3.0 METHODOLOGY

The present study, exploratory in nature, was carried out in Srinagar city (Jammu and Kashmir) in three phases in order to meet the objectives of the study. It involved gathering of both qualitative and quantitative data. Phase I and Phase II constituted the exploratory phase of the study. This comprised

Phase I
- Status of nutrition services in the hospitals registered with Directorate of Health Services (DHS) of Srinagar.

Phase II
- A detailed study of
  A. The nutrition services in selected hospitals. This phase also included patient perception of the nutrition services in the hospitals.
  B. The nutritional assessments of a sub sample of patients with hospital stay of more than 10 days.
  C. The hygiene and sanitation of the food service units.

Based on the results of Phase I and Phase II, development of recommendations for hospital nutrition services constituted Phase III of the study.

3.1 RESEARCH DESIGN

A schematic presentation of the research design is depicted in Figures 3a to 3c.

Various aspects on which data was collected in Phase I and Phase II of the study are presented in Figure 3a and 3b. Figure 3c details Phase III of the study.
Figure 3a: RESEARCH DESIGN: PHASE I AND PHASE II

**LOCALE**

Hospitals of Srinagar

**EXPLORATORY PHASE**

**PHASE I**
- Selection of all registered hospitals in Srinagar
- Categorization of the various hospitals
- Data collection on the nutrition services provided

**PHASE II**
- A. In-depth study of nutrition services in selected hospitals
- B. (i) Patients perception of nutrition services and (ii) Nutrition assessment of patients
- C. Hygiene and sanitation of the food service unit

**SAMPLE**
- DHS Officials
- Hospital Administrators
- Doctors
- Nurses
- Nutrition Care Providers
- Dieticians
- Kitchen Managers
- Material Management Officers
- Storekeepers
- Stewards
- Head Cooks
- Sanitation Workers
- In-Patients (2 categories)
- Food, water and surfaces (microbiological assessment)

**TOOLS AND TECHNIQUES**
- Observation and Discussion
- Checklist
- Interview schedule
- Microbiological testing
- Anthropometric measurements
  - Height
  - Weight
- Hospital records
  - Biochemical data
  - Clinical data
- Dietary Data
  - 24 hour recall
  - FFQ
- MUST (modified)
### Figure 3b: DATA COLLECTION FOR PHASE I AND PHASE II

<table>
<thead>
<tr>
<th>Hospitals</th>
<th>Nutrition Services</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>- General information</td>
<td>- Nature and presence of dietetic department</td>
<td>- Patients perception of nutrition services</td>
</tr>
<tr>
<td>- Presence of a dietetic department</td>
<td>- Suitable infrastructure</td>
<td>- Nutritional status of patients with long term stay in the hospital (≥10-15 days).</td>
</tr>
<tr>
<td>- Infrastructure and physical facilities</td>
<td>- Food delivery</td>
<td></td>
</tr>
<tr>
<td>- Food service Personnel</td>
<td>- Food quality</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Hygiene and sanitation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Microbiological testing of food and water</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Types of diets</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Normal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Therapeutic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Special feeding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Dietary counselling</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- IPD/OPD Counselling</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- In-service Training</td>
<td></td>
</tr>
</tbody>
</table>

### Figure 3c: PHASE III

DEVELOPMENT OF RECOMMENDATIONS FOR OPTIMIZING NUTRITION CARE

- Data analysis and interpretation of Phase I and Phase II data
- Development of recommendations for optimizing nutrition care of patients at Srinagar hospitals for DHS officials, hospital administrators, doctors, nurses, dieticians and other stakeholders
- Feedback from stakeholders
3.2 LOCALE

Srinagar, which is the capital of Jammu and Kashmir State, is situated at a high altitude of 1,730 m above sea level, spread on both sides of river Jhelum. The total population of Jammu and Kashmir is 1.25 crore (Jammu and Kashmir Population Census, 2011).

While the Dal and Nageen Lakes enhance its picturesque setting, the challenging play of seasons and the salubrious climate make the city attractive. The day to day increasing burden of patients pouring in from the corners of the Valley, due to lack of infrastructure and inability to handle the complicated ailments in district hospitals, has created an alarming situation in the city hospitals. This has overburdened the city hospitals, especially in Srinagar and adversely affected the state of hygiene and patient care as quoted in the newspapers (Greater Kashmir, 2007). Therefore, a need was felt to evaluate the nutrition services which form an integral part of patient care in the hospitals. The present study was therefore carried out in Srinagar city. To fulfill the objectives of the study, the nutrition service units of registered hospitals in various areas of Srinagar city, were investigated.

3.3 SAMPLE

Details of the sample for Phase I and Part A, Part B and Part C for Phase II of the study are given

3.3.1 Phase I

Information from the hospitals with regard to nutrition services was collected in this Phase
Components of Phase I were to explore

- The existing hospitals in Srinagar from the primary source where the hospitals were registered and to categorize various hospitals which were surveyed as government, autonomous or private hospitals.

- The kind of nutrition services provided in the hospitals surveyed.

Purposive sampling was used in the study. The sample for Phase I of the study was as follows

- DHS officials
- Hospitals in Srinagar
- Some other stakeholders

3.3.1.1 Rationale for sample selection in Phase I of the study
For a general assessment of nutrition services, different cadres of personnel involved directly or indirectly in nutrition care like DHS officials, hospital administrators, dieticians, doctors, nurses, cooks, stewards and sanitation workers were included, to get a holistic overview into the nutrition care services and identify the positive aspects and lacunae needing attention in nutrition care.

3.3.1.2 Selection Criteria
Informed consent and willingness of hospital administrators and other personnel involved in nutrition services to participate in the study formed the basis of sample selection for the study. The consent letter is given in Annexure I.

