Methodology
III METHODOLOGY

The experimental procedure adopted for the present study titled, “Promoting the Nutritional Status and Behaviour Pattern of the Autistic Children through Dietary Intervention” had the following steps:

Phase I
A. Selection of area and sample
B. Formulation of tools and collection of baseline data

Phase II
C. Development and evaluation of a pulse based probiotic food
D. Development and testing the acceptability of special food supplements
E. Nutrient analysis of the biscuit

Phase III
F. Selection and grouping of the autistic children
G. Intervention through supplementation
H. Imparting nutrition education to the mothers of autistic children
I. Evaluation of the impact of intervention in the autistic children
   1. Assessment of the nutritional status
      a) Anthropometric measurements
      b) Clinical assessment
      c) Biochemical assessment
      d) Dietary assessment
   2. Assessment of the food behaviour of the autistic children
   3. Assessment of behaviour of the autistic children
   4. Assessment of functional skills
J. Data analysis and interpretation of the results

Phase I
A. Selection of area and sample

Tiruchirapalli, Chennai, Coimbatore and Neyveli cities of Tamil Nadu were selected as the area for conducting the present investigation as the investigator was familiar to these areas. Also there were many intervention centres in these places supporting autistic children. Initially the investigator visited the centres catering to the
needs of the autistic children in the above cities. Based on the availability of the samples and the consent obtained from the authorities, 20 different centres were selected for conducting the study. The number of autistic children selected for the study from each centre is presented in the Table V.

TABLE V
CENTRES AND THE SUBJECTS SELECTED FOR THE STUDY

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the centre</th>
<th>No. of children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coimbatore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Sanjeevani Care Trust</td>
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</tr>
<tr>
<td>2.</td>
<td>Coimbatore Spastic Trust</td>
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<tr>
<td>3.</td>
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<td>Chennai</td>
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<tr>
<td>4.</td>
<td>Vijay Human Services</td>
<td>22</td>
</tr>
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<td>5.</td>
<td>Sankalp</td>
<td>20</td>
</tr>
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<td>6.</td>
<td>Maduram Narayan Centre</td>
<td>12</td>
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<tr>
<td>7.</td>
<td>Saraswathi Kendra Centre</td>
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<td>8.</td>
<td>Aikya</td>
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<td>9.</td>
<td>Bright Learning Centre</td>
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<td>10.</td>
<td>We Can Trust</td>
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<td>11.</td>
<td>Kirubai Physio Centre</td>
<td>09</td>
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<td>Trichy</td>
<td></td>
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</tr>
<tr>
<td>12.</td>
<td>The Dolphin Special School</td>
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<tr>
<td>13.</td>
<td>Videvelli</td>
<td>11</td>
</tr>
<tr>
<td>14.</td>
<td>Intact</td>
<td>06</td>
</tr>
<tr>
<td>15.</td>
<td>Nest</td>
<td>37</td>
</tr>
<tr>
<td>16.</td>
<td>Pravaag</td>
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</tr>
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<td>17.</td>
<td>Spastics Society</td>
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<td>18.</td>
<td>Athma</td>
<td>03</td>
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<tr>
<td>19.</td>
<td>Sivananda Balalaya</td>
<td>17</td>
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<tr>
<td>Neyveli</td>
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<td></td>
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<tr>
<td>20.</td>
<td>Sneha Opportunity School</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
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<td>400</td>
</tr>
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Out of the 438 children available from the above centres 400 were enrolled for the study based on the cooperation extended by the school authorities and parents of the autistic children. Both boys and girls in the age group of 5 to 16 years were enrolled for the study.

B. Formulation of tools and collection of baseline data

Three schedules to elicit the background details, food behaviour of the autistic children and awareness of the parents on the food and nutritional aspects of autistic children were developed.
1) **Schedule to collect background details**

An interview schedule was specially designed to elicit information on the socioeconomic background of the autistic children, their dietary practices, morbidity pattern and the prenatal history of the mother. The socioeconomic details included age, sex, religion, community, place of living, type of family, details of the family members, monthly income and expenditure pattern. Information on food pattern and dietary habits included the food habits, food practices, food beliefs and three days dietary recall.

