

III METHODOLOGY

The present research entitled “**Assessment of Health Status of School Children and the Influence of Demographic and Lifestyle Factors**” was done in four phases. The methodology followed in each phase is described below.

PHASE I : DETERMINATION OF DEMOGRAPHIC, SOCIO-ECONOMIC AND LIFESTYLE FACTORS AND STUDY THE INFLUENCE OF CHILD REARING PRACTICES

- A. Research Design
- B. Selection of Schools
- C. Selection of Sample
- D. Formulation of Tools for Collection of Data
- E. Collection of Data

A. RESEARCH DESIGN

The research design drawn for the conduct of the study was descriptive research where an attempt was made to describe the health condition of children by collecting information from a large group of school students to fully describe a phenomenon namely the health status of children. School going children from six to 15 years are selected and their present health status is described in terms of anthropometric, clinical, biochemical and food and nutrient intake.

According to Shuttleworth (2008) descriptive research design is a scientific method which involves observing and describing the behavior of a subject without influencing it in any way. Surveys, case studies and correlation analysis are categorized under descriptive research (Jefferies 2011).

B. SELECTION OF SCHOOLS

School children selected from both urban and rural areas of Coimbatore formed the target groups. Five each of private Matriculation and Government Corporation schools from urban area and five Panchayat schools from rural area were selected for the study. The choice of the schools was based on the location namely urban or rural areas. Two types of schools namely Matriculation and Corporation schools were selected from urban area because there was a vast difference in the socio-economic status and lifestyle of children of these two types of schools.

Permission was obtained from the Inspector of schools for Matriculation schools, Chief Educational Officer for Corporation schools and Panchayat Educational Officer for rural Panchayat schools. The sampling method for the selection of schools was judgement sampling based on location, accessibility, feasibility to collect data, co-operation of the school authorities, students, teachers and parents.

Statisticians often use the method of judgement sampling in exploratory studies and focus group studies. One advantage of judgement sampling is the reduced cost and time involved in acquiring the sample (Statistics Canada, 2009).

Black (1999) points out the advantage of judgement sampling as ensuring balance of group sizes when multiple groups are selected.

C. SELECTION OF SAMPLE

Sampling is the process of selecting units (e.g., people) from a population of interest so that by studying the sample we may fairly generalize our results back to the population from which they were chosen. A sample is a subset of a population of individuals, objects, or events chosen to participate in a research study (Grinnel et al. 2010).

The sample for the present study consisted of 6190 children studying in classes one to ten of the selected Matriculation, Corporation and Panchayat schools.

Both boys and girls in the age group of six to 15 years were selected from the chosen schools. Stratified random sampling was followed in selecting the children from each class using age and gender as the strata.

Equal number of boys and girls were selected from each of the selected schools. Willingness of the students, parents, co-operation of the school authorities and the teachers was ascertained before the commencement of the study.

To study the influence of child rearing practices, a sub sample of 25 per cent (1852) of total number of selected children, whose mothers were willing to divulge information on child rearing and weaning practices were selected through random sampling method. This comprised of 625 Matriculation, 615 Corporation and 612 Panchayat school children representing all age groups.

D. FORMULATION OF TOOLS FOR COLLECTION OF DATA

1. Interview schedule

Interview schedule is defined as a measuring instrument used to collect data in face-to-face interviews (Grinnel et al. 2010).

An interview schedule (Appendix I) was framed to obtain information on personal details namely age, class studying and gender, demographic details namely place of residence, family system, socio-economic factors namely education, occupation and income of the parents and lifestyle factors like recreational and physical activities of the children. These details were cross-checked with school records also.

2. Questionnaire

Questionnaire is a type of instrument in which multiple responses are usually combined to form a single overall score for a respondent (Grinnel et al. 2010).

A questionnaire (Appendix II) was framed to collect information on child birth, child rearing and feeding practices of children, family history of diet related disorders as well as any illnesses which were/are prevalent among the children and /or among other members of the family.

