Chapter 4

COMMUNICATING NUTRITION
IN PEDAGOGICAL SETTINGS
4.1 COMMUNICATING NUTRITION IN CLASSROOM SETTINGS - DIFFERENT APPROACHES AND LESSONS LEARNT

Nutrition education is a key element in promoting sustainable healthy eating behaviours and should start from early stages of life (Foerester et al, 1997). The importance of early learning of nutrition-related knowledge, attitudes and behaviours for future health is widely recognized (Tones et al., 1994). The prevalence of malnutrition around the world, in the form of both undernutrition and overnutrition due to dietary excesses, is partly being attributed to low awareness. In India alone, there are about 204 million undernourished people and more than 50% of children are suffering from undernutrition (Krishnaswami, 1998 and FAO, 2001). Adolescents constitute one-fifth of the total population and about 84% of this population lives in developing countries. According to WHO, children in the age group of 10 –19 years are referred to as adolescents, Adolescence is the transitional phase of life from childhood to adulthood, during which period, growth spurt with rapid increase in height and weight, psychological and sexual maturity with cognitive development are observed among adolescents (NIN, 1998).

This chapter seeks to examine the impact of different methods for communicating nutrition information on nutrition knowledge of adolescents and young adults in pedagogical settings, employing various communication methods like lecture, CD Roms and Folk dance in the classroom settings.
Adolescence is a particularly unique period in life because it is a time of intense physical, psychosocial and cognitive development and therefore the caloric and protein requirements increase. The nutritional requirements such as macronutrients such as proteins and micronutrients including vitamins and minerals are high during the puberty of adolescents to meet the demand of increased nutritional needs as the adolescents gain up to 50% of their adult weight and skeletal mass, more than 20% of their adult height during this period (Spear, 2002). Undernutrition in these early stages of life can result in growth retardation, mental impairment and low immunity to disease in later life. On the other hand, overweight and obesity – especially in childhood and adolescence – are related to the burden of associated chronic diseases in adulthood (Narayan, et.al., 2001). With almost 20% of Southeast Asia’s population being constituted by adolescents (Griffiths and Bentley, 2001), there is an urgent need to focus on adolescent nutrition in India too. Community trials suggest that nutrition education is an accessible and effective tool in developing healthy nutrition-related practices (Kelder et. al., 1995). But, NNMB Report (2003) points out that only 14% of adolescent population was exposed to nutrition education.

Schools provide the most effective and efficient way to reach a large segment of the population, including young people, their families and the community in general (Perez-Rodrigo and Javier, 2001). The beneficiaries can act as change agents by spreading the messages to a large segment of population (Lionis et. al., 1991; Green and Iverson, 1982). Given this
background, various studies were conducted among school/college-going children, and adolescents using different approaches to communicate nutrition information. The present chapter is based on three different studies:

**STUDY -1**

**Nutrition Education for school-going adolescents using FAO’s learning material - “Feeding Minds, Fighting Hunger Programme (FMFH)**

**About FMFH**

Food and Agriculture Organization of the United Nations (FAO) along with a group of international and non-governmental organizations has launched a global education initiative called ‘Feeding Minds, Fighting Hunger’ (FMFH) with the aim of educating and motivating schoolchildren to get actively involved in creating a world free from hunger and malnutrition. Three different lesson plans of FMFH are suggested for Primary, Intermediate and Secondary school levels. Each lesson contains background information for the teacher, objectives, concepts and contents to be covered in the classroom during implementation. Three common lesson plans for all school levels deal with three different topics: (1) What are hunger and malnutrition and who are hungry? (2) Why are people hungry and malnourished? (3) What can we do to help end hunger? Apart from these guidelines, a variety of classroom activities including teaching aids and discussion points are also provided.
We carried out a study in Hyderabad to assess the efficacy of FMFH lesson plans in improving the knowledge levels of school children. For the purpose of the study, only the intermediate level lesson plan was used to educate the school students.

Objectives

1. To assess the current knowledge levels of middle-level schoolchildren and their science teachers on topics related to FMFH lessons
2. To orient teachers on the concepts of FMFH and to educate middle-level schoolchildren through them; and
3. To evaluate the impact of school-based teaching of FMFH lessons on the improvement of nutrition-related knowledge levels of school children.