Data on morbidity pattern included the age of identification of the problem, specific problems of the child, treatment modalities, immunisation pattern and the incidence of illness. Details on the prenatal history of the mother included the pattern of weight gain, type of delivery, complications during pregnancy and delivery, age of the mother and father at conception, duration of gestation, birth weight of the child, period of breast feeding, environmental exposures during pregnancy, consanguinity, immunisation during pregnancy and ‘Rh’ incompatibility.

2) **Autism awareness schedule**

An autism awareness schedule was developed to assess the awareness of the parents on various aspects related to food and nutrition of the autistic children.

3) **Food behaviour schedule**

Children with autism have feeding difficulties and unusual eating patterns. Many of these youngsters have an extremely limited food repertoire, which is likely related to sensory regulatory difficulties, desire for sameness, or other issues (Williams *et al.*, 2000). An interview schedule was developed to study the eating habits and feeding problems of the autistic children.

All the above three schedules were pretested on 10 randomly selected subjects, required modifications were made and finalised as given in Annexures A, B and C and administered to all the 400 subjects / parents. The details pertaining to the above schedules were collected from the parents of 400 children and teachers of both the experimental and the control group and also through observation by the investigator.
Phase II
C. Development and evaluation of a pulse based probiotic food

1. Preparation of the probiotic food

The probiotic foods currently available in the market are either dairy based or cereal based. This study aimed at developing a probiotic mixture using pulses as a base. *Lactobacillus* was used as an inoculating organism. The organisms in the form of commercial *Lactobacilli* as well as curd were tested and the outcomes were compared to choose the best one for feeding the autistic children. According to Burks *et. al.* (2008) probiotics play a role in maintaining intestinal mucosal immune homeostasis in children with ASD. Taking nondairy probiotics helps the child’s good gut flora to reestablish itself. In turn, when the gut is healthy, the immune system works better, oxidative stress is lowered and the body’s attempts to rid itself of toxins are more fruitful (Bucklery *et al.*, 2010). The main components of the probiotic food included cowpea, green gram, commercial *Lactobacilli* and curd (Plate 1). The procedure involved in the preparation of probiotic food is given in Figure 3.

![Preparation of the probiotic food](Figure 3)
The two pulse based probiotic foods were prepared using equal proportions of the cowpea flour and green gram flour with the addition of i) 2% commercial lactic acid bacillus or ii) 20% homemade curd. The two probiotic foods developed were further evaluated for their probiotic properties using standard procedures.

2. Evaluating the pulse based probiotic food

Bacteria must tolerate gastrointestinal stress conditions for their metabolic activity, as well as to colonise in the gastrointestinal tract. Therefore it is necessary to evaluate the resistance ability of bacteria to gastrointestinal stress before their use as probiotics. The probiotic food was tested for resistance to bile salt, acidic pH, as well as their ability to inhibit pathogens as outlined by the joint FAO/WHO working group (FAO/WHO 2002) using the following procedures:

a. Viability of the lactobacilli

The total microbial count of the mixture was determined using the standard pour plate technique adopted from Maier (2009). One gram of the freshly prepared probiotic mixture was dissolved in 10 ml of distilled water. Nutrient agar was prepared and held at 44 - 46°C in a water bath. Serial dilutions were prepared and 1 µl of the diluent was transferred to a sterile, empty petri dish. Approximately 15 ml of agar medium was poured into the petri dish containing the sample. The sample and agar were mixed thoroughly by rotating the plate several times, clockwise, and then counter clockwise. When the media had solidified, the plates were inverted and incubated. Following the appropriate length of incubation, the colonies were counted using a colony counter (Plate 1).

b. Resistance to gastric acidity

Tolerance of the Lactobacilli to acidic pH was determined by growing bacteria in acidic de Man, Rogosa and Sharpe (MRS) broth. MRS broth was poured in test tubes at pH 7.0, 4.0 and 2.0, adjusted with 1M HCl and 0.5M NaOH. An amount of 5 log_{10} cfu (10^5 cfu) of the culture was poured in each broth tube. Test tubes were incubated at 37°C for 120 minutes. Survival of Lactobacilli was evaluated by plate count method (Awan and Rahman 2005) (Plate 1).
Plate 1
Assessment of the pulse probiotics
c. Bile acid resistance

