Design of the Study
3. DESIGN OF THE STUDY

Methodology adopted in the present study is discussed under the following headings.

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   3.1.1 Selection of the Schools and Subjects
   3.1.2 Selection of the Subjects
   3.1.3 Selection of Tools for Baseline Information
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   3.4.2 Second Phase: Baseline Study
   3.4.3 Third phase: Intervention Programme
   3.4.4 Fourth Phase: Evaluation of Intervention Programme
   3.4.5 Fifth phase: Preparation of the Report
The major objectives of the present study “Impact of food and nutrition security on the performance of competitive sports activities among school children, Dharwad City, Karnataka,” were to assess the food and nutrition security of school children who are engaged in various sports, to conduct nutrition intervention programme to empower the selected sports personnel with knowledge, practice, nutrition security by education and supplementation of foods and finally to evaluate the impact of nutrition intervention programme on knowledge, practice, food and nutrition security and their impact on physical and field performance. The methods and materials used to achieve the objectives of the present study are presented under the following headings.

3.1 GENERAL BACKGROUND INFORMATION

This survey was planned to elicit information on family background, sports profile, food and nutrient intake of selected sports personnel, who are engaged in sports activities in Dharwad. Based on the findings of general information base line study, Intervention study was planned. The procedure adopted to collect general background information is given below.

3.1.1 Selection of the Schools and Subjects

The selected urban area namely Dharwad city, is located in the middle region of Karnataka, situated in southern part of India. Dharwad city was selected as the area for research work, as it is the official place of the investigator. See Fig 1 for the location of Dharwad, in Karnataka. There are twenty-five schools imparting higher secondary education in Dharwad City (List of schools are appended in Annexure-A). Out of these 25 schools, eight schools were selected randomly, representing 32 % of the schools to obtain representative samples of the schools. Permission to carry on the research work was taken from the Principals and Physical Education Teachers.

3.1.2. Selection of the Subjects

In the present study high school athletes who were involved in team games were chosen for the study, because in every age, performance of high level is not possible, but
in each sport, there is a definite age period known as the age of high performance, in which the sportsman is in a favorable position to give high performance. The age of high performance in most of the sports begins at about 20 years and ends before 30 years. This means that the sport man should be able to give his best performance within this age period. To give high performance in twenties, it is indispensable to start training in the childhood, because 8-12 years of systematic training is required to achieve high performance (Lempart 1973). This important fact has brought in to sharp focus on children and adolescents; hence the present study has chosen high school players who are involved in team games.

All the schools have Physical education classes as part of the curriculum and students participate in different sports and games of their liking and talent. Various competitive sports are being played at school level, regional level and at higher levels. Competitive sports which are popularly played in the schools are athletics like running, jumping, disc throw and team games like foot ball, volley ball, cricket, kabaddi, khokho, basket ball, throw ball, hockey and so on.

To achieve the first objective of the research, children who were engaged in various sports activities were selected. The students studying in eight, ninth and tenth standard belonging to the age group of 13 to 16 years have been selected with the permission of the Principals of the selected schools. The total number of students studying in eighth, ninth and tenth standard drawn from eight schools were 880 consisting of 556 boys and 324 girls. Among these, 87 boys and 85 girls, those who were players at school level participated in the present study as shown in Table 9.

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Available No.</th>
<th>Selected No.</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>556</td>
<td>87</td>
<td>16</td>
</tr>
<tr>
<td>Girls</td>
<td>324</td>
<td>85</td>
<td>26</td>
</tr>
</tbody>
</table>
Figure 2. Location of Dharwad City in Karnataka, India
3.1.3 Selection of Tools for Baseline Information

3.1.3.1 Questionnaire

A Questionnaire is a tool or device for securing answers to a set of questions, by the respondent who fills in the Questionnaire. The Questionnaire method was selected for the present study, as it is frequently used method of data collection (Young, 1987). The merits of Questionnaire are its low cost non-bias, anonymity and application in large-scale surveys. In the present study, questionnaire and checklists were selected to measure knowledge, practice and other relevant information.