3. Pilot study

A pilot study was conducted to pre-test and validate the interview schedule and questionnaire. A convenient sample of 60 children (20 from each type of school) and 60 mothers (20 from each type of school) were selected and the tools were pre-tested. Based on the pilot study, suitable modifications were made in the interview schedule and questionnaire.

E. COLLECTION OF DATA

Data was collected utilizing the interview schedule through direct personal interview from 6190 children. Personal factors namely age, class-studying, gender, demographic factors namely place of residence, family type, socio-economic factors namely educational and economic status of parents, lifestyle factors namely physical activities in school, recreational activities at home, athletics and games played, dietary factors like food consumption pattern were elicited and recorded. Each sample was individually interviewed by the investigator.

Plate I shows interview being conducted by the investigator. Out of the 6200 children selected, 6190 children co-operated in completing the interview schedule. The rest expressed unwillingness for the study.

The questionnaire, targeting the sub-sample of 1852 children, was sent to the parents through the children. A letter was enclosed along with the questionnaire requesting true data, giving assurance that the information would be kept strictly confidential. The investigator visited the houses of the selected children in both urban and rural areas and explained the need for true answers and assisted in the completion of the questionnaire. Plate II shows the explanation given to a parent for filling the questionnaire.

Information on the birth details of the children, breastfeeding and weaning practices followed was obtained through the questionnaire.

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

A. Selection of sample

B. Assessment of nutritional status

1. Anthropometric measurements
 - a. Measurement of height
 - b. Measurement of weight
 - c. Measurement of Mid Upper Arm circumference
 - d. Measurement of waist circumference
2. Clinical examination
3. Biochemical estimation
4. Diet survey

A. SELECTION OF SAMPLE

The entire sample of 6190 children whose background information was studied in Phase I were selected for assessing the anthropometric measurements, clinical examination, blood pressure measurement and diet survey. Biochemical examinations were done for the subsample as described below:

A subsample of 1852 children for whom child rearing and weaning practices were assessed in Phase I was chosen for estimation of blood glucose level.

Another subsample of 30 obese children and 30 normal weight children were chosen for estimation of blood lipids. Only those children who were willing to give blood for estimation were included in the study.

A subsample of 200 anaemic and non-anaemic children as deduced through clinical examination was chosen for estimating blood haemoglobin levels.

Permission was obtained from school authorities and parents of the selected children for subjecting them to biochemical examination.

B. ASSESSMENT OF NUTRITIONAL STATUS

1. Anthropometric measurements

Anthropometry is a widely used, inexpensive and non-invasive measure of the general nutritional status of an individual or a population group.

Anthropometry is the study of the measurement of the human body in terms of the dimensions of bone, muscle and adipose (fat) tissue. Anthropometry focusses on development of bodily features such as body shape and body composition (static anthropometry), the body's motion and strength capabilities and the use of space (dynamic anthropometry) (Herron, 2006).

a. Measurement of height

Height of a child is affected by a combination of factors like age, sex, diet, amount of exercise and environment (Khan, 2011). Height/stature measurement is valuable and practical method in assessing the growth of children (Dhingra et al. 2010).

Height was measured using a stadiometer for Matriculation and Corporation school children as stadiometer was available in all Matriculation and Corporation schools. The children were asked to stand barefoot on the stadiometer with feet together and legs straight and the wooden bar was made to touch the head and the corresponding reading was taken to the nearest of 0.1 cm.

In case of Panchayat schools, markings were made on the vertical wall using a scale and the children were made to stand against the wall and a scale was placed horizontally above their head without parallax error. They were asked to move away and the corresponding reading was recorded to the nearest of 0.1 cm.

The procedure was repeated thrice to obtain accurate readings.

Height was measured for all the 6190 children from all the three types of schools.

b. Measurement of weight

Normal growth and development pattern affecting body shapes and sizes could be inferred using body weight measurements in children (Barslow, 2007).

Weight is an important part of the physical growth of children and is an indicator of health and wellness. Adequacy of nutrition in children is determined by the gain in weight. Traditionally, attention has been focused on under nutrition in weight measurements. However, in the present decade, concern about excessive weight gain has increased which encompasses overweight and obesity.

