EXPERIMENTAL PROCEDURE

The methodology adopted for the present study on the “Role of diet – counselling and modification and positive therapy in minimizing stress and anxiety among school-going adolescents in Coimbatore” consisted the following steps:

A. Selection of the locale
B. Selection of the subjects
C. Selection of the tools
D. Assessment of Socio-economic background of the families of the selected adolescents
E. Assessment of nutritional status
   The nutritional status was assessed through:
   E. I. Anthropometry
   E. I. a. Recording the height
   E. I. b. Recording the weight
   E. I. c. Computing the Body Mass Index (BMI)
   E. II. Recording the food and nutrient intake of the selected adolescents
   E. II. a. General Dietary Survey
           Food consumption frequency and Meal skipping pattern
   E. II. b. Food Weighment Survey
   E. II. b. (i) Food intake
   E. II. b. (ii) Nutrient intake
   E. II. b. (iii) Tryptophan intake
   E. II. b. (iv) Tryptophan/ LNAA ratio of the diet consumed
F. Estimating the haemoglobin levels of the selected adolescents
G. Assessment of factors influencing stress and anxiety
   G. I. Assessing the nutritional knowledge of the selected adolescents and parents
   G. II. Estimating the stress levels of the selected adolescents, their parents and teachers
   G. III. Assessing the stress coping strategies, ranking of stressors and
Experimental Procedure

private tuition details of the selected adolescents

G. IV. Assessing the anxiety levels of the selected adolescents

G. V. Assessing the prevalence of Peer Victimization among the selected adolescents

G. VI. Assessing the daytime sleepiness, sleep debt and other sleep related problems

G. VII. Assessing the physical activity pattern of the selected adolescents

G. VIII. Academic performance of the selected adolescents

H. Conduct of interventions

H. I. Grouping of selected adolescents

H. II. Imparting positive therapy for the selected adolescents, parents and teachers

H. III. Conduct of training on management of stress, anger and forgiveness

H. IV. Sensitization on peer- victimisation and bullying

H. V. Conduct of nutrition Education for the selected adolescents and parents

H. VI. Modification of diet for the selected adolescents

I. Evaluating the impact of the interventions

J. Consolidation and statistical analysis of data

A. Selection of the Locale:

There is a high prevalence of stress, anxiety and deliberate self-harm in school students in India and especially in Tamil Nadu. Therefore, Coimbatore city, an educational hub in Tamil Nadu, was selected for the study (Figure 6). A central government-run, co-educational school with classes from I to XII was selected based on relevance to the study, proximity and willingness of the school-management and parents of the adolescents to participate in the study.
B. Selection of the subjects:

Students studying in Class–X appear for board exams and experience high levels of stress and anxiety, sometimes even precipitating in suicide. Therefore class X adolescents studying in an English-medium, co-educational school, were selected as the target group, using purposive sampling. This facilitated the study of students of both sexes and also ensured ease of communication in English. Purpose and protocol of the study was explained to the school authorities and the parents of the target group students and their consent was taken for the study. Out of a total of 177 students, 176 were selected based on willingness and consent of the parents to participate in the study. All students were in the age group of 14-15 years at the start of the study.

Students of the same school and class were selected to keep almost all variables identical and minimise external variables. To avoid sample contamination, the selected adolescents studying in four different sections were designated as control group and three experimental groups.
C. Selection of the tools

A questionnaire is a research instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents. Questionnaires have advantages over some other types of surveys in that they are cheap, do not require as much effort from the questioner as verbal or telephone surveys, and generally have standardized answers that make it simple to compile data. Questionnaires are also sharply limited by the fact that respondents must be able to read the questions and respond to them.