The ability of the *Lactobacilli* to grow in the presence of bile salts was determined in MRS broth, as described by Dunne *et al.*, (1999). Briefly, MRS broth tubes were enriched with 0.0, 0.3, 0.5 and 1.0% (w/v) of oxgall (sigma) and were inoculated with $5 \log_{10} \text{cfu} (10^5 \text{cfu})$ of the culture. The growth was examined after 24 hours of incubation by plate count method (Awan and Rahman 2005) (Plate 1).

d. Antimicrobial activity

Antimicrobial assay was carried out by disc diffusion method (Bayer 1967). The sterile Muller-Hinton agar plates were prepared. The test organisms were spread over the Muller-Hinton agar plates by using separate sterile cotton swabs. The prepared disc (bacteriocin) and standard disc were placed on the surface of the medium at equidistance. The plates were incubated at 37°C for 24 hrs to determine the antimicrobial activity of bacteriocin. Streptomycin antibiotic discs (30mg/ disc) were used as standard for bacteria; amphotericin B antibiotic disc was used as standard for fungi. Each experiment was done in triplicate for calculating the mean value (Plate 1).

e. Determination of shelf life

The shelf life of the probiotic mixture was determined at refrigerated conditions and at ambient temperature. The product was stored in a sterile airtight container for a period of 15 days under the above two conditions and the microbial count was determined periodically through pour plate technique (Plate 1).

D. Development and testing the acceptability of special food supplements

1. Selection of ingredients

The most basic, fresh, natural and non-processed nourishment could be the best supplement for the autistic child. The challenges that are faced by the autistic children are multifold and this could be addressed by incorporating foods containing certain essential nutrients and friendly microbes. In order to accomplish this objective, recipes were developed using special ingredients namely brown rice, flax seed, roasted Bengal gram dhal, dates syrup, honey and palm oil (Plate 2).

Health benefits of the selected special food components are described below:

a. Brown rice: The unpolished, dehusked paddy is the brown rice, which is a rich source of dimethylglycine (DMG). DMG is a tertiary amino acid that occurs
naturally and resembles B vitamins. Many studies have shown that inclusion of DMG in the diet of the autists produced improvement in behaviour, better eye contact, increased frustration tolerance, better response to infection, better concentration and interest in toys and games, decreased seizures, enhanced muscle energy, reduced muscle cramping, improved speech, improved physical performance and acts as an immune modulator (Kendall and Lawson 1992).

Apart from the above, DMG is thought to be a metabolic enhancer, increases cellular respiration and oxygen utilization. It acts as a detoxifier and an effective antioxidant that protects the cell from free radical reaction. DMG is an ergogenic nutrient which improves the production of energy, thereby possibly enhancing physical stamina (Rimland 1996).

b. Flax seeds: Flax seeds also called as the wonder food is botanically called as Linum usitassimum. It has been ranked as one of the world’s healthiest food. Flax seeds are rich in alpha linolenic acid (ALA) an omega-3 fatty acid. Autistic individuals benefit from omega-3 supplementation in terms of behaviour control and learning. EFA are also important in fighting the increased inflammatory response seen in many autistic children.

c. Date syrup: Iron deficiency in the autistic children has been associated with irritability and sleeplessness. Insomnia, defined as difficulty in initiating or maintaining sleep, has been documented consistently in children with autism spectrum disorder (Hering et.al., 1999; Richdale 1999 and Williams et.al., 2004). Date syrup that is rich in iron was incorporated to improve their nutritional status and overall health. Al-Farsi et.al., (2007) stated that date syrup is valuable as medicine for their tonic effect, serves as a good source of natural antioxidants and could potentially be considered as a functional food or functional food ingredient. Being easily digested, it is very useful for supplying energy. Nicotinic acid content in dates is an excellent remedy for intestinal disturbances.