Weight was recorded using an electronic digital scale. The digital LED was adjusted to read zero before weighing the children. Then the children were made to stand on the scale bare foot on the center of the weight scale platform. The weight was recorded in kilograms to the nearest of 0.1 kg. Recording of weight helps in monitoring the growth of children and in detecting any weight irregularities in comparison with standard growth charts (CDC, 2011).

Weight was recorded for all the 6190 children selected from the three types of schools.

c. Measurement of Mid Upper Arm Circumference (MUAC)

Mid Upper Arm Circumference is the most useful and practical method for assessing muscle mass, as this region is easily accessible and measurement requires simple procedure.

In the field, quick assessments of wasting in young children could be made using mid-upper arm circumference (Tolt, 2006).

The arm circumference insertion tape, which is a non-tear, stretch-resistant plasticized tape was used to measure the mid-upper arm circumference of children.

The midpoint of the child's left upper arm was calculated by locating the tip of the child's shoulder and the tip of the elbow. The child's arm was straightened and the tape was wrapped around the arm at mid-point and the arm circumference was recorded to the nearest of 0.1cm (Cogill, 2003).

d. Measurement of waist circumference

It has been speculated by Fernandez et al. (2004) that waist circumference alone may be a more useful and more easily obtainable index in both adults and children for assessing the risk for cardiovascular diseases.

Waist circumference predicts metabolic syndrome abnormalities in children (Hirschler, 2007).

The use of waist circumference has significant clinical utility for the prediction of risk factors for cardiovascular diseases and metabolic syndrome among children and adolescents. Waist circumference is also a predictor of insulin resistance syndrome in children and adolescents and could be included in clinical practice as a simple tool to help identify children at risk (Hirschler et al., 2007).

The WHO STEPwise Approach to Surveillance provides a simple standardized method for collecting, analyzing and disseminating data for waist circumference. The WHO STEPS protocol for measuring waist circumference instructs that the measurement be made at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest (WHO, 2008). A stretch resistant fiber glass tape was utilized for the process and the tape was extended around the waist of the children at the superior border of the iliac crest. The tape was positioned in the horizontal plane to the site of measurement. The tape was checked for its parallel position to the floor and that it did not compress the skin. According to the WHO STEPS protocol, the tape was kept snug around the body, but not pulled tight to avoid constriction.

e. Computation of Body Mass Index

Body Mass Index (BMI) is a number calculated from a person's weight and height. BMI provides a reliable indicator of body fatness for most people and is used to screen for weight categories that may lead to health problems (CDC, 2011).

BMI is a reliable indicator of body fatness for most children and teens. BMI does not measure body fat directly, but Mei et al.(2002) has shown that BMI correlates to direct measures of body fat, such as underwater weighing and dual energy x-ray absorptiometry (DXA). BMI can be considered an alternative for direct measures of body fat. Additionally, BMI is an inexpensive and easy-to-perform method of screening for weight categories that may lead to health problems. For children and teens, BMI is age- and sex-specific and is often referred to as BMI-for-age.

Calculating BMI is one of the best methods for population assessment of overweight and obesity. Because calculation requires only height and weight, it is inexpensive and easy to use. Body Mass Index was calculated by dividing weight by square meters of height.

$$\text{Body Mass Index} = \frac{\text{Weight (kg)}}{\text{Height (m}^2\text{)}}$$

BMI percentiles are the most commonly used indicators to assess the size and growth patterns of individual children. The percentile indicates the relative position of the child's BMI number among children of the same sex and age and denotes whether a child is underweight, healthy weight, overweight or obese (CDC, 2011).

f. Computation of Waist to Height Ratio (WHtR)

Waist circumference and Waist to Height Ratio are better predictors of cardiovascular disease risk factors in children than BMI (Savva et al. 2000). The waist-to-height ratio is more sensitive than BMI as an early warning of health risks. It is significantly associated with all risk factors for obesity and metabolic syndrome and can predict morbidity and mortality in longitudinal studies, often better than BMI. (Ashwell and Hsieh 2005). Waist-to-height ratio is a simple and effective global indicator for health risks (Hara et al. 2002, Kahn et al. 2005)

The WHtR may give a more accurate assessment of health for those who have a higher percentage of muscle and a lower percentage of body fat. Waist-to-Height ratio is a simple measurement for assessment of lifestyle risk and overweight. Waist to height ratio is equally fair for tall and short children. (<http://www.health-calc.com/body-composition/waist-to-height-ratio>).