In the current study, questionnaires were used for collecting information from the selected adolescents, their parents and teachers, since they were literate. The following questionnaires were used during investigation:

- General Information Questionnaire
- Questionnaire on Diet, Exercise, Life Style and Stress Pattern
- Section-A: General Dietary survey
- Section-B: Stress, sleep and private tuition related details
- Section-C: Physical activity pattern
- Nutritional Knowledge - Adolescents
- Nutritional Knowledge - Parents
- Stress Inventory
- Manifest Anxiety Inventory
- Multidimensional Peer-Victimization Scale
- Paediatric Daytime Sleepiness Scale (PDSS)

D. Assessment of Socio-economic background

The General Information questionnaire (Appendix-IV) was used to collect the background information of all the 176 selected adolescents and their families and was used before the start of intervention. It contained questions regarding the adolescents and their family such as the student's name, sex, date of birth, number of siblings, parents’ educational details,
family type, family income, and contact details. It was filled up by the parents of the adolescents.

E. Assessment of nutritional status:

Nutritional status of the selected adolescents was assessed through:

- Anthropometry
- Food and nutrient intake
- Blood haemoglobin

E. I. Anthropometry

Anthropometry-based nutritional assessment has the advantage of being a universally applicable, inexpensive and non-invasive method. This procedure also is applicable to large sample sizes. It can be used to identify target groups of population or areas for intervention, as a tool for nutritional surveillance, and in cross-sectional evaluation. Measures of nutritional status are usually valuable in as much as they may be predictive of health outcomes, the practical requirements for assessment of nutritional adequacy arise from the need to intervene by advice or by more aggressive strategies to improve the nutrition of individuals or population and thereby to reduce the risk and burdens of those diseases that have or may a nutritional components (FAO, 1999).

E. I. a. Recording the height

Height is useful in determining the nutritional status. The height of an individual is influenced by both genetic (hereditary) and environmental factors. Height is affected only by long term nutritional deprivation and is considered as an index of chronic long duration malnutrition. Height of all the 176 adolescents was measured and recorded before and after intervention. Height was measured without shoes. The subject was asked to stand erect with shoulders and heels flat against the wall, looking straight ahead. Height was measured to the nearest 0.1 centimeter using a tape. The height was measured at the start of the study and also post intervention.
**E. I. b. Recording the weight**

Body weight is the most widely used and the simplest reproducible anthropometric measurement for the evaluation of nutritional status. It is sensitive to even small changes in nutritional status. Body weight indicates the body mass and is a composite of all body constituents like water, minerals, fat, protein and bone.

The subject was asked to stand straight with feet placed on a calibrated Krups weighing scale (ranging from 0-120kg). The scale was set to zero before each measurement and weight was recorded to the nearest 0.5kg. The weight was measured in the morning after assembly, with the subject wearing uniforms and without footwear. The weight was measured for all 176 adolescents at the start of the study and also post intervention (after a period of eight months).

**E. I. c. Computing the BMI**

BMI has been found to be most appropriate, non invasive and cost effective variable for determining nutritional status among adolescents (WHO, 1995). As per NIN (2009) nutritional anthropometry is the measurement of human body and different age levels and degrees of nutrition. Growth retardation may be the first response of the body towards nutritional deficiency while appearance of clinical signs may be the final stage. From the public health point of view identification helps to prevent milder cases going into severe forms with risk of mortality.

Using the formula for Body Mass Index (BMI) given below, the students' body mass index was calculated.

\[
\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m}^2\text{)}}
\]
The BMI values and the age of the adolescents were compared with the ICMR (2010) standards using BMI-for-age charts that give age and gender specific centiles. The students were categorized into underweight, normal, overweight and obese, based on the percentile cutoffs as given below:

- Underweight: < 5th Percentile
- Normal: 5th to 85th Percentile
- Overweight: 86th to 95th Percentile
- Obese: > 95th Percentile

The BMI assessment was done both before and after intervention for all the 176 adolescents.

E. II. Recording the food and nutrient intake of the selected adolescents

E.II.a. General dietary survey

Food consumption frequency and Meal skipping pattern

A questionnaire (Appendix-V, Section-A) was evolved by the investigator for the students to elicit information regarding dietary preferences, food intake frequency of various types of foods, meal-skipping pattern, such as the number of meals frequently skipped, the type of meal skipped (breakfast, lunch or dinner) and the reason for skipping the meal. This questionnaire was administered to all 176 selected adolescents before and after intervention. Each point in the questionnaire was read out and explained by the investigator to the students, who then filled in the details.