- The selection criterion for the hospitals included in this study was as follows:
Inclusion criteria
All registered hospitals, government, private and autonomous hospitals which had an Inpatient Department (IPD) were selected.

Exclusion criteria
Hospitals which offered only Out Patient Department (OPD) facilities were not considered for the study

3.3.1.3 Sample size
All hospitals registered with DHS in Srinagar, were included in the study

3.4 Phase II (Part A and Part B)
From the hospitals surveyed and categorized based on the type of hospitals and the presence or absence of a Dietetics Department, all hospitals providing food to patients were selected for an in-depth study of nutrition services. The aspects covered in the in-depth study of nutrition services included:

- Nature and presence of a Department of Dietetics and qualified dieticians to provide nutrition care
- Suitable infrastructure
- Adequate personnel
- Type of diets (normal and / or therapeutic diets)
- Food quality
- Food delivery
- Special feeding
- Hygiene and sanitation
- Microbiological testing of food items served, water, utensils and working slabs
- Dietary Counselling provided to in-patients and out-patients.
- Teaching and In-service training of the food service personnel.
- Patients perception of food services, food quality and food safety
- Nutritional status of patients with long term stay (about 10-15 days) in the hospitals.
Sample for Phase II of the study thus included the various persons involved directly or indirectly with nutrition care and nutrition services in the hospitals and the patients. Also, included were samples of hospital cooked food, water, utensils, equipment and surfaces in the kitchen for microbiological assessment in Part C of Phase II.

The sample thus comprised

- Hospital Administrators.
- Nutrition care providers including hospitals administrators, doctors, nurses, dieticians, kitchen managers, cooks, stewards, material management officers, storekeepers and sanitation workers.
- In-patients at the selected hospitals, including children and adults of both genders, for the perception of nutrition services and only adults for nutritional assessment, who had the ability to stand.
- Cooked food samples, water samples and surfaces for microbiological analysis.

### 3.4.1 Rationale for sample selection for Phase II of study

- **Hospital Administrators**
  
The hospital administrators have the ultimate responsibility for providing conditions to serve the patients a proper diet. Hospital administrators could be involved in selecting, directing and training personnel or could also be the director of one or more food production units, or be responsible for research in food service administration (Cocke, 2010).

Hospital administrators were included in order to study their role in the overall organizational set up and management of the hospital dietetic departments.

- **Doctors**
  
  Doctors are responsible for all medical treatment and prescribing appropriate treatment including nutritional treatment. In addition, they must provide some nutrition information to patients, in order to provide good care to patients. They can motivate patients to eat
healthy and also guide patients for dietary change. This is especially so, as doctors are usually perceived as the best source of information, by patients.

However, the doctors need to refer to dieticians for actual delivery of nutrition care. In the case of more complicated patients, doctors should utilize the expertise of dieticians for optimal health and nutrition care of the patients. Hospitals should have a multidisciplinary nutrition steering group to establish policies for nutritional care. Doctors should be actively involved in this development (Royal College of Physicians, 2002).

Doctors were thus included in the study to have an insight into their role in the patient care especially in context of nutrition services, in the hospitals.

- **Nurses**

Nurses play a central role in patient care. Nurses have a day to day responsibility for ensuring that patients are given appropriate diets adapted to their health and needs. Moreover, they mostly have the additional responsibility of recording, assessing and reporting the patient’s food intake and their nutritional status. It has long been recognized that nursing care which promotes nutritional intake when and as appropriate, can aid recovery from illness and enhance the quality of life of patients. There has been growing concern that nurses do not pay sufficient attention to the nutritional needs of patients or clients (Green and Jackson, 2002). Nurses from wards and senior incharge nurses and supervisors were therefore included to know if they participated in the nutrition care in any manner and provided any assistance to patients with their meals.

**Nutrition Care Providers**

Various personnel directly involved in the provision of nutrition care were included in the study. These were
• **Dieticians**

Dieticians play a major role in the nutrition care of patients at hospitals. The responsibilities mostly include menu planning and food purchasing, maintenance of safe food storage practices, supervision of food preparation, supervision of food distribution, selection, training and supervision of personnel, supervision of sanitation and hygiene of the dietary department, nutritional assessment, counselling, formulating diet charts, nutrition education, research and financial control of dietary-budget and records (DGHS, 1989). Thus, dieticians occupy an integral position in the nutrition care services, and formed an important part of this study.

• **Kitchen /Canteen Managers**

Kitchen managers should take part in formulating hospital nutrition guidelines in patient care. The kitchen has the opportunity to constantly adjust and adapt their production to the actual needs for food and beverages of the patients. At the same time, the skilled kitchen staff gets the opportunity to follow their products all the way to the patient (Lassen et al, 2006). Kitchen/Canteen managers were included as they direct the kitchen staff for various activities in the preparation and cooking of diets and meals for patients.

• **Material Management Officers (MMO)/Storekeeper**

Material management officers mostly direct the kitchen storekeeper and the junior staff for the maintenance of the store rooms of the dietetic department. The MMO/storekeepers are responsible to keep a record and maintain the diet indent and receipt, proper storing of ration and perishable items in cold room, accounting, issue and records of the food supply and pest control (Das, 2011). They were thus included in the study. Where there was no material management officer, the storekeeper was included to gather necessary data.

• **Cooks**

Cooks are responsible for ensuring that the kitchen supplies sufficient amount of tasty and nutritionally wholesome food that meets the requirement of patients (Kondrup,
Cooks thus constituted a part of the study to investigate the nature of meals cooked and other activities related to preparation and cooking of meals.