d. Honey: Sucrose and other simple sugars are easily broken down and they elevate the blood glucose levels. The autistic children have an impaired glucose tolerance, since the glycemic index of honey was found to be less than the sugars. It was used in place of sugar as a sweetening agent also it contains vitamins, minerals, protein, enzymes and amino acids. Researchers have found that honey has various
vitamins and iron in large amounts and its use strengthens the white blood corpuscles (www.benefits-of-honey.com/health-benefits-of-honey.html).

e. Roasted Bengal gram dhal: In order to improve the taste, texture and incorporate protein in the food product roasted Bengal gram dhal was used. Addition of the protein would enhance the production of enzymes and amino acids required for the metabolic processes.

f. Palm oil: Palm oil was used instead of butter and hydrogenated fat since it would reduce the transfat content of the biscuit.

2. Formulation of recipes

   The different food preparations namely porridge, laddu and biscuits were developed and their suitability to feed the children was studied as described below:

   a. Porridge

   Flax seed incorporated probiotic porridge was prepared in two forms as salt porridge and sweet porridge with five different compositions each (Plate 2). Sugars in any form increased the hyperactivity of the autistic children therefore the sweet porridge was prepared using honey because the glycemic index of honey is low when compared to cane sugar. The method of preparation is given in Annexure D. The acceptability of the 10 variations tried is given in Table VI.

<table>
<thead>
<tr>
<th>Variations</th>
<th>Acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1/H1</td>
<td>Strongly dislike</td>
</tr>
<tr>
<td>S2/H2</td>
<td>Dislike</td>
</tr>
<tr>
<td>S3/H3</td>
<td>Slightly dislike</td>
</tr>
<tr>
<td>S4/H4</td>
<td>Like</td>
</tr>
<tr>
<td>S5/H5</td>
<td>Neither like nor dislike</td>
</tr>
</tbody>
</table>

   Acceptability trial was conducted for the parents / care takers, teachers and selected autistic children. Sweet porridge was found to be more acceptable than the salt porridge. The field trial revealed that the smooth consistency of the product was not liked by the children. The mothers also did not prefer the use of porridge as the flavour of the flax seed was more prominent in the porridge. However among the five variations H4 was found to be agreeable than the other variations.
b. Laddu / Balls

In order to address the above demerits the food product was prepared in the form of laddu /sweet balls (Plate 2), using the same ingredients and in the same five different proportions. The method of preparation is given in Annexure D.

Two variations were tried; one using honey and the other using date syrup. Sensory evaluation was carried out as outlined for the above product and it revealed that both the products had less acceptability in terms of flavour. Also the field trial indicated that handling the laddus by the children was difficult since they crumble easily and the mothers opined that feeding the laddus may not be feasible.

c. Biscuits

A product which was familiar to all the children and easily acceptable was identified to be biscuits and they were prepared meticulously to overcome the above demerits (Plate 2). Care was taken to introduce all the beneficial ingredients. The biscuit could not be prepared with the incorporation of the probiotic, since the high oven temperature would destroy the beneficial bacteria. Hence the biscuits were prepared without the probiotic mix and the pulse probiotic was later mixed with honey and smeared between two biscuits just before feeding so that the beneficial microbes did not destroy.

Two types of biscuits; salt biscuit and sweet biscuit were prepared out of the same ingredients using appropriate taste component. Palm oil was used as a shortening agent. The method of preparation is given in Annexure D. The trigger foods as listed below were avoided because of the following reasons:

- refined wheat flour – gluten is maldigested
- butter and milk / milk solids – traces of casein present is maldigested
- synthetic flavours, colours, baking soda and preservatives – aggravate the negative behaviour
- sugars – triggers their hyperactivity
Plate 2
Recipes tried using special food components

Plate 3
The biscuits being tasted by teacher, parents and children
The major ingredients used for both the biscuits comprised of brown rice flour, roasted Bengal gram dhal flour, ground roasted flax seed and palm oil, but the taste ingredients were changed as given in Table VII.