3.1.3.2 Survey

The survey method is a combination of Questionnaire and interview. Generally this method of data collection is used by survey research organizations (Ghosh, 1982). In the present study, the survey, which is a useful tool, was selected to elicit information about family background and other related matter concerned with the study. Another specific tool namely Diet survey (24 hour dietary recall method) was also adopted for this study to assess dietary intake of the selected sports personnel (See in Annexure-B).

3.1.3.3 Observation

Observation is an effective technique of data collection. Observation helps the researcher to supplement data with qualitative details (Young, 1971). Useful information can be obtained from the simple approach of observation (Brandt, 1981). In the present study, Observation was also used to record information while collecting data.

3.1.3.4 Anthropometric measurements

Anthropometric measurements were selected as they are very good indicators of nutritional status or nutrition security. Various measurements like height, weight, mid arm circumference, chest circumference, triceps and biceps (skin fold thickness) were selected
and used, as per the guidelines of Jelliffe (1966). The details of the measurements are given below.

Weight: Weight of the selected subjects was measured using a portable spring balance to the nearest of 0.5 kg. The accuracy of the weight was ascertained by using standard weights. The zero adjustments of the scale were checked prior to each measurement.

Height: The height of sports persons was measured by using fiberglass-measuring tape with the sensitivity of 0.1 cm.

Body mass index: Body mass index was calculated using weight and height measurements.

Mid arm circumference (MAC): It was measured by using a fiberglass measuring tape in cm.

Chest circumference: It was measured by a fiberglass measuring tape in cm.

Skin fold measurement: Skin fold measurements biceps and triceps were measured by using Harpenden Calipers.

3.1.3.5 Body composition: Body composition was calculated using the anthropometric measurements. The three measures of body fat composition i.e. percentage body fat (PBF), fat mass (FM) and fat free mass (FFM) were computed for subjects.

Percentage body fat (PBF): PBF was calculated using BMI as a criterion for children and adults given by Deurenberg et.al (1991).

\[ PBF = \begin{cases} 
1.51 \times BMI - 0.70 \times Age - 3.6 \times Sex + 1.4 & \text{for children (<= 15 yrs)} \\
& \text{Where for sex, males}=1 \text{ and females} = 0 
\end{cases} \]

Fat mass (FM): Fat mass was computed using Bose (1999) calculations.
Fat mass \( (\text{Kg}) = \frac{\text{PBF}}{100} \times \text{weight (kg)} \).

**Fat free mass (FFM):** \( \text{FFM} = \text{weight (kg)} - \text{fat mass (kg)} \)

3.1.3.6 **Formulation of Questionnaire and Checklist:** Questionnaire and checklist were formulated after obtaining the suggestions from experts in the field of sports and nutrition. Questionnaire was divided into four parts, Part A consisted of family background, Part B sports profile, Part C food security and Part D consisted of nutrition security.

**Part A-Family Background:** The Questionnaire was prepared to elicit information on details with regard to number of members, the family composition, type of family, educational level and occupation of the family members.

**Part B-Sports profile:** The Questionnaire consisted of regular sports played by subjects and specialization in sports, reasons to take up the sports; time spent on practice, medals/cups won by subjects.

**Part C-Diet Survey:** Diet survey proforma was developed to assess dietary habits of the subjects namely vegetarian/non-vegetarian, number of meals, frequency of use of different foodstuffs, special food supplements taken during sports. Assessment of dietary intake was carried out with a set of pre standard cups and spoons (Katories of different capacities 50 ml to 200 ml) using 24 hour recall method as suggested by Thimayyamma, (1999).

**Part D- Nutrient Intake:** Based on the information collected from 24-hour recall method, nutrient intake per day of the selected sports personnel was computed using a ready recknor, which was developed by the Dept. of Food Science and Nutrition, Mysore. A pilot study was conducted to check the validity and reliability of the questionnaires and checklist and the results of the pilot study were used to finalize the questionnaires. A copy of the Questionnaire is given in Annexure-B.
3.2 BASELINE INFORMATION

Based on the findings of the general information data, the baseline study was adopted to select the sports personnel who are playing team games and to study their physical performance, nutrition knowledge and practice before the intervention study.