- **Stewards**
  The steward or chief cook in charge of the kitchen ensures that the meals are in readiness at the hours assigned for each, and they are of good quality. It is also his responsibility to supervise the distribution of the food from the kitchen. WiseGeek (2012) quotes a steward as a kitchen worker who supports the kitchen staff through performing various tasks. He normally works in a team of two or more people. Before the shifts for each meal begin in a hospital, the kitchen steward frequently inspects the preparation stations, stoves and refrigerators. It is usually his job to make sure all the necessary equipment is properly stored and readily available for the kitchen staff.

The main role of stewards in a hospital dietetic department is to distribute food to patients. Stewards were thus included to know about the food delivery systems of the dietetic departments of the various hospitals.

- **Sanitation Worker**
  Sanitation and hygiene is an important aspect in any hospital including the dietetics department/kitchen. Sanitation workers are responsible for keeping floors and walls clean, sanitize tables, chairs, doors and eating trays, and thoroughly clean bathrooms. Many facilities designate sanitation managers to oversee other employees and make sure that nothing is neglected or cleaned improperly (WiseGeek, 2012). Sanitation workers were included in the study to obtain information about cleaning and sanitizing of the various areas of the dietetic department.

- **In-Patients**
  In any hospital, the in-patients are the end receiver of the nutrition care and nutrition services. Their satisfaction with the meals is very important. Infact, information about the food service, and the patients-staff communication about the food service is another important aspect of patient care (Lassen et al. 2006).
In-patients were included in the study, as the recipient of nutrition care, to gain insight into their perception of the nutrition services including

- Aspects like food in general, food quality and food service. They were also asked about the nutritional counselling received from the dieticians.
- Adult in-patients with an admission within 48-72 hours and with hospital stay of at least 10 days and above were selected as a part of the study sample, for assessment of their nutritional status.

3.4.1.1 Selection Criteria of Sample for Phase II (Part A and Part B)

The selection criterion for the sample of Phase II of this study was as follows:

3.4.1.1.1 Nutrition care providers and patients

✓ **Hospital Administrators /Doctors**

In the case of hospital administrators/doctors, the criterion for selection was willingness of the hospital administrators/doctors to grant permission for the work and co-operate in the study.

✓ **Nutrition Care Providers**

The basis of selection of sample of various personnel involved in nutrition care was

- Willingness to participate in the study and informed consent from the personnel.
- Representation of each cadre of personnel involved in nutrition services, based on available personnel, for the detailed investigation.

Under this category, both direct and indirect providers of nutrition care were included such as hospital administrators, doctors, nurses, dieticians, cooks, stewards, material management officers, store keepers and sanitation workers.
In-Patients

In patients were selected from all the hospitals under study and from various speciality areas. In order to evaluate the nutrition services, two aspects of nutrition care were assessed. The first was

a) The perception of patients of nutrition services in the hospital.

b) The second aspect included nutritional assessment of patients with more than ten days of hospitalization based on anthropometry, biochemical parameters, clinical signs, dietary data and nutritional risk scoring. This was to study the effect of long term hospitalization, on nutritional status.

For perception of nutrition services, the selection criteria was
- Willingness to participate and informed consent from the patients.
- Selection of patients of either sex.
- Patients admitted at least 2-3 days prior to the survey for perception of food services.
- Patients of different age groups covering geriatric patients, adults and children depending on availability.

For assessment of nutritional status the selection criteria was
- Willingness to participate in the study and informed consent from the patients.
- Adult patients (males and females).
- Patients admitted within 48-72 hours, with an expected admission of more than 10 days and above to enable initial nutritional assessment and follow up of anthropometric status (weight and BMI) pertaining to length of stay in the hospital for nutritional risk screening.

3.4.1.2 Sample Size for Phase II (Part A and Part B)

As it was not possible to interview all the personnel involved in the nutrition care process, a suitable representative sample from each cadre was interviewed and care was taken to ensure that there were senior staff from each group.
The sample size of each category of personnel involved in nutrition care from each hospital included in the study, and mode of selection is presented Table 3.1. For some categories of nutrition care providers, there was only 1 person in each hospital in that category and hence was included in the study, like hospital administrators, kitchen manager, material management officer or storekeeper. Where there were more persons in each category (doctors and nurses), a representative sample of 2% was taken as it was considered adequate to provide the necessary information. In the case of stewards, cooks and sanitation workers, the head of that category was included. With respect to dieticians, all were included in the study, irrespective of whether there was only 1 dietician or more in the hospital.

3.4.1.2.1 In-Patients
For patients, the sample size is tabulated in Table 3.2. As seen from the table, patients were selected for (a) obtaining their perception about the nutrition services and (b) patients with >10 days stay in the hospital for nutritional assessment.
A representative sample of in-patients was included in the study. As indicated in Table 3.2, 5% of the total bed strength of each hospital was selected for food perception of patients and at least 2% for nutritional assessment of patients, with hospitalization greater than 10 days, based on availability of such patients, with inclusion of about 50-60 patients.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Percentage of sample selection</th>
<th>Total number of patients</th>
<th>Total number of Hospitals</th>
<th>Mode of selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients for food perception</td>
<td>5%</td>
<td>155</td>
<td>11</td>
<td>In-patients with recent admission (2-3 days at least)</td>
</tr>
<tr>
<td>Patients for nutritional assessment</td>
<td>At least 2%</td>
<td>50-60</td>
<td>4</td>
<td>Patients with more than 10 days expected stay admitted within 48-72 hours stay in the hospitals</td>
</tr>
</tbody>
</table>

3.5 Phase III

This phase involved developing recommendations based on data gathered in Phase I and II of the study, for DHS officials, directors, hospital administrators and dieticians. This was for improving the hospital nutrition services at Srinagar, in an attempt to improve the nutrition care for patients. Good nutrition services are known to improve prognosis of those who are ill and need special diets and patient care (Saroj, 1989).