Materials and methods

The study was conducted in schools of the old city of Hyderabad in association with a non-governmental organisation, the Confederation of Voluntary Associations (COVA). The prime focus of COVA is on citizenship rights and on perspective building for harmony and peace between the diverse communities in the country. Through direct programmes and by networking with other NGOs, COVA organises perspective building activities, carries out campaigns, and conducts research for influencing diverse sections of civil society and the state apparatus to adopt inclusive and secular outlook. It also seeks to promote policies that would foster rights and
secure justice and peace for all. In the old city of Hyderabad, COVA not only works with women, slum communities, professional and educated sections but also with children, students and youth. For carrying out various capacity building programmes and awareness, COVA directly works with a number of schools in Hyderabad, especially in the old city (COVA, 2009). Out of 83 such member schools of COVA, 49 schools whose medium of instruction was English were considered for the study. Informed consent was obtained from the heads of the participating schools and pupils.

Sample size: In the pilot study, a pre-tested knowledge assessment questionnaire (KAQ) consisting of 20 multiple-choice (closed-ended) questions was administered to 75 schoolchildren selected randomly from five schools. The 20 questions were related to hunger, food insecurity, nutrition, nutrition deficiency disorders and FAO; two additional questions related to their preferences in methods of learning were also included (Appendix -1).

For the main study, the cluster randomisation procedure was used to determine the number of schools. The sample size was calculated from an expected improvement of 4 points (on a scale of 20) in mean scores after the intervention, with 95% level of significance and 80% power. From the total number of schools available, 10 schools were selected randomly and each school was again randomly allocated to either the control or the experimental group. Thus, five schools were treated as control group and the remaining
five as experimental group. All children from grades VIII and IX, and the biological science teachers of these classes, were included in the study.

**Statistical analyses:** Data from the KAQ were analysed using the SPSS package version 11.5 (SPSS Inc., Chicago, IL, USA). Effect size was also assessed to determine the extent of the intervention's effect in improving knowledge levels among children and teachers in schools in the experimental group over those in the control group.

**Nutrition Education**

**Teacher training workshops:** A teacher-training workshop was organised in March 2003 for the biological science teachers of grades VIII and IX of the experimental schools. The teachers were trained in the concepts of FMFH and different strategies of communication, in order to modify the FMFH lesson plans to suit the local needs of their schoolchildren. A follow-up workshop was conducted in July 2003 to reinforce the knowledge acquired in the previous workshop before the teachers implemented the FMFH lesson plans in their respective schools.

**Development of communication materials:** The following communication materials were developed based on the preferences indicated by the students in the pilot study, in consultation with the teachers:
**Posters:** One poster on functions of foods and three posters on micronutrient deficiency disorders – anaemia, vitamin A and iodine deficiency disorders – were identified from existing posters of the NIN and modified. In addition, posters relating a Hunger Map of Asia, a Hunger Map of the World, vulnerable groups, food systems and what can children do to help end hunger and malnutrition were adapted from the FMFH lesson plans. These topics were identified with the help of teachers during the first teacher training workshop. Each school was given a complete set of 10 posters.

![Posters](image)

**Skit:** A skit covering all the concepts mentioned in FMFH lesson plans was developed involving the children’s theatre group of COVA to reinforce classroom education. For the purpose of development of the Skit, the FMFH booklet was initially given to the script writer and the director, who interacted with the scientists of the National institute of Nutrition for certain clarifications. In order to ensure that the script was in concurrence with the lesson plans, the script was finalized in consultation with the investigators. Considering the limitations of space, infrastructure like well-equipped
auditoria in many of the study schools, child artistes of the theatre group were trained to perform in the ‘street play’ format. Once the skit was ready, it was performed before a panel of nutrition scientists who ensured that the scientific information is not jeopardized. Then the play was performed in each of the schools in the experimental group. Each performance was followed by a discussion with the respective school teacher.

![Skit performance in progress in a study school](image)

**Implementation of FMFH lesson plans**

In the experimental schools, teachers implemented FMFH lesson plans using the communication materials along with various classroom activities.