E.II.b. Food weighment survey

Nutrient and food intake are closely related to nutritional status and health of an individual. Adequate amount of nutrient in the form of daily diet are essential for the maintenance of health and good nutrition. School children are generally occupied with academic work, games and are under emotional stress which coupled with unbalanced diet resulting in poor health and
Experimental Procedure

 Apart from human suffering, malnutrition is one of the major causes of morbidity, mortality, loss of national productivity and medical expenses (Narasinga Rao, 2005).

 The food weighment survey was conducted to assess the food, nutrient and tryptophan intake; and tryptophan/LNAA ratio of the diet consumed.

E.II.b.(i) Food intake

 The food weighment method (Appendix-VI) was used to assess the actual food and beverage intake of ten percent of the subjects before and after intervention. Ten percent of the adolescents were selected from each group with equal number of boys and girls and their food and beverage intake over three consecutive days was measured. The total weight of each of the raw ingredients used for cooking, the total weight of the cooked food and the quantity of the cooked food consumed by the adolescents were measured. Any leftovers (as in lunch-box) were deducted from the individual consumption. This was used to calculate the proportion of the raw ingredients consumed by the adolescent per day. This procedure was carried out for three consecutive school days, taking care to avoid days of fasting or partying.

 Thereafter the three days food consumption was recorded, averaged out and a mean consumption pattern was obtained. This data was compared with the NIN guidelines (Dietary guidelines for Indians - A Manual, 2010) and the deficit or excess of food groups was estimated.

E.II.b.(ii) Nutrient intake

 The nutrient intake of the selected adolescents was calculated from the food weighment survey details using the Table of Nutritive value of some common Indian foods (Gopalan et al, 2007). Along with energy, the nutrients estimated included protein, fat, calcium, iron, β carotene, thiamine, riboflavin, niacin, pyridoxin, folic acid and ascorbic acid. Thus the excess or deficit of each nutrient was computed and compared with the RDA (ICMR, 2010).
E.II.b.(iii) Tryptophan intake

Based on the food consumption data obtained by food weighment survey, the tryptophan intake of the selected adolescents was estimated for all the four groups, before and after intervention, using the Table on Nutritive value of some common Indian foods (Gopalan et al, 2007). The tryptophan intake was compared with the RDA to assess the level of intake by the adolescents before and after intervention.

E.II.b.(iv) Estimating the tryptophan/ LNAA ratio

Fernstrom and Wurtman (1972) suggested that foods having a higher tryptophan/ LNAA ratio increase the availability of L-tryptophan in serum for serotonin synthesis and crossing the blood-brain barrier.

Dougherty et al (2008) reported that the uptake of tryptophan into the brain for serotonin production is dependent on its cerebral availability, via an increase in the ratio of plasma tryptophan to the sum of the five large neutral amino acids (LNAA) which are Isoleucine, Leucine, Phenylalanine, Tyrosine, and Valine. The ratio of tryptophan/LNAA is calculated by dividing the amount of tryptophan present in the food by the sum of the amount of each of the five Neutral long chain amino acids.

The tryptophan, leucine, iso-leucine, tyrosine, phenylalanine and valine content were estimated for all the food items consumed by the adolescents to calculate their Tryptophan / LNAA ratio. The amount of each amino acid present in the food item was calculated using the Table of nutritive value of common Indian foods (Gopalan et al, 2007), wherein the amount of amino acid present in each food item was given in mg/g of Nitrogen, which was then multiplied with the value of total nitrogen/100g of food to get the amount of that amino acid present in 100g of that food item (Appendix-VII).