3.5.1 Sample

The main sample for Phase III of the study included
- DHS Officials
- Hospital Administrators
- Dieticians
- Some other stakeholders

3.5.2 Rationale for sample selection for Phase III of study

As DHS officials and hospital administrators are involved in policy decisions regarding hospital management, and are in a position of responsibility to formulate and implement
recommendations for the nutrition services, it was proposed to give the recommendations which evolved from the study, to them.

In addition to persons in positions of authority, the recommendations were also given to other stakeholders like doctors, nurses and patients in order to obtain their views about recommendations for improving nutrition services.

3.5.3 Sample Size
The recommendations formulated were thus given to
- Director Health Services (DHS) Officials of Srinagar numbering 1.
- Hospital administrators and/or directors of all registered hospitals of Srinagar, for recommendations -1 per hospital (n=11).
- Chief dieticians/senior dietician/junior dietician in hospitals where this position existed (n=10).
- Doctors = 2 from each hospital
- Nurses=2 from each hospital
- Patients=2 from each hospital

3.6 TOOLS AND TECHNIQUES
Several tools and techniques were used for the data collection in different phases of the study. The tools included in the study were observation, checklist, interview schedules, patient’s case records, 24 hour diet recall with food frequency questionnaire (FFQ), and anthropometry. All tools developed were pre-tested prior to their use in the study.

3.7 PRE-TESTING
“A pre-test usually refers to a small-scale trial of particular research components. It serves as a trial run that allows identification of potential problems in the proposed study. Although this means extra effort at the beginning of a research project, the pre-test and/or pilot study enables us, if necessary, to revise the methods and logistics of data collection,
before starting the actual fieldwork. Thus, time, effort and money can be saved in the long run. Pre-testing should always be undertaken in an area near the study site, using respondents similar to those who will participate in the actual study (Gibson and Ferguson, 1999). In the present study, the tools developed (interview schedules and checklist) were pre-tested and necessary modifications made prior to use. Based on the pre-testing, modification of the interview schedules was made by the deletion of the inconsistent, ambiguous and lengthy items and the addition of essential items. The order of questions was also modified and some questions were rephrased and these were then used for data collection.

3.8 Phase I: Survey of hospitals.
In order to gather information on nutrition services provided by the hospitals of Srinagar, tools used were observation at hospital food service units for infrastructure, sanitation and hygiene and discussion with the nutrition care providers about nature of dietetic department, food delivery, food quality, therapeutic diets, special feeding, and nutrition counselling. The observations were done with a help of checklist (Annexure II) to ensure that all the aspects were covered and all relevant information was obtained from the interview schedules used to assess the nutrition services. Furthermore, patients were also interviewed about the nutrition services of the hospitals. Thus, the tools and techniques used included

- Observation and Discussion
- Checklist
- Interview Schedules

Data gathered using these tools consisted of general information regarding the
- Type of hospitals
- Number of beds
- Number of speciality wards
- Presence of dietetics department
- Dietician to patient ratio
- Infrastructure facilities
- Personnel available for nutrition care
The menus followed
- Equipments available for production and delivery of food
- Food safety, hygiene and sanitation

3.9 Phase II: This phase included

A. An in-depth study of food and nutrition services
B. Patients Perception of nutrition services and patients’ nutritional assessment with 10-15 days hospital stay
C. Microbiological testing of cooked food, water, utensils, working slabs of the hospitals kitchen. The tests done for this included
  - Swab test for utensils used for cooking
  - Swab test for working slabs
  - Total Plate Count (CFU) for food and water
  - Most Probable Number of coliform bacteria for water
  - E. coli for water

3.9.1 (A) Food and Nutrition Services
In order to obtain the desired information for parts A of Phase II, the following tools were used
- Interview Schedules supported by observation and discussion.
- Check list supported by observation and discussion.

a) Interview Schedules
The interview method of collecting data involves presentation of oral –verbal stimuli and reply of oral verbal responses. An interview has its flexibility. An interviewer administered survey is more accurate and obtains more returns than a post-self completion survey. The advantage of an interview is that it can elicit information from a respondent that covers a long period of time in a few minutes. Also, a face to face interaction assists in the establishment of rapport and a higher level of motivation among respondents. It is a useful method when exhaustive data is required on a small number of complex topics (Burns, 2000). The interviewer can pursue in-depth information around
the topic. Interviews may be useful as follow-up of certain respondents to information obtained from questionnaires, to further investigate their response (McNamara, 1999).

To meet the objectives of this study, interview schedules were developed for different nutrition care providers ranging from hospital administrators to dieticians to sanitation workers. Interview schedules were also administered to patients in order to obtain their viewpoint on the nutrition services.

Thus, a total of 13 interview schedules (Annexure III to Annexure XV) were administered independently to the following:

Hospital administrators, chief dieticians/senior dieticians, ward dieticians, doctors, nurses, material management officers, storekeepers, canteen manager/kitchen manager, cooks, stewards, sanitation worker and two to the patients, one for food perception and one for nutritional assessment.

b) Check list supported by observation and discussion

The data gathered using the interview schedules was authenticated by observation, discussion and use of a check list. This was used for understanding the operational systems from purchasing, production, food service and delivery to sanitation and hygiene of the food services.