Different variations were of the salt and sweet biscuits. They were subjected to sensory evaluation (Plate 3) and it was found that the sweet biscuits had a better acceptability when compared to the salt biscuits. Variations V4 and V5 were more acceptable than the others. These two types of biscuits were given to the selected autistic children and it was found that V5 was found to be the most acceptable and the autistic children ate the product readily.

E. Nutrient analysis of the biscuit

The nutrients present in the biscuits viz, carbohydrate, protein, fat, fibre and minerals namely sodium, potassium, calcium, magnesium, iron, zinc, copper and manganese were analysed using standard procedures (Ranguramulu et.al., 2003). Content of omega – 3 fatty acids was calculated using esha foods database.

Phase III

F. Selection and grouping of the autistic children

Sixty autistic children both boys and girls in the age group of 5 to 16 years were selected for the study. Children who were taking medications for other ailments such as seizures or hyperactivity were excluded from the study. Children who were comparable in terms of the therapies received such as behaviour therapy, occupational therapy, yoga, dance and outdoor play activities were chosen as the subjects for the present investigation. They were divided into three groups of 20 children each and designated as experimental group I, experimental group II and the control group. Consent was obtained from the school authorities, individual parents and Human Ethical Committee of the University (HEC.2010.15) before starting the experimental study.

<table>
<thead>
<tr>
<th>Variations</th>
<th>Taste ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salt biscuits</td>
<td></td>
</tr>
<tr>
<td>V1</td>
<td>Salt</td>
</tr>
<tr>
<td>Sweet biscuits</td>
<td></td>
</tr>
<tr>
<td>V2</td>
<td>Honey</td>
</tr>
<tr>
<td>V3</td>
<td>Dates</td>
</tr>
<tr>
<td>V4</td>
<td>Dates Cashew</td>
</tr>
<tr>
<td>V5</td>
<td>Dates syrup Honey</td>
</tr>
</tbody>
</table>
G. Intervention through supplementation

Research on using essential fatty acid supplementation to treat autism and related disorders have used doses of omega-3 EFA at 0.5 - 2.3 grams per day (Amminger et al., 2007). It was decided to supplement 50g of the biscuits supplying 1.8 g of omega 3 fatty acids to the experimental group I for a period of six months, which amounted to two biscuits in the forenoon and two biscuits in the afternoon (Plate 3). Experimental group II received the same quantity of biscuits in addition to one gram of the probiotic in honey smeared between the two biscuits. The biscuits were distributed to the children in the school regularly by the care taker during their snack time. During the holidays the biscuits and the probiotic flour were packed separately and handed over to their parents for feeding their children when they were at home. The parents were oriented about the storage and the quantity of the biscuits to be fed. The feeding of the biscuits at the school and at home was regularly monitored by the investigator.

H. Imparting nutrition education to the mothers of autistic children

Nutrition education was imparted to all the parents of the autistic children at the intervention centres for a duration of one hour, two times during the study period. In-depth education programme was organized for the children who participated in the intervention programme. Powerpoint presentations (2007 version) on the nature of the disorder, the signs and symptoms, possible causes, factors involved in autism, formation of opioids from maldigested gluten and casein, beneficial nutrients that affect their behaviour and the foods to be avoided were highlighted in the nutrition education programme (Plate 4). The tool was prepared with simple messages, so as to enhance the comprehension of the parents (Annexure E). The doubts were clarified by the investigator as and when the questions arose from the parents. The autism awareness schedule comprising of objective type questions were formulated to assess the knowledge of the parents on autism issues and food (Plate 4). This was administered before and after the nutrition education programme. Colourful posters highlighting the above contents were also displayed in the hall (Plate 4) in which the presentation was made so that the parents could read the contents leisurely and take home the important messages.
Plate 4
Nutrition education activities
In order to further stress on the need to modify the food habits of the autistic children, an exhibition was organised displaying the various foods that are to be avoided and included among the cereals, pulses, vegetables, fruits, milk and milk products, animal foods, sugars, nuts and oilseeds, oils, preserved foods and junk foods, which evinced a good response among the parents (Plate 4). A cookery contest was conducted for the parents based on the foods containing the beneficial nutrients (Plate 4). This provided a platform for the parents to know the different regional recipes and it also motivated the parents to bring in changes in their daily cuisine.