**Post-intervention knowledge assessment**

The post-intervention knowledge assessment was carried out by administering the same KAQ that was used at baseline to 254 students in the control group and 216 students in the experimental schools. The children were instructed not to discuss among themselves while answering the questionnaire. One school opted out of the study and some children were not
present at the time of administration of the post-intervention questionnaire. As there was no significant difference in mean scores between experimental schools at baseline, the dropout did not affect the overall outcome.

Furthermore, retention of the concepts of FMFH lesson plans was also studied by administering the same questionnaire after a gap of 2 months for the experimental group. For the purpose of analysis, each right answer was assigned a score of one and the wrong answer was scored zero.

**Results**

**Pilot study:** The mean score (± standard error) of 75 children of all five schools was 8.36 ± 0.36. About 80% of the schoolchildren preferred to learn through classroom lectures, followed by teaching aids (such as charts and posters) and role-play.

**Main study:** Mean score (±SE) on the concepts of FMFH lesson plans of biological science teachers was 14.20 ± 0.66 in the control schools and 13.00 ± 1.29 in the experimental schools at baseline. However, an increase in knowledge levels among the biological science teachers of the experimental schools (17.50 ±0.64) was observed after the intervention.

Baseline scores of schoolchildren in the control and experimental schools showed that there was no significant difference (t = 1.43; P = 0.2) between the groups, indicating homogeneity in the groups. Post-intervention
results indicated a significant improvement ($t = 12.72; P = 0.000$) in the knowledge levels of the experimental group (Fig. 1). Significant improvement ($t = 7.95; P = 0.000$) was also observed in the knowledge levels of the control group (Fig. 1).

![Figure 1. Comparison of mean scores of control and experimental groups at baseline and after intervention](image)

However, comparisons between the mean improvement in knowledge levels of the control (1.65 ± 0.21) and experimental groups (3.09 ± 0.19) revealed a significant increment ($t = 4.54; P = 0.000$) in the experimental group versus the control group, indicating the efficacy of the intervention (Fig. 2). Regarding the retention of knowledge gained during the intervention, comparison of post-intervention-1 and post-intervention-2 mean scores of schoolchildren in the experimental group showed no significant difference ($t = 1.7; P = 0.09$) (Fig. 1), indicating that there was retention of knowledge.
Figure 2. Improvement in the mean scores of the school children after intervention

Effect size: The effect size is the average percentile standing of the average treated (or experimental) group relative to the average untreated (or control) group. In the present study, the effect size of the difference in improvement in nutrition knowledge after the intervention between experimental and control groups was $d = 0.40$, indicating that the mean of the treated group is at the 66th percentile of the untreated group. Effect size can also be interpreted in terms of the percentage of non-overlap of the treated group's scores with those of the untreated group. In the present study, the effect size of 0.40 indicated a non-overlap of 27.4% in the two distributions, establishing that the intervention's effect was of medium magnitude as per Cohen's standard.
STUDY - 2

Effect of two different educational tools on Nutrition knowledge of school-going adolescent girls.

Why adolescent girls?

In India, the nutritional needs of adolescent girls in particular are often neglected (Basu et.al., 1986). Increased physical activity combined with poor eating habits, menstruation and adolescent pregnancy contribute to poor nutritional status of the population. According to the National Nutrition Monitoring Bureau (NNMB) Report 2003, the prevalence of anaemia is 69% among adolescent girls. Micronutrient deficiency disorders in the adolescent phase result in growth retardation, low immunity to disease, and impaired reproductive functions that contribute to some pregnancy-related deaths or result in delivering low birth weight (LBW) babies, thus perpetuating the transgenerational cycle of malnutrition (Bhaskaram, 2001).

Objectives

To assess the nutrition knowledge of the adolescent girls from different schools of Hyderabad and to study the efficacy of two different nutrition education tools (traditional (lecture-based) and CD Rom-based) in improving the nutrition knowledge levels among the adolescent girls in the classroom setting.
Materials and Methods

Selection of schools: The list of schools was obtained from the District Educational Officer, Hyderabad. There were 48 Government-aided Higher Secondary Schools in the new city of Hyderabad. Among these schools, 20 schools were contacted at random and the principals of these schools were explained about the objectives of the study. Out of these schools, the principals of four schools agreed to participate in the study. Informed consent was obtained from both principals and students of the participating schools.

Study design and subjects: Purposive sampling method was adopted to select adolescent girls studying 8th class for the study. A total number of 164 adolescent girls were recruited for the study.