3.9.2 (B) (i) Patients Perception of Nutrition Services and (ii) Nutritional Assessment of Patients

Inpatients (n=155) were included to gather information on their perception of nutrition services. Nutritional assessment is an integral part of nutrition and patient care and this has also been recognized by NABH (2007), which lays strong focus on practicing good patient care protocols, including nutritional assessment of all patients in accredited hospitals. Nutritional assessment methods are based on a series of dietary, laboratory, anthropometric and clinical observations (Gibson, 2005). Comprehensive nutritional assessment was carried out on a sample of patients (n=50), with hospital stay greater than
10 days. For this group, patients were selected from four hospitals (H1, H5, H6, and H10) where many patients were admitted for long duration. Nutritional status assessment of subjects was done on the basis of their anthropometry, biochemical status, clinical profile and dietary and nutritional intake. Nutritional screening of these subjects to assess their nutritional risk was also done using modified Malnutrition Universal Screening Tool (MUST). For this, weight of the subjects was taken initially and again about 10 day after their initial weight measurement, to find out the percentage change in their weight status.

The tools and techniques used for nutritional assessment thus included an interview schedule (Annexure XV) which incorporated

- Anthropometry (height, weight and BMI)
- Biochemical profile from case records
- Clinical parameters from case records
- Dietary Intake (24 hour diet recall and FFQ )
- A modified Malnutrition Universal Screening Tool- MUST

**Anthropometric Measurements**

Nutritional anthropometry has been defined by Jelliffe et al, (1989) as “measurements of the variations of the physical dimensions and the gross composition of the human body at different age levels and degrees of nutrition,” as also described by (WHO, 1995). Common anthropometric measurements include height, weight and BMI, especially in the hospital setting.

Numerous surveys have revealed that many hospital patients are undernourished. Elderly patients are particularly vulnerable to the adverse consequences of undernourishment. Slow acquisition and application of available knowledge has been blamed as a principle reason for lack of progress in tackling the problem of hospital malnutrition. A study by Tierney (1996) provides a resume of the knowledge accumulated from research, with the purpose of promoting active and informed nursing involvement in the detection and management of undernutrition in hospital wards.
In the present study, for nutritional assessment, height and weight were measured using standardized equipments and techniques (Jellife et al, 1989). All anthropometric measurements were done in duplicate. Height and weight were measured to calculate BMI. Height and weight were initially measured in duplicate in 10 patients, to ensure reproducibility.

**Height**

Height of an individual is the sum total of four components-legs, pelvis, spine and skull and reflects skeletal growth. Long term malnutrition can adversely affect height as reflected by height deficit in children (Jelliffe et al, 1989). In adults, height will not change in 10 days but it was measured and used for calculating BMI (weight kg/ height m²) and changes in BMI and hence nutritional status, over 10 days, for the long stay patients. Height measurements can be obtained using a direct or an indirect approach. The direct method involves a measuring rod or stadiometer, and the ability of a person must be able to stand erect or recline flat. Indirect methods, including arm span, recumbent length, and knee height measurements, may be options for those who cannot stand straight, such as individuals with scoliosis, kyphosis (curvature of the spine), cerebral palsy, muscular dystrophy, contractures, or paralysis or those who are bedridden (Mahan and Stump, 2012).

Height was measured with the help of an anthropometric rod which had a sensitivity of 0.1 cm. All readings were taken in duplicate. Subjects were made to stand barefoot on a flat floor with both heels together, legs straight and shoulders relaxed. The head was positioned in the Frankfurt plane. The anthropometric rod was then placed behind the subject so that the lower end was behind the heels and the beam passed vertically between the buttocks touching the back of the head. The head piece or the sliding part of the measuring rod was lowered so that the hair (if present) was pressed flat.

**Weight**

Weight is one of the most common measurements used to assess body mass and malnutrition on the basis of weight deficit or excess. Weight may be recorded at a single
A digital weighing scale with a sensitivity of 0.1kg was used for recording weight. This balance was used because it was portable, light, and convenient to use in the hospital setting. The machine was calibrated with standard weights and accuracy was checked from time to time. The subjects were weighed barefoot with minimal light clothing. They were asked to stand straight and keep the head straight. To avoid errors in measurements due to meal intake, weight was measured before the lunchtime at the hospital. Heavy clothing like sweaters and any heavy ornaments and wrist watches were removed (Jellife et al, 1989).

**BMI**

The body mass index (BMI), or Quetelet index, is a proxy for human body fat based on an individual’s weight and height. BMI does not actually measure the percentage of body fat. It was invented between 1830 and 1850 by the Belgian polymath Adolphe Quetelet during the course of developing “social physics”. Body mass index is defined as the individual’s body weight divided by the square of his or her height. The formula is universally used as a unit of measure that is, of kg/m\(^2\), indicates both over and under nutrition (WHO, 2012d).

The BMI of patients were calculated based on their height and weight.

- **Biochemical Data**

Biochemical tests reveal current nutritional status. With increasing knowledge of the metabolic functions of vitamins and minerals, assessment of nutritional status by clinical signs has given way to more precise biochemical tests which may be applied to measure individual nutrient concentration in body fluids (e.g. serum retinol, serum iron) or detection of abnormal amounts of metabolites in urine (e.g., urinary iodine) frequently after a loading dose, or measurement of enzymes in which the vitamin is a known co-factor (for example in riboflavin deficiency ) to help establish malnutrition in its preclinical stages. Haemoglobin estimation is the most important laboratory test that is
carried out in nutrition surveys. Haemoglobin level is a useful index of the overall state of 
nutrition irrespective of its significance in anaemia. It is an important biochemical test 
carried out in nutrition surveys. An RBC count and a haematocrit determination are 
valuable (Park, 2012).

Biochemical data was gathered from the patient’s medical records at each hospital. Data 
gathered was Hb value, blood sugar levels, ESR, RBC and WBC count.