Based on the food consumption data obtained by food weighment survey, the actual amount of food items consumed were used to calculate the amount of tryptophan, leucine, isoleucine, valine, phenylalanine and tyrosine in the diet for each of the selected adolescents before and after intervention.
Experimental Procedure

The Tryptophan/ LNAA ratio of the diet was estimated using the formula given below:

\[
\text{Tryptophan/ LNAA ratio} = \frac{\text{Amount of tryptophan}}{(\text{Leucine} + \text{iso-leucine} + \text{valine} + \text{phenylalanine} + \text{tyrosine})}
\]

F. Estimating the haemoglobin levels of the selected adolescents

Beard (2001) reported that tryptophan hydroxylase, an enzyme involved in production of serotonin also uses iron as an essential cofactor. Iron is required for the conversion of tryptophan to serotonin, therefore blood haemoglobin was estimated before and after intervention, using the Colour Scale for Haemoglobin. Colour Scale for Haemoglobin is based on the principle of comparing the colour of a drop of blood absorbed on a particular type of paper, against a printed scale of colour corresponding to different levels of haemoglobin. The range of haemoglobin measurement is 4-14 gm/dl. The technique is simple and inexpensive and does not require any additional chemicals reagents, energy source etc. to perform the test. It is a simple and effective medical device for the accurate estimation of haemoglobin levels in blood. It comprises of a standard colour card with six shades of red that represent haemoglobin levels at 4, 6, 8, 10, 12 & 14 g/dl respectively along with specialized test strips. For severe anaemia, the Scale shows a sensitivity of 95 per cent and a specificity of 99.6 per cent. To distinguish normal from mild anaemia, the sensitivity and specificity are 98 per cent. Results are well above the reliability of any clinical measurement. This product is validated by a reputed international laboratory in India and CE certified.

Written permission was taken from the parents of the adolescents and Haemoglobin was estimated for all the 176 selected adolescents before and after intervention, after informing them about the purpose of the test and the safety precautions taken. Finger prick was done using sterile lancet and a drop of blood was absorbed onto the specialized test strip. After allowing colour to develop for 30 seconds, the colour was matched with the standard
colour card provided in the kit. The colour was compared with the colours on the chart in bright light and blood haemoglobin was thus determined.

To eliminate parasitic infection on prophylactic basis, students belonging to Experimental group-III were provided a single dose of chewable Albendazole de-worming tablets before start of intervention.

G. Assessment of factors influencing stress and anxiety

G. I. Assessing the nutritional knowledge of the selected adolescents and their parents

Nutritional knowledge of the selected adolescents and their parents was assessed using the questionnaire given in Appendix-VIII and Appendix-IX respectively. It was a 20-point questionnaire evolved by the investigator for the purpose of assessing the nutritional knowledge of the adolescents and their parents. The investigator administered these questionnaires class-wise to all the adolescents (n=176) and to their parents (n=348) while conducting the training sessions. Every question was read out and explained by the investigator and the students/ parents filled in their responses. Each correct response was scored and the total score was obtained. Assessment of nutritional knowledge was done both before and after intervention for all the adolescents as well as their parents.

G. II. Estimating the stress levels of the selected adolescents, their parents and teachers

Stress level of all the 176 selected adolescents, their parents (n=348) and teachers (n=12) was assessed using the Stress Inventory (Natesan and Menon, 2005), (Appendix-X). This is a tool which has been standardised and used extensively for the Indian population, especially in South India. It comprises of 30 statements related to stress and its associated symptoms. The investigator read out each point on the questionnaire and explained it to the subjects while administering the questionnaire to avoid confusion. The subject needs to respond in yes or no based on their experience and each yes is recorded as a positive score. The total score of each person is his/ her stress score. Through this, the level of stress was assessed by comparing the
total stress score with the classification given in the tool as low (0-4), moderate (5-9), high (10-19) or very high (>20) levels of stress.

The same format of Stress Inventory was used for the students, their parents and teachers, as it was applicable to all of them. The stress levels of all the selected adolescents, their parents and teachers were estimated both before and after intervention.

**G. III. Assessing the stress coping strategies, ranking of stressors and private tuition details of the selected adolescents**

Information regarding the methods of stress coping, whether positive or negative coping techniques were used, was elicited from all the selected adolescents \(n=176\) using the questionnaire in Appendix-V (Section-B), both before and after intervention.