Waist to height ratio was calculated by dividing waist circumference in centimeters by height in centimeters.

$$\text{WHtR} = \frac{\text{Waist Circumference (cms)}}{\text{Height (cms)}}$$

Waist circumference to height ratio (WC-HR) was calculated by dividing waist circumference (expressed in centimeters) with height (expressed in centimeters). It was found that waist to height ratio (WC-HR) had a higher predictive power for diabetes than waist circumference and BMI and there was a better continuous relationship for WC-HR as compared to waist circumference or BMI (Hadaegh et al., 2006).

2. Clinical Examination

A clinical or physical examination is an evaluation of the body and its functions using inspection, palpation (feeling with the hands), percussion (tapping

with the fingers), and auscultation (listening). A complete physical examination usually starts at the head and proceeds all the way to the toes. (Tally and O'Connor, 2009)

In this study, the symptoms of deficiency diseases observed in the epithelial tissues were assessed for all the 6190 children with the help of a general physician and were recorded. Proforma on symptoms of nutritional deficiency recommended by ICMR (2010) was followed (Appendix III).

Blood pressure was measured for all the 6190 children on three consecutive days and mean blood pressure as recommended by NIH (2010).

3. Biochemical Estimation

Biochemical estimation namely blood glucose and lipid profile were done to assess the risk for lifestyle diseases among children. A sub sample of children was subjected to analysis of blood glucose and lipid profile.

Blood glucose was measured at the fasting state using the electronic blood glucose monitor based on glucose oxidase method recommended by WHO (2012) for a sub sample of 1852 children. Lipid profile of 30 obese children and a comparable group of 30 non obese children was estimated by the Liebermann-Buchard method recommended by NIN (2003). Lipid profile included total cholesterol, triglycerides, LDL cholesterol and HDL which were analysed for the subsample.

Assessment of haemoglobin is one of the most important tools for assessing the nutritional status of children. Blood haemoglobin was assessed on a subsample of 84 anaemic children for whom clinical examination revealed symptoms of anaemia and 116 clinically non-anaemic children. Haemoglobin levels were measured using a haemoglobinometer by the Tallquist method. The procedures followed in the biochemical estimations are described in Appendix IV.

The investigator visited the house of the children on school holidays/weekends and collected the blood samples for analysis of the respective parameters. With the help of a laboratory technician blood samples were collected and analyzed.

4. Diet Survey

The interview schedule developed to collect background data was used to assess the food consumption pattern of the children. Data on types of foods

consumed, meal pattern, menu, skipping of meals, snack and junk foods consumed, types of fruits and vegetables consumed were elicited with the help of the interview schedule developed.

Consecutive three-day dietary recall was used for all the 6190 children to quantify food and nutrient intake. Cups and measures recommended by Home Science Association of India were used to find the quantity of food consumed at all three meals. In Corporation and Panchayat schools, the food eaten by children in the noon meal programme at school was recorded. In Matriculation schools, either the lunch brought in lunch box or eaten at food service outlet in school was assessed. The cooked foods were converted to their corresponding raw equivalents and the nutritive value of the amount of raw ingredients was calculated using the Nutritive Value of Indian Foods (ICMR, 2010).

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

- A. Selection of school food service outlets
- B. Selection of sample
- C. Collection of data

A. SELECTION OF SCHOOL FOOD SERVICE OUTLETS

American Heritage dictionary (2011) defines school food service as a dining area, as at a school where meals may be purchased and eaten.

School food service forms an integral part of a healthy school environment. The cafeteria plays a central role in educating and modeling healthy behavior and can serve as a learning lab for nutrition education.