3.2.1 Selection of the Games and Subjects

Competitive team games, which are popularly played in schools are football, volleyball cricket, kabaddi, khokho, basketball, throw ball, hockey and so on. Among these, four competitive games were selected namely kabaddi, khokho, being Indian games and football, volleyball western games for the present study as studies on team games are very meager in India.

Sports personnel, who participated in the study from eight schools, were selected for baseline as well as intervention study. Out of 87 boys, 81 boys who were playing kabaddi and football were selected. Out of 85 girls, 72 girls who were playing khokho and volleyball were selected. The selected subjects were divided into three groups based on their specialization in-group games and were categorized into three groups namely Control, Experimental -1 and Experimental -2. Details are given below in Table 10.

<table>
<thead>
<tr>
<th>Game</th>
<th>Sex</th>
<th>Control</th>
<th>Exp-1</th>
<th>Exp-2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kabaddi</td>
<td>Boys</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>36</td>
</tr>
<tr>
<td>Foot ball</td>
<td>Boys</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>45</td>
</tr>
<tr>
<td>Khokho</td>
<td>Girls</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>36</td>
</tr>
<tr>
<td>Volley ball</td>
<td>Girls</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>36</td>
</tr>
<tr>
<td>Total</td>
<td>-</td>
<td>51</td>
<td>51</td>
<td>51</td>
<td>153</td>
</tr>
</tbody>
</table>

3.2.2 Development of Products for Supplementation Trails

Two traditional preparations namely sweet laddu and a carbohydrate electrolyte drink were selected for supplementation trails. The ingredients used for these two products were mainly underutilized and locally available seeds and they are good sources of iron and complex carbohydrates. The seeds namely Rajkeera and garden cress seeds were utilized for the preparation of laddu. Kokum was selected for the drink along with other basic ingredients. Procedures of standardized preparation are given in Annexure-C.

3.2.3 Tools Used for Baseline Study

3.2.3.1 Sensory Analytical Tool

Sensitivity threshold test was selected to identify students with high level of tasting ability. A descriptive Scoring method using a scorecard was selected as sensory evaluation method. They were given a product and a drink on separate days for evaluation. Among these, 20 were selected for the sensory tests. They were given a product and a drink on separate days for evaluation and acceptability trials were carried out with the same age groups. Nutritive value of the products and procedure is given in the Annexure-D.

3.2.3.2 Checklist to Assess Nutrition Knowledge and Practice

A Checklist type of questionnaire was selected, as it is reliable method to elicit information to assess nutrition knowledge and practice. A performa was formulated to elicit information on nutrition knowledge and practice of team game players. The questionnaire was validated by a panel of experts in the field of nutrition, physical education, and sports nutrition and was modified according to their recommendations. The questionnaire was also pre-tested for clarity with a group of individuals similar to the study participants. A total of 46 questions were included in the questionnaire. Each correct answer was given one score. The questionnaire was administered to both the groups before the intervention programme. See Annexure-E
3.2.3.3 Tools Used for Health and Nutrition Education

**Lecture:** It is the oldest and most effective tool for transmitting messages in a simple and understandable form. It brings about desirable changes to educate subjects was used. Computer based power point show is recognized as one of the most powerful tools of communications (Kreisel, 2004). It makes learning more realistic, more interesting, and more pleasant. It elicits full attention of the viewer and thus gain in knowledge is better than through other methods. In the present study, lectures with various audiovisual aids namely posters, power point show were used as part of nutrition education programme as an educational tool.

**Exhibition:** An exhibition intends to educate community with the help of visual aids like charts posters, diagrams, display, layouts, models and so on. It arouses interest stimulates thoughts and elevates knowledge and is effective in bringing about changes in practice.

3.2.3.4 AAHPERD Physical Fitness Tests to assess Physical Performance

Physical fitness tests indicate performance of the subjects AAHPERD (American Alliance Health Physical Education Recreation and Dance), (AAHPERD Test Manual, 1980). They are widely used in the assessment of sports performance. In the present study five components of physical fitness tests were included. They are speed, strength, agility, flexibility and endurance (Annexure F).