Abata (1994) suggested that the most common sources of day-to-day stress for young adolescents are problems with peers (including "romances"), family issues or problems with parents, school-related problems or pressures, their own thoughts, feelings, or behaviours (feeling depressed or lonely).

The questionnaire in Appendix-V, Section-B was also used for ranking of stressors commonly affecting adolescents, which were listed out by the investigator using relevant references (Patten et al, 2000; Thergaonkar and Wadkar, 2007; Burke and Weir, 2010). Each point was read out and explained and the students were asked to rank the severity of the various stressors listed out, as experienced by them, ranging from exam and result anxiety to interaction with parents and teachers. The score of the students was consolidated and Spearman’s ranking coefficient of the stressors was calculated.

Appendix-V, Section-B questionnaire was also used to elicit details regarding the number of students attending private tuitions, number of subjects studied, the duration and frequency of the private tuitions. They were also asked whether they attended private tuitions in the morning, in the evening or both morning and evening.
G. IV. Assessing the anxiety levels of the selected adolescents

The anxiety level of all the 176 selected adolescents was estimated using the Manifest Anxiety Inventory evolved by Natesan and Menon, 2001 (Appendix-XI) before and after intervention. It is a standardized tool which consists of 40 statements related to anxiety. Each point in the questionnaire was read out and explained by the investigator and the adolescents were asked to tick a ‘yes’ or ‘no’ for each statement based on their experience. Each ‘yes’ is recorded as a positive score and the sum-total of the score of each person forms the anxiety score. Based on the anxiety level classification provided in the tool, it was categorized as very low (0), low (1-8), moderate (9-16), high (17-24) or very high (>25).

G. V. Assessing the prevalence of Peer Victimization among the selected adolescents

Research has shown that repeated peer-victimization leads to a chronic state of stress, endangering children’s healthy development. Peer-victimization was shown to contribute to anxiety, depression, low-self-esteem, as well as aggression, disruptiveness, and other provocative behaviour symptoms. To assess the levels and types of peer victimisation amongst the selected adolescents, the Multidimensional Peer-victimisation Scale (Appendix-XII) was administered to all 176 adolescents. This is a tool used for measuring Peer-Victimization, developed by Mynard & Joseph (2000). It is a 16-item measure with 4 subscales assessing physical and verbal victimization, social manipulation, and property attacks. It is designed for a target group of 11–16 years old youths. It comprises of 4 aspects of victimisation experienced by students, viz. physical victimization (e.g., “Other kids … hurt me physically in some way”), social manipulation (e.g., “…tried to get me into trouble with my friends”), verbal victimization (e.g., “…called me names or swore at me”) and attacks on property (e.g., “…tried to break or damage something of mine”). Items are scored on 3-point scales describing the frequency of victimization (1 = “not at all”, 2 = “once”, 3 = “two or more times”).
Experimental Procedure

Point values are assigned as follows: Not at all = 0; Once = 1; More than once = 2;

Physical victimization scale: Items 6, 7, 8, and 9;
Verbal victimization scale: Items 1, 4, 5, and 16;
Social manipulation scale: Items 2, 11, 13, and 14;
Attacks on property scale: Items 3, 10, 12, 15

**Scale scores** are computed by summing item responses. Scores on the total scale have a possible range of 0 to 32; scores on each of the four subscales have a possible range of 0-8. Higher scores reflect more victimization.

Every item on the scale was read out and explained by the investigator and adolescents were requested to rate peer-victimization within the last six months. The Multidimensional Peer victimization questionnaire was administered to all the selected adolescents before and after intervention.

**G. VI. Assessing the daytime sleepiness, sleep debt and other sleep related problems**

The quality and quantity of sleep is a major determinant of the stress levels experienced. The Paediatric Daytime Sleepiness Scale (Appendix-XIII), developed by the Iowa Sleep Disorder Center (Drake *et al*, 2003) was used to assess the daytime sleepiness levels of all the 176 selected adolescents before and after intervention. It is a Likert type scale consisting of eight questions about sleepiness during waking hours. Each point on the tool was read out and explained by the investigator and the adolescents were asked to record their response by circling one of the five responses, which were then scored as never (0), seldom (1), sometimes (2), frequently/ often (3) and very often/ always (4). The scores were added and a daytime sleepiness score was arrived at. A sleepiness score of greater than 30 is indicative of sleep disorder and may need treatment.