A special cyclic menu was developed for a period of seven days, incorporating the foods containing the beneficial nutrients and eliminating/ restricting the damaging foods from the diet. The beneficial nutrients included were omega 3 fatty acids, dimethylglycine, iron and vitamin B6. Gluten and casein containing foods were eliminated or restricted and sugars, food additives and junk foods were avoided. The above food modifications were done in order to improve the nutritional status and health of the children and to promote positive behaviours. The parents were sensitized about the need to bring in food modifications (Plate 3) and the cyclic menu was printed in the form of a pamphlet and distributed to the parents (Annexure F).

I. Evaluation of the impact of intervention in the autistic children

The impact of intervention was assessed through changes in the nutritional status, food habits, behaviour and cognition of the children. All the measurements were taken both initially and six months after the intervention as detailed below:

1. Assessment of the nutritional status

Child nutritional status is an essential component of a country’s overall human development. There is a growing consensus that poor nutritional status during childhood can have long-lasting scarring consequences into adulthood, both in terms of health and mortality, and in terms of other measures of human capital (Maluccio et.al., 2005; Behrman et.al., 2006 and Glewwe and Miguel 2007). Comprehensive nutritional assessment involves evaluation by clinical, anthropometric, biochemical and dietary methods. Although methods based on dietary characteristics do not directly measure nutritional status, they are very often used by nutritionists in the field to assess it (Agnes 1999).
a. **Anthropometric measurements**

Anthropometric measurements are often used as proxies for assessing the eventual extent and severity of malnutrition. The classical indicators in this respect have to do with the growth of children and body composition of adults. The most commonly used measurements are the body weight, height, age and sex of each individual (Agnes 1999).

i. **Height**: The heights of all the subjects were measured using a fibre glass measuring tape. The subject was made to stand near the wall with his/her heel and head touching the wall, taking care to see that the floor area was even. The head was held comfortably high. A smooth ruler was held on the top of the head in the centre, crushing the hair at right angle to the scale and the height read off in centimetre from the lower edge of the ruler to the nearest 0.5 cm. Each reading was taken twice to ensure correctness of the measurement. The height of an individual is influenced both by genetic and environmental factors. Since height is affected only by long-term nutritional deprivation, it is considered as an index of chronic or long duration malnutrition (Rao *et.al.*, 2010).

ii. **Weight**: Weight is a measurement of body mass. It is the simplest anthropometric measurement with the least individual error. A weighing scale of platform type was used for weighing the subjects as it was portable and convenient to use. The weighing scale had 0.5 Kg sensitivity and checked for accuracy and adjusted to zero before weighing. The weight was taken without shoes and other heavy clothes. The subjects were asked to stand on the platform of the scale without touching anything and looking straight ahead and their weights were recorded. Body weight is the most widely used and the simplest reproducible anthropometric measurement for overall evaluation of nutritional status of young children (Rao *et.al.*, 2010).

From the recorded weight and height of the individual child, the BMI was calculated using the formula, \[ \text{BMI} = \frac{\text{Weight in Kg}}{\text{Height in } \text{m}^2} \]. The BMI-age-percentiles were calculated using the CDC growth chart ([www.cdc.gov/growthcharts/](http://www.cdc.gov/growthcharts/)).
b. Clinical Assessment

Clinical assessment is the simplest and most practical method of ascertaining the nutritional status of individuals. This method is based on the examination for changes believed to be related to inadequate nutrition that can be seen or felt in superficial epithelial tissues, especially skin, eyes, hair and buccal mucosa (Uppal et.al., 2005). Clinical examination was done for all the individuals using the WHO clinical assessment proforma (Annexure G). Changes in hair, eyes, mouth and teeth were recorded with the help of a physician.