• **Clinical Data**

  Clinical examination is an essential feature of all nutritional surveys since its ultimate 
objective is to assess levels of health of individuals or population groups in relation to the 
food they consume. It is the simplest and most practical method of ascertaining the 
nutritional status of a group of individuals (Park, 2012). For clinical data, physical signs 
of nutritional deficiencies, if any, related to eyes, hair, teeth, face and nails were assessed 
(Jellife, 1977).

  In the present study, patients were assessed for physical signs of nutritional deficiency.

• **Dietary Assessment**

  The dietary intake of the subjects was obtained for 1 day through a 24 hour recall 
method, validated with the help of a Food Frequency Questionnaire (FFQ).

  **24 hour diet-recall method**

  The 24 hour diet recall is based on the assumption that the intake described is typical of 
the daily food intake. The 24 hour recall is one of the easiest methods of collecting 
information regarding the person’s intake. In the 24 hour recall method, subjects and their 
parents or caretakers are asked by the nutritionist, who has been trained in interviewing 
techniques, to recall the subject’s exact food intake during the previous 24 – hour period 
or preceding day (Gibson and Ferguson, 1999). Thus, the method assesses the actual 
intake of individuals. It is a recollective technique where the interviewer questions the 
respondent to name with approximate amounts the foods that were eaten during the 
previous day at each meal and in between meals. In this study, a one day 24 hour recall
was used. Although a 24 hour recall is generally repeated for 3 days - 1 holiday and 2 working days (Zeman and Ney, 1996), in a hospital setting, a one day recall is more practical. Therefore a 1 day recall was used in the present study to assess the patients food intake

*Food Frequency Questionnaire (FFQ)*

The food frequency questionnaire aims to assess the frequency with which foods, individually or in terms of food groups, are consumed during a specified time period. It was originally designed to provide descriptive qualitative information about usual food consumption patterns. The FFQ should especially include fresh fruits for vitamin C intake (Tsugane et al, 1998); green leafy vegetables, orange and yellow fruits for carotenoid intake (O’Neil et al, 2001); and milk and milk products for calcium intake (Barr et al, 2001). The FFQ helps to validate a 1 day recall by supplementing the information obtained from just one day’s diet.

In the present study FFQ was used to validate the data obtained by the 24 hour recall. The dietary and nutrient data was calculated by ICMR, (2010) and ICMR (2011).

*Standardization of cooked foods to raw weights*

Cooked food stuffs were standardized to obtain the weight of raw food ingredients of the food items. This needs to be done to assess the amount of various foods consumed and hence to calculate nutrient intake from dietary data with accuracy. For this, it is necessary to assess portion sizes for every individual, differentiate between small, medium and large portions and assess average portion weights (Fehily and Johns, 2004). The dietary data obtained by a 24 hour recall in terms of household measures was converted into equivalent of raw weights, by standardizing the recipes of a regular Kashmiri meal consumed in every household and foods consumed in the hospital, in the laboratory. This data (Annexure XIX) was used to calculate the intake of various food groups and nutrients by the patients. From the raw weights of the foods consumed by the patients, the mean intake of various foods per day was calculated and based on that, the nutrient intakes.
Malnutrition Universal Screening Tool (MUST)

A modified version of Malnutrition Universal Screening Tool (MUST) was used for the nutritional screening of patients in the study. ‘MUST’ is a five step screening tool to identify adults, who are malnourished, at risk of malnutrition, undernutrition, or obese. It also includes management guidelines which can be used to develop a care plan. It is for use in hospitals, community and other care settings and can be used by all care workers according to British Association of Parenteral and Enteral Nutrition (BAPEN, 2007). The screening tool was modified with respect to its Step 1 (Figure 3.3). As most of the patients did not stay in the hospital beyond about 10-15 days, the change in body weight upon hospitalization was assessed after 10-15 days only instead of 3-6 months, as stipulated by MUST. A detail of MUST and its scoring pattern is depicted in Figure 3.3. The modification made was not validated as it was just used as an indication or pointer of change in nutritional status over 10-15 day period, the time period for which the patients available for this study were hospitalized.
3.9.3 (C) Microbiological Assessment of Food, Water and Surfaces of Hospital Kitchens

Hospital food is an essential as well as unavoidable part of patient care. Good food can encourage patients to eat well, giving them the nutrients they need to recover from surgery or illness. Hospitals are in general thought to be the most hygienic place. However a poorly-run hospital can be responsible for any sort of food-borne illnesses and hence can serve as a reservoir of pathogens. The role of foodstuffs, contaminated by potentially pathogenic bacteria, has long been established as one of the most common causes of gastroenteritis, but the control of this condition remains a major public health problem in all communities (Rabbi et al, 2011)
The microbiological assessment of food, water and surface samples from hospital kitchens of Srinagar was carried out in the Department of Food Science and Technology Laboratory, University of Kashmir (Annexure XXII and XXIII).

**Sample Collection and Method of Sampling**

Purposive sampling was done for microbiological analysis of cooked food, water, utensils and working slabs for obtaining microbial counts. For the microbiological testing, samples were collected from hospital kitchens of 10 of the 11 registered hospitals of Srinagar, included in the study.

In this study, microbiological testing of cooked food (served to patients), water, utensils and work surface was conducted. Microbial assessment of 27 food samples derived from 15 food items, 10 water and 8 surfaces was carried out at 10 registered hospitals of Srinagar, both private and government, which provided food to patients. One hospital (H7) did not give permission for sample collection for microbiological assessment. The food and water samples were transferred to sterile containers and transported to the laboratory and microbiological analysis was done on the same day, thus avoiding any contamination. The samples were stored immediately after collection in a temperature controlled fridge to minimize bacterial growth.