Numerous studies have emphasized the high prevalence of sleep problems in adolescents. Sleep duration on school nights and sleep duration on non-school nights are used to compute sleep debt, defined as non-school night sleep duration minus school-night sleep duration.
Experimental Procedure

To estimate the sleep debt of the selected adolescents, the questionnaire in Appendix-V (Section-B) was used for all the 176 students before and after intervention. The selected adolescents were asked to report the time that they went to bed and woke up during the school days and the non school days. The difference between the two was computed as sleep debt. The adolescents were also asked, using the questionnaire in Appendix-V (section-B), whether they had difficulty in falling asleep at night or waking up in the mornings, and if so, then the reason for the same.

G.VII. Assessing the physical activity pattern of the selected adolescents

The questionnaire in Appendix-V (Section-C) was administered to all the 176 selected adolescents to assess their physical activity pattern. The adolescents were asked to complete a table that listed out the various types of physical activities, the duration as well as the frequency for the same. This information was used to assess the physical activity pattern of all the 176 selected adolescents before and after intervention.

G.VIII. Academic performance of the selected adolescents

The academic performance of all the 176 selected adolescents was compared before and after intervention using the marks scored in their half yearly and final exams.

H. Conduct of interventions

Interventions were conducted for a period of eight months, starting from end of September 2009 to May 2010. The background and food weighment surveys were started from July 2009, to complete them before the commencement of the half yearly exams. A period of eight months was thus designated for the study to cover the period from half yearly exams to the final exams and till result declaration.

H. I. Grouping of the selected adolescents
H. I. a.Control Group:
This group (Section A) of 41 students comprising of 20 boys and 21 girls were designated as the control group. All the information mentioned above was collected from them both before and after the intervention period of eight months. No intervention of any kind was carried out for this group.

H.I.b. Experimental Group I:

A group (Section B) of 41 students comprising 17 boys and 24 girls were designated as Experimental group-I and were given an intervention for a period of eight months consisting of six sessions each of Positive Therapy (PT) and Stress Management Training (SMT) and individual counselling.

H.I.c. Experimental Group II:

This group (Section C) comprised of 45 students with 25 boys and 20 girls. This group received intervention consisting of six sessions each of Nutrition Education (NE), PT and SMT including individual counselling.

H.I.d. Experimental Group III:

This group (Section D) of 49 adolescent students comprising of 28 boys and 21 girls were given eight months of nutrition intervention involving Dietary Modification (DM) using foods having a high tryptophan/LNAA ratio, six training sessions of NE, six sessions each of PT and SMT with individual counselling.

H.II. Imparting Positive Therapy for the selected adolescents, parents and teachers

PT is a unique system of stress management that combines the eastern techniques of Yoga and the western techniques of Cognitive Behaviour Therapy (CBT). PT helps to replace debilitating negative thoughts with positive, self-enhancing thoughts. PT helps in the development of positive personality traits such as courage, confidence, optimism and cheerfulness. The strategies used in PT are breathing exercise, relaxation therapy, counselling for assertiveness training, tension releasing exercises including smile and laugh therapy.
Experimental Procedure

Six sessions of PT were conducted for the adolescents belonging to EG-I, EG-II and EG-III in their free periods such as games, Socially Useful Productive Work (SUPW), arts, etc. Days such as 15th August and last working day of the month that were half days were also utilized for training.

The exercises used in PT were:

- **Breathing exercise**: To teach the students a slow, deep breathing technique to induce relaxation and improve blood oxygenation through deep breathing.