**Speed (50 mts dash):**

**Purpose:** To measure the acceleration ability of the subject.

**Equipment:** Steel tape, two stopwatches, running spaces, marking powder, paper and pen.

**Description:** The subject starts from a standing position with both feet behind the starting line. The starter gives command ‘go’, the subject starts running in a straight line with maximum speed up to 50 mt marking.
Scoring: One trial is given, the time was recorded in seconds.

Strength (Vertical jump test):

**Purpose:** To measure the explosive power of lower extremities.

**Equipment:** Steel tape, training wall and chalk powder for the fingertips, paper and pen.

**Description:** This test is also called the strength jump and jump and reach test. The test measures the explosive strength of the leg extensor muscles. A scale is marked on the wall on a black background from 1.5 to 3.5 meters above the ground. The sportsman either stands facing the wall or with his side to the wall and then without raising his heels, extends his one arm upwards to a maximum level along the scale. This level is recorded and gives the standing reach of the sportsman. Chalk powder is applied on the tips of the fingers of the same hand and sportsman stands with his side to the wall on a line 20 cm away, parallel to the wall. By bending his knees and taking arm swing, he jumps vertically up and makes a mark on the scale with his hand as high as possible. There should be no double jump. Three attempts are given in succession and with a little rest period in between.

**Scoring:** The score is the difference between the reaching height and the jumping height. Three trials are allowed, best will be taken and the scores are recorded in cm.

Agility (4x10 meters shuttle run):

**Purpose:** To measure the agility in running and in changing direction.

**Equipment:** Steel tape, stop watch, marking powder, paper and pen.

**Description:** The test is conducted on even surface with lines marked on it. The sportsman stands behind a line with one foot forward. On signal ‘go’ he runs all out to a line 10 mt ahead. Crosses it with both feet, turns around quickly and runs to the start line, crosses it
with other feet, turns around and runs back to the other line. In this manner the sportsman
shuttles twice to complete 40 mt. The test should be conducted on 3 to 4 sportsman at the
same time. Each sportsman must run in his own line. The timekeepers for each sportsman
take the time after completion of one shuttle. Two attempts are given with at least 5
minutes pause in between.

Scoring: Two trials are given and the time is recorded in seconds.

Flexibility (Standing forward bend and reach test):

Purpose: To measure the trunk flexibility of the subject in forward direction.

Equipment: Steel tape, paper and pen.

Description: The barefooted subject stands over the box keeping marked part of the box
in between the feet (i.e. Pelvic wide apart stance). Hands at the time of bending must be in
a line. From a standing position the subject should bend forward with knees locked. The
movement should be smoothen without any jerk, touch with fingertips on the below of the
marking area of the box.

Scoring: The fingertips cover the marking area lowest one from the two hands will be
taken as the score. Minimum two or three trials are given and the best score one touches
will be recorded in cm.

Endurance (7 min Run/Walk):

Purpose: To measure the cardiovascular fitness.

Equipment: Stopwatch, clapper, whistle, pen and paper.

Description: The test was conducted on the 400 mts track. The 400 mts length of the track
was divided into 8 equal parts of 50 mts each. All the subjects were assembled at the
starting line. They were instructed to run/walk continuously for duration of 7 minutes. The
start was given by using the clapper. After the completion of seven minutes the whistle was blown at the end of 7 minute and all the subjects were stopped to run / walk.

**Scoring:** The distance covered in 7 minutes was recorded in nearest 50 mt. The distance recorded that the number of laps completed plus the number of divide segments of incomplete.

3.2.3.5 Hemoglobin: Hemoglobin, which is an indicator of anemia, was selected and analyzed using Cyanmethemoglobin method as suggested by WHO (1966). See Annexure-G.

3.3 INTERVENTION STUDY

Based on the findings of the baseline data, the intervention programme as specified in the objective of the study, namely nutrition education specially with reference to general and sports nutrition and supplementation of foods to increase nutrition security were adopted to find out the impact of food and nutrition security on the performance of team game players. Intervention programme was carried out on the sub sampling of the subjects from the baseline survey.