c. Biochemical assessment

Biochemical methods for nutritional assessment are used to recognize acute malnutrition, to confirm the clinical diagnosis of a deficiency disease and to detect subclinical micronutrient deficiencies (Truswell et.al., 2007). Since autism is an immune deficiency disorder as per theory, the immune status of the children was assessed by determining the immunoglobulin G, A and E of the entire test group through immunoturbidimetry method. Iron deficiency is associated with certain behaviour patterns in autistic children, therefore the haemoglobin was tested through cyanmethaemoglobin method (Dacie and Lewis 1991) and the grading of anaemia was done as per the WHO guidelines (WHO 1989).

d. Dietary assessment

A weighment survey was conducted by food weighment method using the weighment form. The raw weights of the ingredients taken for the total family, cooked weights of the preparations and the amount of cooked food consumed by the individuals were recorded for a period of three days among the families of all the 60 selected subjects. Left over foods if any, were also noted. From the individual consumption, raw equivalents were calculated and the nutrient intake was computed using the Food Composition Table Gopalan et.al., (2007). A comparison of the food and nutrient intake of the selected subjects with RDA was also done.

2. Assessment of the food behaviour of the autistic children

The eating habits of the autistic children were studied by administering an interview schedule to the parents. The parents were oriented about the different food behaviours exhibited by the autistic children and were guided by the investigator to fill in the details appropriately pertaining to their child.
3. Assessment of behaviour of the autistic children

The behaviour of the autistic children was assessed using the Autism Behaviour Checklist (ABC) (Krug et.al., 1978) modified to suit the present study (Annexure H). The ABC consists of a list of atypical behaviours characteristic of the pathology and due to its easy application and low cost, it is being used by health professionals in several countries (Volkmar et.al., 1994 and Miranda-Linne et.al., 2002). A team comprising of the clinical psychologist, the teacher, the parent and the investigator were involved in scoring and interpreting their behaviour. This checklist comprises of 57 questions divided into five domains (1) sensory, (2) relating/cognition, (3) body and object use, (4) language and (5) social and self help. They were rated according to the frequency of occurrence of a particular behaviour or its magnitude into (4) always, (3) frequently, (2) rarely, (1) not present and (0) not eligible. The average score in each domain was taken as a marker for assessing their behaviour.

4. Functional assessment of the autistic children

The skill development of the autistic children was assessed through the Individual Educational Programme (IEP) adapted from the Madras Development Programming System (MDPS) appropriately modified to suit the present study (Jayachandran and Vimla 1983). It provides information about the functional skills of the child to facilitate individual programme planning.

The scale consists of 360 observable and measurable items grouped under 18 functional domains, namely gross motor, fine motor, eating, dressing, grooming, toileting, receptive and expressive language, social interactions, reading, writing, number, time, money, domestic behaviour, community orientation, recreation and leisure time activities and vocational orientation. Each domain lists twenty items in an increasing order of developmental difficulty and along the dependence-independence continuum. The MDPS system helps to record the challenging behaviour which can be taken care through the IEP.

The child's performance on each item was rated as 1 - totally dependent, 2 - physical prompting, 3 - verbal prompting, 4 – clueing and 5 - independent, depending on whether the child can or cannot perform the target behaviour listed in an item on the scale. The initial skill assessment for every domain was done by the special educator for both the experimental groups and the control group. The skill training
was given to the children routinely based on their curriculum and the final skill assessment was done after six months. All these activities were closely followed by the investigator and their performance was recorded which helped in evaluating the child’s progress over a period of time. A detailed case study is given in Annexure I.

J. Data analysis and interpretation of the results

The data collected were consolidated, tabulated, analysed and interpreted using statistical procedures. Figure 4 presents the research design involved in this study.
Identification of disabled children (n = 400)

Assessment of socioeconomic and nutritional status, dietary habits and mothers’ prenatal history (n = 400)

Selection of samples (n = 60)

Feeding trial (6 months)

Control (n = 20)
Given nutrition education

Experimental group I (n=20)
Supplemented with biscuits and given nutrition education

Experimental group II (n = 20)
Supplemented with probiotic biscuits and given nutrition education

Evaluation

- Anthropometric measurements (Ht and Wt)
- Biochemical parameters (Hb, Ig G, A & E)
- Clinical picture
- Dietary intake
- Morbidity pattern
- General behaviour and food behaviour
- Functional development

Research Design

Figure 4