistically significant difference existed in mean height values in Matriculation school children. Among Corporation school and Panchayat school children, there was no significant difference in any of the mean values showing that the impact of junk food was predominant in Matriculation schools only.
- A comparison of the food and nutrient intake between the regular and occasional customers revealed that the food served in the food service outlet tended to increase energy and fat consumption of children without contributing much to other nutrients. There were more of snack and junk foods.
- In children from Corporation and Panchayat schools, a significant difference was observed for fat and calcium with customers consuming more fat and lesser calcium due to greater intake of fried foods by the children consuming from outside eateries and less calcium intake due to avoiding milk and consuming other beverages. However, there was significant difference in vitamin C owing to the difference in the consumption of fruits between those who ate from outside eateries and those who did not, with those from outside eateries having more intake of fruits and thereby greater vitamin C intake.
- Cleanliness in the Matriculation school food service was adhered to in the form of daily, weekly and spring cleaning schedules. However, the outside eateries from which Corporation and Panchayat school children ate had poor regard for hygiene and sanitation.
- In personnel hygiene, however, several aspects like hand washing, trimming of nails, employee uniform, use of disposables and head wear were lacking in the Matriculation food service outlets. Similarly compliance was not found in certain preparation practices like washing and cutting of vegetables, hand washing and serving food.
- In the outside eateries, the quality of all the foods served was very poor with scant regard for food and personnel hygiene.

PHASE IV: PROMOTION OF GOOD FOOD HABITS AND HEALTHY LIFESTYLE IN CHILDREN AND COUNSELING OF TEACHERS, PARENTS AND FOOD SERVICE PERSONNEL

- Nutrition education imparted to children, parents, teachers and food service personnel was highly effective. The effect of nutrition education on children was found to be statistically significant at one per cent level with improvement in knowledge in terms of nutrient content of foods, daily food and nutrient requirements, types of foods needed, quantity of foods consumed, junk foods, health and hygiene aspects, attitude in terms of preference for nutritious foods compared to junk foods, consumption of more vegetables and fruits and in the choice of suitable recreational activities and practice in the form of improved choice for good quality and perfect quantity of foods consumed, inclusion of more vegetables and fruits in the diet, improved physical activity and reduction in television viewing time. Similar changes were observed for parents and teachers with experimental group showing a significant improvement in knowledge, attitude and practice compared to the control group.
- When HACCP techniques were taught and later evaluated in the food service personnel, a statistically significant improvement was observed.
- The effect of intervention programmes on children in the form of aerobic exercises, yoga and avoiding junk food consumption brought out the highly positive effect of aerobic exercises in reducing both weight and waist circumference in children, which was significant at one per cent level. Yoga helped to reduce waist circumference and the difference was significant at one per cent level compared. However, the change observed by avoiding junk food did not provide significant results. **This brings out the importance of physical activity in controlling excessive weight gain in children and could help in planning effective physical training programmes for children on a continuous basis.**
- Both aerobic exercises and yoga involved the exercising of abdominal muscles which led to the decrease in waist circumference in these obese children. Physical activity was found to be essential for weight reduction in children and adolescents.

The study carried out among the selected Matriculation, Corporation and Panchayat school boys and girls brought out greater prevalence of obesity and overweight among urban children compared to rural counterparts, who exhibited greater extent of underweight. The dual prevalence of both obesity and overweight as well as underweight was found out in the selected children. This necessitates the management of not only the food consumed by these children, but promotion of healthy and sanitary habits among the children to prevent infections. This would in turn influence better absorption of nutrients and prevent the occurrence of dietary deficiencies among children. In these selected children, in addition to dietary deficiencies, lifestyle disorders, especially metabolic syndrome was seen. This calls attention towards improving the physical activities of these children, most of whom are involved only in sedentary leisure time activities.

The intervention planned for the children brought out the benefits of aerobic exercises and yoga.

Hence a combined strategy of modification of lifestyle pattern, dietary intake by restricting junk food and excess calorie consumption and following an exercise pattern would help prevent obesity and overweight and the consequent lifestyle disorders in children.

The results of the present study indicated the high correlation between overweight or obesity with affluence. High socio-economic status predisposed to consumption of calorie dense fatty foods and junk foods, physical inactivity and altered lifestyle such as spending more time in front of television and computers coupled with greater snacking. Urbanization restricted space available for outdoor activities.

This changing scenario of lifestyle has resulted in increasing incidence of high blood glucose, blood lipids and hypertension, collectively called as metabolic syndrome, the condition which has never existed in the past among children.

Education and counseling of children, teachers and parents is indicated for safeguarding the health of children as well as the future of India.

Limitations of the study

1. It was difficult to get permission from parents to withdraw blood for biochemical analysis.
2. Difficulty in eliciting data from the food service outlets inside and outside the schools was felt.
3. Due to academic activities, more number of children could not participate in the intervention programmes.
4. Photographing of the children was not permitted by the school authorities which was felt as one of the greatest constraints by the investigator.

Recommendations for future studies

1. Researches could be undertaken by including more number of schools and subjects.
2. A relationship between junk food consumption and academic performance of the children could be adjudged.
3. A comparison of health status of children from Metropolitan cities and remote rural areas could be initiated.