Baseline data: A structured interview schedule was administered to find out the socio-demographic details of the study subjects. A pre-tested knowledge assessment questionnaire (KAQ) consisting of multiple-choice questions on various aspects of health and nutrition was administered to children (Appendix -2). All answers were coded for data analysis.

Nutrition education: After obtaining the baseline data, two schools were considered as control group while the other two were experimental group. The experimental group was given two nutrition education interventions while no intervention was given to the control group. In intervention-1, the experimental group was given nutrition education by the science teachers in
the classroom setting in the traditional method using slides, charts and folders, which were developed based on the knowledge levels at baseline and also science curriculum up to 8th grade. The post intervention data were obtained at two different points of time – one immediately after the intervention and the second with a gap of three months from the experimental group to assess the knowledge improvement and retention after classroom intervention. For intervention-2, a Compact Disc (CD) with animated messages on Nutrition and Health was developed and pre-tested by the investigators. The impact of this new technology tool in improving knowledge over and above the first intervention was assessed separately by re-administering the same questionnaire.

**Data Analysis:** Data collected from these girls (n=164) using KAQ were analyzed separately using SPSS Package (version 11.5). ANOVA test was performed (at 5% significance level) to determine differences in the nutrition knowledge levels between the control and experimental groups at baseline as well as after intervention-1 and intervention-2. In order to determine the significance of difference in the increments of knowledge between the interventions, paired t-test was performed.

**Results**

**Socio-demographic characteristics:** The average monthly family income of 50% of the subjects was less than Rs.6000/-, while it ranged from Rs.6,000/- to Rs.17,000/- for the rest. The education of fathers of 59% of the subjects was
below 10th class. However, about three-fourth of the mothers had education up to 10th class.

**Impact of nutrition education:** At the baseline, the average nutritional knowledge levels were not significantly different between the control and experimental groups (p>0.05) indicating the homogeneity of the groups with regard to the awareness on nutrition and health (p>0.05). Post intervention data analysis by ANOVA test indicated that there was a significant improvement (p<0.001) in the knowledge levels of the experimental group after intervention-1 using folders, charts and slide show. An improvement in the mean scores from 46.7% to 58.8% in KAQ test was observed in the experimental group with an increment of 12.27% as against the increase from 46.8% to 49.7% in control group with an increment of 2.9%, which was not significant (p>0.05). After a gap of three months, the same KAQ was re-administered to the experimental group and no significant (p>0.05) difference was observed in the mean scores showing that there was retention of the knowledge gained through intervention-1. Then, intervention-2 was given with CD-Rom. After the intervention-2, the increase in the nutrition knowledge was observed from 46.7 to 56.9% in the experimental schools with an increment of 10.5%. Similar increase in the nutrition knowledge from 46.6 to 53.1% in the control schools with an increment of 6.4% was observed. However, the intervention-2 (using CD Rom) did not show any significant
improvement in the nutrition knowledge in the experimental group over and above the knowledge gained and retained after intervention-1.

Table 1. Impact of nutrition education on adolescent girls in Hyderabad

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of adolescent girls</th>
<th>Mean ± SD</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Before (Baseline)</td>
<td>Intervention-1</td>
<td>Increment-1</td>
<td>Intervention-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% of marks</td>
<td>% of marks</td>
<td>% of marks</td>
<td>% of marks</td>
</tr>
<tr>
<td>Experimental</td>
<td>87</td>
<td>46.73±15.14</td>
<td>58.86±16.13</td>
<td>12.27±12.7</td>
<td>56.92±14.37 NS</td>
</tr>
<tr>
<td>Control</td>
<td>77</td>
<td>46.69±12.4</td>
<td>49.75±12.3</td>
<td>2.9±8.5</td>
<td>53.19±14.36</td>
</tr>
<tr>
<td>F value</td>
<td></td>
<td>13.88 *</td>
<td>25.58 **</td>
<td>2.26 NS</td>
<td>4.14*</td>
</tr>
</tbody>
</table>

** P<0.001    * P<0.05  NS – Not Significant

Note: Paired t-test indicated that no significant (p>0.05) difference was observed in the knowledge increments between intervention-1 and intervention-2 improvement of knowledge levels

STUDY-3

Nutrition education for student community volunteers - A comparative study of two different communication methods