- **Relaxation Therapy**: This entailed a 45 minutes long exercise that starts with deep breathing followed by progressive relaxation of head, forehead, eyes, mouth, neck & shoulders, chest, stomach, back, arms and hands, legs and feet. In this relaxed state the adolescents were given positive statements and auto suggestions to improve their overall state of wellbeing and make them feel good about themselves and their life. These statements help build courage, confidence, optimism and a sense of self-worth in the students. (Plate-1)

- **Tension releasing exercise**: This is a simple breathing exercise along with a hand gesture that helps to release stress and tension. (Plate-2)

- **Smile and laugh therapy**: Both are used to improve cheerfulness in the students and induce a light and jovial atmosphere. (Plate-3 & 4)

- **Assertiveness training**: Adolescents who were extremely timid or mild and were targets of bullying by other students were selected for this counseling to improve their self esteem and help them face threatening situations with confidence thereafter.

Two sessions of PT were carried out for the parents of adolescents belonging to EG-I, EG-II and EG-III on Saturdays and half-days. The purpose of the Positive Therapy sessions for parents was to help them manage their own stress as well as understand the process of stress management their children were undergoing and lend their support in fulfilling its purpose. No PT session was done for either the adolescents or parents belonging to the Control group.
Experimental Procedure

The need for managing of stress by the teachers instructing class X students was also identified and they were provided two sessions of Positive Therapy to learn techniques that would help them manage their stress more effectively. (Plate-5)

The parents and teachers were also shown specially recorded video clippings by a leading cardiologist and diabetologist on the harmful effects of stress, the need for managing stress positively and the role of a healthy lifestyle in the prevention of non-communicable chronic diseases.

H.III. Conduct of Stress Management Training (SMT) for Anger and Forgiveness

The SMT was conducted in six sessions for all the adolescents belonging to EG-I, EG-II and EG-III. The adolescents face high degree of academic pressures and are also fraught with various personal problems. All these lead to frustration, anger and resentment. Hence the SMT was designed to include topics like enhancing self esteem, time management, anger management, forgiveness, sleep hygiene, handling failures, awareness and prevention of peer-victimisation, hormonal changes that affect their behaviour and awareness about sexual abuse. Relaxation therapy and cognitive behaviour therapy were used for anger management and forgiveness therapy.

Personal one-to-one counseling was carried out for all the students of EG-I, EG-II and EG-III to address any personal problems they were struggling with. The individual counselling was done during any free period or even during lunch time in a quiet room to provide comfort and confidentiality. No SMT was done for the adolescents belonging to Control Group.

H.IV. Sensitization on Peer-Victimization and Bullying

During the SMT sessions the selected adolescents of EG-I, EG-II and EG-III were sensitized to the ill-effects of peer-victimization and bullying. Through self-esteem building exercise and assertiveness training, the adolescents were taught to stand up for themselves as well as prevent others
Experimental Procedure

from being victimized. Also, reporting persistent victimization to parents or teachers was also promoted through training. No such intervention was done for the adolescents belonging to Control Group.

H.V. Conduct of Nutrition Education (NE) for the selected adolescents and parents:

There were six combined sessions of NE conducted for the adolescents in EG-II and EG-III, utilizing their free periods such as games, arts, etc. Special poster boards (Plate-6a) and PowerPoint presentations were developed by the investigator to create awareness about the nutritional requirements of adolescents. The aspects covered as part of NE were importance of adequate diet during adolescence with special focus of energy, protein, calcium, iron and vitamins, food guide pyramid, nutritional requirements of adolescent boys and girls, nutritional deficiencies common in adolescence, foods that help in relieving stress and the hazards of skipping meals, specially breakfast. PowerPoint presentation, poster board (Plate-6b) and quiz were used as the training aids.

During their winter break in December, adolescents were asked to give a feedback on their understanding and learning from the intervention program in their own words in the form of a note, a poem, as pictures, chart, etc. There was an overwhelming response to the same and numerous articles, charts, poems and letters were submitted by the students on the subjects of nutrition, health, stress management, smile and laughter, etc. (Plates-7a, 7b and 7c)

Display boards were designed by the students of EG-II and EG-III, with the intention of sharing knowledge with the rest of the school, at the end of the academic session. The students put up an extremely attractive and informative display board (Plates-8)

Parents of the selected adolescents of EG-II and EG-III were provided two sessions of nutrition education during intervention (Plate-9). It comprised of aspects such as importance of adequate diet during adolescence using the food guide pyramid, with special focus of energy, protein, calcium, iron and vitamins, difference in the nutritional requirements of adolescent boys and
experimental procedure

Girls, nutritional deficiencies common in adolescence and the hazards of skipping meals, especially breakfast. PowerPoint presentations, audio-visual clippings, charts and food displays were used for the conduct of NE.