Cooked food samples were taken after 20 minutes of holding time, from kitchens of the various selected hospitals. Sampling and testing of the food was done on the same day. The food samples like cooked rice, vegetable, *dal* and non-vegetarian preparations were taken at the time when patients were served. In case of food samples, an amount of 20-50 grams was collected in transparent sterile disposable pouches. These food samples were delivered to the laboratory within 3 hours while temperature control was maintained.

Water samples were also collected from the same 10 registered hospitals. A quantity upto 1 litre of water sample was collected in sterile bottles.
Swabs from various kitchen utensils and surfaces were collected before cooking. The swab samples were 10-working slabs, 10-serving ladles, 10-serving spoons, 2-serving bowls, 10-rim of vegetable containers, 10-rim of rice containers, 10-rim of pressure cookers and 10-knives.

**Tools and Techniques**

**Microbiological tests conducted for food, water and surface sanitation of the kitchens**

Microbiological testing of food and sanitation of the kitchens included

- Total Plate Count (CFU) for cooked food and water
- MPN (Coliform Test) for presence of coliforms in water
- Swab test for utensils used for cooking
- Swab test for working slabs.

All methods used were standardized.

Results of the microbiological tests conducted were compared with standards using

1. BIS code for The Indian standard by BIS (IS: 5402-2002) Method for Plate Count of Bacteria in the Food Stuff (BIS, 2002)
   - MPN – Standard Methods of examining water and waste water (McCarty, 1915).

1) **Total Plate count for bacteria**

The total plate count also referred to as the aerobic plate count or the standard plate count, is one of the most common tests applied to indicate the microbiological quality of food. It is generally accepted as a satisfactory method of estimating the total number of micro-organisms in foods. It not only reflects handling history, state of decomposition or degree of freshness but also the sanitary quality of foods (Jay, 2000). The Indian Standard by BIS (IS: 5887-1976) “Method for Plate Count of Bacteria in the Food Stuff”
the Indian standard by BIS (1976) and “Method for detection and estimation of coliform bacteria in foodstuffs” was followed for determining the coliform count of water was followed (BIS, 2002). Diluent used was phosphate buffer solution. In this method, the dehydrated plate count agar was obtained. Total plate count was procured from Hi-Media Laboratories Limited. Serial dilution upto 1: 10000 was used for preparation. Pour plate method was applied. Petri plates were incubated at 37°C for 24-48 hours after which the numbers of colonies were counted.

Procedure for food samples
One gram from the food sample was homogenized, tested within 2-3 hours after its collection. A steel blender was used to homogenize food sample. A weighed amount of 1 gram of food sample was homogenized with 9ml of sterile phosphate buffer, with the amount of diluent being 9 times of the test portion and serially diluted upto 1:10000 dilutions. Microbiological analysis of food was conducted by determining the presence of total plate count for every food sample analyzed (dilution 1:10 to 1:10000). The samples were analyzed in duplicate upto 4 dilutions. Total plate count was determined in food samples. Total plate count and coliform count was determined by MPN method for microbial analysis.

2) Most Probable Number (coliform count)
The first and accurate estimation of the number of viable bacteria by the MPN method was published by McCardy (1915). The most probable number (MPN) is particularly useful for low concentrations of organisms (<100ml), especially in milk and water, and for those foods whose particulate matter may interfere with accurate colony counts. Only viable organisms are enumerated by the MPN determination. Estimation of a number of coliform bacteria in a water supply is usually done by adding varying amounts of water to Mc-Conkey broth. An indication of acid and gas formation shows the presence of coliform. Coliform is an indicator of faecal contamination and is suggestive of gross negligence in handling and prevalence of unsanitary practices.
The Indian standard IS: 1622:1981 “Methods of sampling and Microbiological examination of water” was used for the microbial examination of water samples. The Most Probable Number (MPN) technique is a mean of estimating the density of viable organisms in a sample. It measures the number of coliform per 100 ml in a water sample. Member of coliform group, *E.coli* is referred to as indicator organism, since its presence in certain numbers may indicate the potential presence of pathogen in the sample. *E.coli* and the Coliform bacteria are gram negative rod shaped facultative anaerobic bacteria. Identification criteria used were production of gas from glucose and other sugars and fermentation of lactose to acid and gas within 48 hours at 37ºC (coliform) and at 44.5 ºC (fecal Coliform and *E.coli*).

**Microbiological assessment of surface sanitation and hygiene**

In the present study, Swab Test Method was used for the assessment of utensils, equipment and working slabs in the kitchen. The Swab Test Method was used in the study for assessment of surface hygiene and utensils used in the hospital kitchen. This was to provide an indication of the handling practices of utensils besides work surfaces (Rangana, 2007).

**Procedure**

**Cotton wool swabs for swab test**

The swabs were made of non-absorbent cotton wool on wooden sticks about 7-8 inches long to form a swab of about 0.5 inch in diameter. These swabs were placed in pairs in test tubes (6 X 1 inches) and plugged with non absorbent cotton wool and sterilized in a hot air oven for 90 minutes at 150ºC. Sterile swabs were dipped in sterile nutrient broth and used for rubbing over the surface to be tested. After rubbing over the surface, the swabs were again dipped into the broth and mixed well with the nutrient broth. All the steps were performed in the shortest possible time to prevent contamination. A burner was used while the swab was rubbed on the surface to be examined, so as to exclude contamination from the surrounding air. After 28-48 hours, the plates were examined for growth/no growth/extent of growth (Rangana, 2007).
Interpretation and evaluation was done by rating the plates based on the standards given in Table 3.3.