3.3.1 Tools used for Intervention study

3.3.1.1 Diet survey

Recording of food intake was carried out for total seven days. The subjects were given three-day diet sheet soon after the nutrition education intervention with a gap of fifteen days, another four- day diet sheets were given during carbohydrate supplementation to assess pre-event food and nutrient intake of selected team game players. They were asked to note down the meals consumed using standardized cups and spoons. See Annexure- H.
3.3.1.2 Carbohydrate Loading

Carbohydrate loading is a technique generally followed to enhance the performance before the competition. As per the procedure of Hoffman (1991), the subjects should consume a normal habitual diet for the first three days of the week and the next three days the test foods are given in any form like breakfast, snack along with their habitual diet. Carbohydrate loading as suggested by Hoffman (1991) includes, intake of 350-550gram of carbohydrates (70% of total calories) during the last 72 hours preceding to the competition. This loading helps to increase 20-40% of glycogen stores above the normal level and later utilized during the competition period, Coyle (1995). This method of carbohydrate loading was followed for the present study as a second component of intervention programme.

3.3.1.3 A checklist to assess the field performance

Physical education teachers assessed the field performance of team game players using a checklist (See Annexure-I). The formulated checklist consisted of game specific components and student evaluation checklist consisted of seven questions on opinions about carbohydrate supplementation. Checklists were refined for its validity with the help of subject experts. Subjects filled in checklist soon after the field performance (See Annexure- J).

3.4 CONDUCTING THE STUDY

After planning the baseline and intervention study, the investigation was carried out in different phases. The details are given below.

3.4.1 First phase: General Family Background Information

The following information was obtained in order to know the food and nutrition security of the selected subjects (172) who were involved in various sports events.
Assessment of family background: After the selection of the schools in Dharwad City, a calendar of research work was planned. As per the plan, the selected schools were visited with prior permission with the principal and the physical education teachers. Informal talk was initiated to develop rapport in the class. After creating a congenial atmosphere in the class, the importance of the present study was explained to them. The filled in questionnaires were collected from the subjects.

Sports profile: Information regarding sports activities undertaken by various sports persons were collected with the help of questionnaire.

Dietary intake: 24 hour recall method was carried out with a set of pre standard cups and spoons.

Computation of Nutrient intake: The individual consumption of energy, protein, fat, carbohydrate, calcium, iron were calculated based on 24 hour dietary recall method using ready recknor (Developed by the Department of Food Science and Nutrition, University of Mysore, Mysore).

Recording of Anthropometric measurements: Anthropometric measurements like height, weight, chest circumferences, mid arm circumferences, skin fold measurements and body composition were measured as per the standard procedure.

3.4.2 Second Phase: Baseline Study

Baseline programme was carried out on the sub sampling of the subjects (153), who were playing group games from the general survey. They were divided in to three groups namely control, experimental 1 and experimental 2. The investigator took training with regard to AAHPERD physical fitness tests with the help of physical education teachers, in order to administer those tests for subjects before intervention programme.
Assessment of physical performance: Subjects were assessed for physical performance (fitness) using AAHPERD physical fitness tests and hemoglobin before the intervention programme.

Assessment of nutrition knowledge and practice: Nutrition knowledge and practice was assessed for selected team game players before the intervention programme.

Product development: Two products were developed namely sweet laddu and a carbohydrate electrolyte drink. They were evaluated using 20 trained student panel members for acceptability. Laddu was prepared in bulk quantity one week before each trial experiment and the sport drink was prepared on the day of the day of the event.

3.4.3 Third phase: Intervention Programme

Based on the findings of the baseline data, the intervention namely nutrition education and supplementation trials were carried out to find out the impact of food and nutrition security on the performance of team players.