H.VI. Modification of diet for the selected adolescents

Serotonin, also known as 5-Hydroxytryptamine (5-HT) is a monoamine neurotransmitter. It is synthesized in the body from the aromatic amino acid L-tryptophan. Serotonin plays a vital role in reducing symptoms of stress, anxiety, improve mood, and induce relaxation. It is estimated that only one percent of dietary tryptophan is used for serotonin synthesis in the brain, but despite the relatively low concentration, it has a broad impact as a neurotransmitter and neuromodulator and has been implicated in numerous psychiatric conditions and psychological processes. The three factors which modulate the concentration of tryptophan in brain—the levels of free tryptophan in plasma, the ratio of total tryptophan levels to those of other neutral amino acids and the uptake process for tryptophan in brain tissues are important in the control of serotonin synthesis. The ratio of tryptophan to the five Long-chain Neutral amino acids was calculated using the essential amino-acid composition of common foods (Gopalan et al, 2007).

The students of EG-III were given an extra session of diet counselling to orient them towards the concept and implementation of dietary modification. To conduct diet counselling, PowerPoint presentations and Food displays were used as training aids. Similarly, the parents of EG-III adolescents were also given training for dietary modification. (Plate-10)

Student’s tryptophan-available food chart (Appendix-XIV) was prepared for dietary modification. The foods having a higher tryptophan/ LNAA ratio were listed in decreasing order and the quantity for each food to be consumed was determined based on the RDA, deficiency in the diet and feasibility of consumption by the adolescents. These foods were also selected based on their ease of availability in the local market. The RDA for tryptophan along with the tryptophan content per serving of each food item in the list was also mentioned. The tryptophan available food chart (Appendix-XIV) was provided to all the students of EG-III. The adolescents and their parents were specially
trained in the use of this chart and were asked to consume at least five of the foods listed therein, preferably having higher tryptophan/LNAA ratio, everyday. A date-wise record of the foods being consumed was maintained by the mothers and the students by putting a tick-mark against the name of the food under the particular date (Plate- 11). The mothers signed off at the end of each chart and their compliance with the dietary modification was regularly monitored by personal home visits and telephone conversation. Any non-compliance by the students was addressed on an immediate basis and any doubts raised by the mothers were also addressed on a personal level. This ensured steadfast compliance with the dietary modification plan and frequent follow-up with the students and their mothers.

Being class–X students and having high levels of stress, the parents and students were very receptive to the concept of stress management through diet and were very pro-active in its implementation.

I. Evaluating the impact of the interventions

The impact of the intervention on the selected adolescents was estimated by assessing the change in the BMI, blood haemoglobin, diet, nutritional knowledge, patterns of stress, choice of coping strategies, anxiety, peer-victimization, daytime sleepiness, sleep debt, physical activity pattern and academic performance.

The impact of the intervention was assessed through nutritional anthropometry, food weighment, biochemical estimation and by re-administering all the questionnaires on all the aspects related to stress and anxiety.

Impact of intervention on the parents of the selected adolescents was estimated by assessing the change in their stress level and nutritional knowledge after intervention.

The impact of intervention among the teachers of class–X was assessed by comparing their stress levels pre and post intervention.
J. Analysis of data

Statistical analysis was done for all the data collected to assess the impact of interventions. The main statistical methods used were t-test, z-test, Tukey’s Multiple Comparison Test, Spearman’s correlation coefficient, Pearson’s Correlation Coefficient analysis, one-way and two-way ANOVA to estimate the significance of variations post interventions. The Graph pad prism statistical package was used for the analysis.