Phase III consisted on evaluation of the food service outlets and impact on the health status of children. Three food service outlets in the Matriculation schools were selected. Corporation and Panchayat schools did not have food service outlets within their premises. In these schools, the foods sold outside the school in carts and petty shops were included for evaluation.

B. SELECTION OF SAMPLE

A total of 3028 Matriculation children from three schools and 1740 Corporation and Panchayat school children were chosen.

From the three Matriculation schools, 1936 students who regularly patronized the food service and 1092 who did not patronize the food service were chosen for the study, based on their willingness to participate.

In Corporation schools, 528 who regularly consumed food from outside eateries while 452 who did not eat food in the outside eateries regularly and from Panchayat schools, 422 who consumed food in the outside eateries regularly and 334 who did not consume outside food were considered for the study after obtaining their consent.

Both the patrons and non-patrons to the food service were selected in order to draw a comparison between the two groups in terms of the diet consumed and their health status. This was done to infer the impact of eating outside food on the health status of the patrons and non-patrons.

C. COLLECTION OF DATA

A questionnaire (Appendix V) was formulated to obtain information from the school food service outlets of Matriculation schools. Questionnaire elicited details on the functioning of the food service outlets in terms of management, menus offered and type of service followed. Information was collected from the supervisor of the food service outlets.

A check list (Appendix VI) containing information on adherence or non-adherence to cleanliness was used to judge the level of sanitation in terms of washing of equipment, cleaning of the food service area, cleaning after each service and food handling methods.

In the case of Corporation and Panchayat schools, a questionnaire (Appendix V) was used to determine the types of snacks sold outside the school during interval. The sanitary conditions of the eateries outside the school premises were judged using a check list (Appendix VI).

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

- A. Education of children, teachers, parents and food service personnel
- B. Intervention programme for obese children
- C. Evaluation of the intervention programme

A. EDUCATION OF CHILDREN, TEACHERS, PARENTS AND FOOD SERVICE PERSONNEL

Phase IV was undertaken for the promotion of good food habits and healthy lifestyle among students, through reinforcement from parents, teachers and to guide the food service personnel on personal hygiene and sanitation. Teachers and parents were included in the counseling to help children develop better food habits and to have a multi-pronged approach in education.

1. Methods of counseling, audio-visual aids used and duration

Children were counseled through group and individual counseling methods, while parents, teachers and food service personnel were individually counseled on the right types of foods, sanitation and hygiene aspects.

Power point presentation was used for group counseling while pamphlets and charts were used for individual counseling sessions in case of Matriculation school children. In case of Corporation and Panchayat schools, group counseling was provided using black boards and charts, while individual counseling was similar to that done in Matriculation schools.

Pamphlets were used as aids in individual counseling sessions.

For food service personnel, appropriate charts were pasted in the food service insisting on correct preparation and serving techniques as well as on sanitation and hygiene. Demonstrations on efficient food handling procedures were carried out. A check list was used to evaluate the practices before and after education.

Time taken for group counseling was 30-45 minutes, while individual counseling was done for 30 minutes. The counseling was repeated twice for each group.

2. Education of children

A sub sample of 1800 children was chosen for counseling. They belonged to all the three different schools. The children were randomly chosen from all classes and they belonged to ages six to 15.

The topics used in counseling pertained to balanced diets, consumption of vegetables and fruits to obtain micro nutrients, hygienic consumption of foods, avoiding junk foods, involving themselves in recreational activities other than television watching, keeping the environment clean to avoid diseases, regular physical activity to maintain ideal body weight and to prevent occurrence of deficiency diseases and lifestyle disorders.

Children were counseled by assembling them in groups during school hours by obtaining permission from the school Principals.

3. Teachers

Teachers belonging to the various schools were randomly chosen to provide counseling. A total of 250 teachers were selected and were educated on the basic requirements of children in the various age groups and the effect of good nutrition.

Teachers were involved in monitoring the children for variations in height and weight, prevalence of deficiency symptoms, especially iron deficiency anaemia, personal hygiene of the children and ensure that children complete their lunch (packed lunch in case of Matriculation schools and mid-day meal in case of Corporation and Panchayat schools). Teachers were counseled after school hours.