<table>
<thead>
<tr>
<th>Extent of growth</th>
<th>Average colony count</th>
<th>Hygiene status</th>
</tr>
</thead>
<tbody>
<tr>
<td>No growth</td>
<td></td>
<td>Excellent</td>
</tr>
<tr>
<td>+</td>
<td>&lt;30</td>
<td>Good</td>
</tr>
<tr>
<td>++</td>
<td>30-100</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>+++</td>
<td>&gt;100</td>
<td>Unsatisfactory</td>
</tr>
<tr>
<td>++++</td>
<td>Countless</td>
<td>Highly unsatisfactory</td>
</tr>
</tbody>
</table>


**Working formula for Microbiological Analysis**

The number of micro-organisms or ‘N’ present in a test sample (cfu/ml) was calculated as a weighed mean from two successive dilutions using the following equation (ISO 7218:1996 (E))

\[
N = \frac{\sum C}{V \ (n_1 + 0.1 \ n_2) \ d}
\]

Where,

\(\sum C\) = the sum of colonies counted on all the dishes (plates) retained from two successive dilutions, at least one of which contains 15 colonies.

\(n_1\) = the number of colonies counted on plates in the first dilution.

\(n_2\) = the number of colonies counted on plates on second dilution.

\(d\) = the dilution from which the first count were obtained.

\(V\) = volume of the inoculum applied to each dish in millilitres (ml).

The result calculated was rounded to 2 significant figures and taken as the result that is number of microorganisms per millilitre or per gram of product.

**No colonies (ND)**

If the two dishes, corresponding to the test sample (liquid products) or the initial suspension (other products), contained no colonies, the result was reported as follows

- Less than 1 micro organism per millilitre {liquid products}.
Less than 1/d micro organism per gram {other products} where d is the dilution factor of the initial suspension

3.10 Phase III

Based on the data gathered from Phase I and Phase II of the study and drawbacks seen in the hospital nutrition services, recommendations were developed for optimizing nutrition services in hospitals of Srinagar. The drawbacks were consolidated into points covering the main lacunae observed in the nutrition services and a recommendation leaflet was developed which included some remedial suggestions also. This leaflet (Annexure XXIV) was given to DHS officials, hospital administrators and dieticians and other stakeholders and their response to the recommendations was also obtained, using pretested feedback forms (Annexure XXV, XXVI and XVII).

3.11 SCORING PATTERN FOR NUTRITION SERVICES

A scoring pattern was developed to assess or evaluate the nutrition services in the registered hospitals of Srinagar and also to compare the nutrition services across the different hospitals. The critical aspects of nutrition services like the presence of a dietetic department, dieticians, food service provider, and the use of therapeutic diets were each given scores ranging from 0-10 each with 10 being the highest score. For other significant components of nutrition services, an overall scoring pattern ranging from 0-2 was used. Individual questions asked under different aspects received a score of 1 if the response was ‘Yes’ and 0 if the response was ‘No’. An overall score of 2 was given for ≥2/3rd jobs performed/FSU aspects and facilities; a score of 1 for 1/3rd and ≤2/3rd and 0 given for < 1/3rd of jobs performed/FSU aspects and facilities. Overall scores of each aspect of nutrition services and the total scores of each hospital were used to evaluate the nutrition services and provide pointers for developing the recommendations for improving nutrition services in Srinagar.
3.12 DATA MANAGEMENT

All data was entered into Excel sheets for further qualitative or quantitative analysis. SPSS 16.0 software and Microsoft Excel 2007 were used for statistical testing. The statistical tests used for data analysis were mean, range, standard deviation, percent adequacies and t-test. P value of less than 0.05 was considered to indicate statistical difference. For quantitative data, all quantitative data was analyzed using parameters like mean, median and standard deviation. Statistical analysis was done wherever necessary. The data gathered was interpreted encompassing the following steps:

- **Qualitative analysis-descriptive write up**
  Qualitative data involving participant observation, direct observation, unstructured interviewing and content analysis of information was represented by descriptive write-up. Qualitative data included percentages and frequencies. Questions were coded in the Interview Schedules. For this data, the total scores of each aspect of nutrition services and the total scores of each hospital were used to evaluate the nutrition services and provide pointers for developing the recommendations for improving nutrition services in Srinagar.

- **Quantitative analysis – anthropometry and dietary intake**
  **Anthropometric analysis**
  Anthropometric data of height and weight was used to compute BMI for categorizing weight status of patients based on age, using WHO (2000) and WHO/IASO/ IOTF (2000) and WHO (2004) values. A modified Malnutrition Universal Screening Tool (MUST) was used to assess patients nutrition risk profile, by computing their MUST scores (BAPEN, 2007). For this, the initial weight of long term stay patients was taken (pre test) and compared with their weight after 10-15 days (post test).

  **Dietary analysis**
  The various foods consumed in terms of raw weights, were grouped together under appropriate food groups and compared for dietary adequacy with ICMR (2011)
recommendation of balanced diets for adults of different ages. Mean intakes of energy, protein, fat, iron, calcium, vitamins A and C and the B vitamins were calculated. The values thus obtained were assessed for adequacy by comparing with respective RDA (ICMR, 2010) and percentage adequacy was calculated using the Nutritive value of Indian foods (ICMR, 1989) using software developed with these values. Also, the number of patients at different levels of percent adequacy was calculated for dietary and nutrient intakes. Intake of the patients could not be compared to disease related therapeutic recommendations, as the 10 hospitals under study, only normal diets, with modification of less salt and less oil were served.

Microbiological analysis
Results of microbiological testing were compared with the standard cut offs for food and water safety by BIS, India, swab test for surface sanitation by West et al (1977) and MPN for water by Mc Cardy, (1915).

Scoring Analysis
Scoring based on the scoring pattern developed, for various aspects of nutrition services were compared across the hospitals investigated as well as total scores of each aspect, were compared.