Studies show that educational institutes provide the most effective and efficient ways to reach a large segment of the population, including young people, their families and the community in general (Perez-Rodrigo, 2001). The beneficiaries can act as change agents by spreading the messages to a large segment of population (Lionis et.al., 1991). If such change agents are community service volunteers, the benefits are likely to be more. The National Service Scheme (NSS), a student youth service programme that has been in operation in colleges of India for over three decades, aims at creating social consciousness among the youth with an overall objective of personality
development (holistic development through experiential exposure) of the students through community service (Green and Iverson, 1982). Their community service programmes usually include adapting a particular village or a slum and conducting community awareness programmes on various issues including health and nutrition, mobilizing opinion leaders through stakeholder meetings and rendering voluntary service for improving hygiene and sanitation of the locality in which they work. The student volunteers who opt for this scheme, if given nutrition knowledge using reproducible communication method, may help to spread nutrition awareness to the community.

As Rau (1994) states, folk dance forms are a measure of communication, which is ‘made-to-order’ for a community, using local dialects and cultural concepts to convey messages. However, their potential has not been exploited fully for conveying health and nutrition messages.

A number of studies have been carried out among school children but there are hardly any studies among college-age young adults and little is known of the most effective communication strategy to provide nutrition education to them. Given this background, the present study was with the following objectives:

a) to assess the current nutrition knowledge levels of undergraduate students (who are volunteers under the National Service Scheme)
b) to provide nutrition education using two different communication methods - the first, using traditional techniques (lectures in the classroom setting aided by print material) and the second using a televised version of a local folk art form, and
c) to study the comparative effectiveness of these methods in improving the knowledge levels.

Materials and Methods

Study Design: Repeated measures of knowledge scores were carried out at two points in time (pre- and post-intervention) for the students participating in two mega camps (where NSS volunteers from various colleges of the University area congregate for a week long skill building programme).

Sample and Study Setting: The study was conducted among the undergraduate students of Osmania University (N=207). The students were community volunteers under the National Service Scheme (NSS). Adopting the purposive sampling method, this study was conducted during two mega camps involving youth volunteers belonging to different affiliated colleges of the University from various districts. In Camp-1, 70 students participated, while in Camp-2 there were 137 students. The study was conducted after seeking the permission of the NSS Programme Officer of the University and obtaining informed oral consent of the students.
**Nutrition Knowledge Assessment:** Baseline information on socio-economic status and nutrition and health-related knowledge levels was collected using a pre-tested knowledge assessment questionnaire (KAQ) consisting of 31 closed-ended questions on energy, fats, protein, obesity, vitamins & minerals, micronutrients, nutrition during adolescence, nutrition during pregnancy and communicable and non-communicable diseases (Appendix-3). Every correct answer was assigned a score of two and the wrong answer was given a zero. Scores obtained for individual questions were added to get the total score of each student.

**Development of Communication Material for Nutrition Education:** The communication materials were developed after discussions with the NSS Programme Officers, Nutrition Researchers and Social Scientists who were present at a Workshop Organised at the National Institute of Nutrition (NIN), Hyderabad. These materials were pre-tested in a pilot study.

The nutrition education material for Camp-1 comprised of charts, colour folders, slides and transparencies. Charts contained basic nutrition and health related information. Seven multi-colour folders (Figure-3) were developed in Telugu (the local language) on different themes like energy, proteins, fats, micronutrients (iron, iodine and vitamin A), obesity, nutrition during adolescence, nutrition during pregnancy and communicable diseases.
Another communication tool, a televised version of Golla Suddulu *, a local folk song and dance form in Telugu was developed for Camp-2 (Figure-4). The subject matter was given to a professional folk dance troupe that developed the programme. Before finalization, the programme was presented in front of an expert group at the National Institute of Nutrition (NIN) in order to ensure that the scientific facts were not jeopardized. The film lasted approximately 42 minutes with five major segments viz., carbohydrates and proteins (7min. 4sec.), fats and oils (7min. 45sec.), micro-nutrients (11min. 57sec.), nutritional requirements during adolescence and obesity, non-communicable and communicable diseases (7min. 55 sec.) and nutrition for pregnant women (5min. 45 sec.).