4. Parents

A total of 250 parents were chosen for providing education on the importance of nutrition and hygiene for the health of their children.

For parents, a discussion on nutrient composition of common foods, need for including a healthy breakfast for the children, oils suitable for cooking, conservation of nutrients through better cooking methods, healthy snacks to be sent to school and the effect of eating out was carried out.

Parents were counseled in their houses during day time and in case of working mothers, week end was scheduled for providing counseling.

5. Food service personnel

All the 36 personnel from the three food service outlets selected for the study were included in counseling.

Counseling was imparted to the food service personnel to improve their work habits in terms of pre-preparation, preparation of food, food handling methods, maintaining hygiene and sanitation in food service area, ensuring personal hygiene and following safety procedures in the food preparation and service areas to prevent accidents and damage. Awareness on HACCP techniques was created among the workers.

Food service personnel were counseled after the closure of the food service outlets or during their lunch break.

Rasanen et al. (2004) opine that counseling with low input is sufficient to increase children's nutrition knowledge and ability to explain nutrition related subjects if advice has been first given to the parents and if the parents have received reinforcement and concrete help with parent-child communication after their children have been involved in the counseling. The differences attained in nutrient intake could also be maintained.

A follow up after counseling was done and periodical visits were planned and executed. USAID (2009) points the effect of a revisit by the counselor to the households to observe what was really practiced and intended to be adapted as a result of counseling. Counseling was carried out for a duration of 90 days.

The knowledge, attitude and practices were assessed before and after counseling. The impact of counseling was judged based on changes in knowledge, their food preparation practices being tested by providing a questionnaire before and after counseling, their attitude towards nutrition and food preparation and consumption and towards recommended allowances was judged through questioning and the improved practices were observed. Food safety should concern everyone involved in group feeding of highly susceptible populations. Research could include a pre- and post- test with concurrent observations of actual food handling practices in the food production areas. The three main areas involved for counseling of food service employees involve hand washing, using thermometers and proper handling of food contact surfaces (Piling et al. 2007).

Susanne et al. (2007) suggest that positive effects on dietary habits of children may be greater through face to face talks between the mothers and experts. This was carried out in the present study.

B. INTERVENTION PROGRAMME FOR OBESE CHILDREN

Totally 441 boys and 451 girls were overweight while 178 boys and 144 girls were identified as obese out of the 6190 selected school children. From the obese children identified, one hundred and twenty children (2%) were randomly selected. They were divided into three groups of 40 children each. Each group consisted of 20 boys and 20 girls.

Three intervention programmes were planned and assigned to the three groups as outlined below.

Group I was given training in yoga. Yoga postures were demonstrated to the children by the investigator with the help of the physical trainer at the school.

Group II was made to perform vigorous aerobic exercises daily for one hour a day.

Group III was advised to consume a diet restricted in junk foods. No extra food other than the home food was consumed by the third group.

An exercise log book pertaining to the type of exercise and duration was maintained for the children of group I and II. One hour in the evening after school hours was utilized for the purpose of training in yoga and in aerobic exercises. Due consent was obtained from the school authorities and parents of the children for the intervention programmes. The intervention was carried out for a period of nine months with periodical evaluation and a final evaluation was carried out.

C. EVALUATION OF THE IMPACT OF COUNSELING AND INTERVENTION PROGRAMMES

The knowledge gained by the students, parents, teachers and school food service personnel was evaluated through providing the same multiple-choice questions on nutrition, health and sanitation provided before counseling. A comparison was made between the knowledge present before and after counseling.

Anthropometric measurements namely height, weight, arm and waist and hip circumferences were done for obese, overweight, and underweight children after six months duration post-counseling to assess the effect of counseling. The impact of counseling was assessed in the form of knowledge gained and change in physical dimensions. The results were statistically analyzed in terms of knowledge, attitude and practices for the various groups.

RESEARCH DESIGN

FIGURE 1