Conducting Education as Nutrition intervention programme: The nutrition education classes as first component of intervention for two groups (102 subjects) namely Experimental 1 and 2 were conducted in four schools. The selected subjects were made to sit in a separate class rooms at the last period of the school time table and were conducted with the help of book lets charts, folders and power point show. The nutrition education programme was carried out for a period of three months with frequency of one hour per week. A total of twelve of lecture classes along with audio visual aids were given for the selected team game players. The content of the education programme included general nutrition, sports nutrition and its relation to performance. Education was also provided through exhibitions held in the Dept. of Food Science and Nutrition at Home Science Institute in Dharwad. Details of the topics for nutrition education classes are given in the Annexure-K.
Carbohydrate supplementation: As explained earlier Carbohydrate loading suggested by Hoffman (1991) includes intake of 350-550gram of carbohydrates (70% of total calories) during the last 72 hours proceeding to the competition. Total carbohydrate loading or supply of meals for all the players for 72 hours or three days for two trials before the event was found to be very difficult. Therefore it was planned in the present study to supplement carbohydrate through a snack item to add on to the normal diet consumed by the players to reach a desirable load of carbohydrate for the experimental group. The amount of carbohydrate to be supplemented in the form of a snack was computed based on the diet survey, which was carried out before the intervention. For the purpose of carbohydrate supplementation Laddu, a traditional snack item was selected. Preparation of laddu was standardized using refined wheat flour and underutilized foodstuffs like amaranth seeds, garden cress seeds, groundnuts, jaggery and oil. One serving of laddu (two -103g) contained 72g of carbohydrate and provided 416 Calories. Acceptability trials were carried out for the developed product with the help of 20 trained panel members. An additional supplementation of carbohydrate in the form of two laddus was provided (72g of carbohydrate and 412 kcal) per day to experimental group to elevate the carbohydrate level to more than 300 g, which was a desirable level of carbohydrate supplementation before the event, for three days continuously prior to the competition, and they consumed the laddu in addition to the usual diet taken at home as carbohydrate supplement.

It is also stated that there was a need for quick energy and electrolyte supplementation, if the game exceeds more than one hour during the (Convertino et.al.1996). A palatable flavor is known to enhance fluid intake during exercise and flavored drinks enhance fluid balance in a field situation (Michelle et al 2002). Since team games usually takes more than one hour, it was planned to provide sport drink for the players before, during and immediately after the competition. A drink was prepared and standardized using kokum peels (Garcenia indica), soaked rice flakes and sugar for
supplementation during the competition. One serving of drink supplied 6.75% of carbohydrate and fortified electrolytes (Sodium: 10mM/L, Potassium: 5mM/L) as stated by Martin (2003).

The subjects were explained about the supplementation trials with the help of Physical education teachers. This loading trail was done for all the subjects who participated in four team games. The calendar of feeding trials was finalized with the help of physical education teachers and time allotment was given to each games.

A sports drink was also provided during the competition day for experimental group. Experimental group received 250 ml of drink (5ml /kg body weight) before the event and another 300 ml was given during the event (3ml /kg body weight). After the event, 250 ml (5 ml/kg body weight) as recommended by (Burke and Hawley, 1997).

Organization of real matches: The approach of evaluating the real match situation as suggested by Burke (1999) was selected for the present study to find out the impact of carbohydrate supplementation on field performance of players. The experimental group was supplemented with two laddus before the event for three days as explained earlier. The laddus in separate packets were distributed to all the players on the playground after completing their practice. The investigator made sure about complete feeding of laddus on the playground. The real match was organized between control group and experimental group who received carbohydrate supplementation and also nutrition education with the assistance of school authorities and coaches. On the day of competition, the players were asked to report to the field at 9 am. They were made sure to consume similar type of light breakfast, which is rich in carbohydrate and low in fat before 7 am by giving them structured dietary guidelines. Match started at 10.30 am. And each match was played for two or three games depending on the result and the duration of the game. The practice time was maintained uniform for both the groups for one hour. The experimental group was advised to reduce the practice for 30 minutes during supplementation. Two trials of all
matches were organized with a gap of fifteen days. A total of eight feeding trials were conducted.

**Assessment of dietary intake:** A total of seven days food intake of subjects who participated in supplementation trials was recorded using standardized cups and teaspoons. The standardized cups were provided to the children and they were educated with regard to measurements. They were requested to write down the amount of foodstuffs they consumed for one whole day in terms of cups and teaspoons, and the investigator collected these filled in forms.

**Computation of nutrient intake:** The food intake of seven days was converted to nutrient intake using standardized procedures using the ready recknor. Individual nutrient intake of energy, protein, fat and carbohydrate, were calculated.