Figure 3. Folders developed to educate NSS volunteers

* It is a popular form of entertainment, by a group of dancers dressed as shepherds teaching morals through songs (in local dialect) and dance with the aid of percussion instruments.
As Mukherji et al. (1997) observed, there are some difficulties involved in the use of folk media as they require careful planning and preparation with appropriate scripts that balance standardized messages and local needs. They also call for input and training to standardize performance quality every time. In order to overcome this problem, a standardized performance was televised and the film was used for intervention. Since the students were already employing folk dance form for community education on personal hygiene and sanitation, the present film could be used as a guide by them to reproduce all or any of the segments for community education on nutrition.

**Intervention:** Communication materials such as charts, colour folders, slides and transparencies coupled with lectures by nutrition scientists were used for nutrition education intervention for Camp-1 (n=70) at the first mega camp.
The sessions were interactive and allowed for ample discussion with the expert. While the televised version of folk dance form was used as educational intervention tool for Camp-2 (n=137) at the second mega camp. In this intervention too discussion followed after each segment was screened.

**Post-intervention Knowledge Assessment:** The same questionnaire that was used to obtain the baseline data was administered to assess the knowledge improvement of the students after the interventions in both the Camps.

**Results**

The age of the respondents ranged between 19 and 21 years. About 67% of them were pursuing science courses. Nearly half of the students were pursuing second year of their under graduate course while very few were in the final year (Table-2). The Chi-square test showed that there was no significant (p>0.05) difference between the nutrition knowledge of the students pursuing Sciences and Arts subjects. Baseline knowledge scores of Camp-1 and Camp-2 were not significantly (t = -0.745, p > 0.05) different showing that the Camps were homogenous in terms of their nutrition knowledge.
Table 2. Background characteristics of the respondents (n=207)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Camp-1 (%) (n=70)</th>
<th>Camp-2 (%) (n=137)</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arts &amp; Humanities</td>
<td>21.5</td>
<td>40.1</td>
<td>33.3</td>
</tr>
<tr>
<td>Science</td>
<td>78.6</td>
<td>59.9</td>
<td>66.7</td>
</tr>
<tr>
<td>Year of Undergraduate Course</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st year</td>
<td>-</td>
<td>12.4</td>
<td>8.7</td>
</tr>
<tr>
<td>2nd year</td>
<td>40</td>
<td>55.5</td>
<td>49.8</td>
</tr>
<tr>
<td>3rd year</td>
<td>60</td>
<td>32.1</td>
<td>41.5</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
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<tr>
<td>Male</td>
<td>45.7</td>
<td>75.2</td>
<td>65.2</td>
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<tr>
<td>Female</td>
<td>54.3</td>
<td>24.8</td>
<td>34.8</td>
</tr>
</tbody>
</table>

Post-intervention data showed that the there was a significant (t= 0.745, p< 0.05) improvement in the knowledge levels of the students in Camp-1 where classroom lectures with aids like posters, charts and folders were used as the nutrition education method. Significant (t=0.219, p<0.05) knowledge improvement was also observed among the students of Camp-2, where the televised version of folk art from was used as the educational tool. Comparison between the mean improvement in knowledge levels of Camp-1 and Camp-2 revealed that there was no significant (p>0.05) difference in the knowledge gained by the students by two different communication methods, indicating that both the methods were equally effective (Fig.5). However, analysis of only those subjects who showed positive increments after interventions showed that Camp-2 had a significant nutrition knowledge increment (t= 2.578, p<0.05) compared with Camp-1 (Table-3), indicating that the educational intervention using the televised version of folk art form was better in bringing about positive increment.
Figure 5. Nutrition knowledge with different communication tools

Table 3. Comparison of positive increments in nutrition knowledge after intervention

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean ± SD</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camp -1 (Lecture + Print Material) (n=63)</td>
<td>15.21 ± 8.48</td>
<td>2.578</td>
<td>p &lt; 0.05*</td>
</tr>
<tr>
<td>Camp-2 (Video film with folk dance) (n=114)</td>
<td>18.76 ± 9.29</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant

Some inferences from the studies and lessons learnt

1. These studies prove that providing nutrition education to the adolescents in the classroom setting in the schools is an effective and efficacious way of imparting nutrition knowledge. Effective nutrition education should result not only in the acquisition of knowledge and skills, but also induce
desirable changes in the eating habits of the learners (Smith, 1997). However, all these studies stop only at information dissemination and measuring knowledge improvement, which may need not necessarily lead to change in dietary practices.