### 3.4.4 Fourth Phase: Evaluation of Intervention Programme

To find out the impact of the intervention programme in terms of nutrition knowledge, practice and also impact of nutrition security (carbohydrate supplementation) on the performance of team sports, the following evaluation was carried out.

**Nutrition Knowledge and Practice:** A Checklist, which was used to assess the knowledge and practice level before the intervention programme was also used to find out the impact of nutrition education. After three months of nutrition education, both the groups were assessed for nutrition knowledge and practice.

**Nutrient Intake:** Diet survey as mentioned earlier was used to assess the impact of nutrition education and carbohydrate supplementation on nutrient intake for a period of seven days including three days after nutrition education and three days with carbohydrate supplementation and on the match day.
Physical performance: Physical performance was evaluated by AAHPERD test as explained earlier. All the tests were conducted after carbohydrate supplementation and before the real match competitions.

Field performance: There are no standardized techniques used in research to evaluate sports performance in team games because it involves complex mixture of physical fitness and mental skills. In the absence of any standard method to quantify field performance of the team games, a checklist was evolved with scoring method. This checklist was formulated with the help of experts in the field and checked for its validity. A checklist was prepared to evaluate game specific skills of all team games, over all performance of players and number of fouls observed during the match. Three invited coaches evaluated performance of all players. They were briefed about the evaluation of each individual player during the competition. The experts were unaware of the control and experimental group and they evaluated them, using the checklist with a maximum score of ten. Field performance was evaluated after two trials of real matches.

Self-evaluation: Subjects who had taken carbohydrate supplementation were evaluated their performance on the field after the competition by using checklist.

3.4.4 Fifth phase: Preparation of the Report

After collecting the data from general, base line and intervention study, various preliminary calculations were carried out before tabulating the results.

A master table was prepared to include all the information collected. The data was analyzed with the help of a statistician, SPSS package and XI stat (2006) to interpret the results. Various tables were prepared using number and percentages to present the results on family background, nutrition knowledge, practice, food security and nutrition security and physical performance. The impact of supplementation on performance of four games were analyzed using, student’s t tests, ANOVA, Multivariate (Principal Component and Discriminant) analysis, suitable graphic presentation, tables, figures were prepared along with the text of the report.
**First Phase**: Selection of the study area - 8 schools - Dharwad city
Selection of the subjects - 172 children aged 13-16 years
Initial assessment of information from selected schools children.
Methods used for collecting information
Questionnaire, interview, diet survey, anthropometric measurement, Hemoglobin,

**Second Phase**: Selection of 4 team games (3 groups for each game) and players -
Kabaddi - boys (12) Foot ball - boys (15) KhoKho - girls (12) Volley ball girls (12)
Total n= 153
Assessment of nutrition knowledge and food and nutrient intake, anthropometric measurements, hemoglobin level and physical performance using AAHPERD test
Product development for intervention programme: Laddu (snack) and drink using locally available foods)

**Third Phase**: Conducting Intervention programmes
- Conducting Nutrition Education NE.
  - Control group 4 groups (n= 51)
    - No education
  - Experimental group 1 - (4 groups) n= 51
  - Experimental group 2 - (4 groups) n= 51
  - Education - 12 lecture hours using AV aids for all games.

- Carbohydrate supplementation and conducting real matches for Control and Experimental groups
  - Control group (4 groups, no suppl)
    - n= 51
  - Experimental group 2 (4 groups) n= 51
  (Four groups - all games - education + supplementation)
  - Snack - supplementation for 3 days before the real matches.
  - Drink - supplementation during and after the real matches.

**Fourth Phase**: Evaluation of Intervention programme
- Assessment of Nutrition education programme
  - Nutrition knowledge and Practice, Food and nutrient intake, (before NE and after NE)

- Impact of Carbohydrate supplementation on Group games:
  1. Physical performance using physical fitness tests.
  2. Assessment of performance parameters in real matches, (in the field by Coaches and players)
     nutrient intake before the matches and during the match and after the match.

**Fifth stage**
Processing the data - Statistical analysis and preparation of the report.

Figure 3. A birds eye view - methodology used for the study