2. In Studies 1 & 2, it was observed that there was a significant knowledge increment in the control groups also even without providing nutrition education. The knowledge gained by the experimental groups, however, was significantly higher. This significant post-intervention improvement in knowledge levels of the students in control groups could be attributed to other factors such as the nutrition lessons in their curriculum, exposure to various media and the influence of parents, teachers and peer groups (Clancy–Hepburn et al., 1974). Or it could be a form of reactivity whereby the students’ knowledge has improved simply in response to the fact that they are being studied and not in response to any particular experimental ‘intervention’ sometimes referred to as the ‘Hawthorne Effect’ (McCarney et al., 2007).

3. All the three studies rely heavily on interpersonal communication and suggest that person-to-person communication is an effective means of providing nutrition education. But they do demonstrate the effectiveness of multi-media approach to complement inter-personal communication. Even though the benefits of using computer-based nutrition education tools in schools is widely documented, only a few studies have compared
the efficacy of teaching tools in experimental designs. A study carried out by Turnin et al. (2001) concluded that using computer-based nutritional teaching method at school provides additional support to conventional teaching. Contrary to this observation, Study-2 proved that the CD-Rom intervention did not result in any further improvement in nutrition over the traditional classroom teaching. It has also been observed that during intervention-1, a majority of the adolescent girls paid attention to the classroom lecture given by the science teacher using folders, slides and charts and interacted with the teacher, whereas, while using audio visual CD, the attention of the adolescent girls was very low indicating the effectiveness of the conventional method. This could be due to the reason that most of the girls viewed computers as entertainment devices than educational devices. While, in Study-3, the significant ‘positive’ increment observed with folk-dance based intervention as compared to the traditional teaching, indicates that the visual impact coupled with folk music helped in retaining attention of the volunteers. Raghavan (1979) and Ranganath (1982) suggested that folk media are culturally contextual, particularly in rural areas. Their flexible format can be adapted easily to program needs and local situations (Mukherji et al., 2005). In the present study too it was observed that the volunteers were already using similar folk-dance based programmes to educate the community on issues like sanitation and personal hygiene and they found the present folk dance based nutrition education method replicable. Hussain et al., (1997) who
have also studied relative efficacy of folk media in promoting Vitamin A rich foods in Bangladesh concluded that interpersonal communication approaches are still effective in disseminating messages in the developing world, while entertainment education using folk media could deliver messages to a wider audience. In the present study too inter-personal communication appears to have played an important role because even though both the interventions were followed by discussion with the investigators, the folk dance based intervention generated more discussion. This indicates that folk media can be used to complement interpersonal communication as they have the potential to generate interest in nutrition related topics thus enlarging the scope and effect of the interpersonal communication for nutrition education.

4. The participation of teachers in nutrition communication to adolescents is reiterated. But it is often very difficult to get teachers to cover these ‘extra’ topics outside the curriculum. In all the studies getting the commitment from managements of the educational institutes was not so easy. The reluctance of the educational institutions to take up activities outside the regular curriculum was indeed a problem that was encountered in all the three studies. For instance, in Study-1 one school in the experimental group dropped out mid-way, whereas, in Study-2, of the 20 schools contacted, only five agreed for the study. This emphasizes the need to make nutrition education part of the school curriculum.
4.2 CONTENT ANALYSIS OF NUTRITION COMPONENT IN SCHOOL SCIENCE TEXTBOOKS

Although, in our studies, we observed that school children prefer to learn in the classroom setting through the teacher, choosing to teach nutrition education is not a clear-cut choice for teachers or schools, as nutrition has to compete with other subjects (Lytle, 1994). As already pointed out, providing nutrition education as an external knowledge intervention may not always meet with success because it is difficult to get teachers to cover these ‘extra’ tasks outside the regular curriculum (Subba Rao et.al., 2007). Nutrition education needs to be complemented with proper food safety education (Subba Rao and Sudershan, 2007) because it includes procurement of safe foods in sufficient amounts to cover the nutritional requirements of individuals (Aranceta, 2003). Education about these aspects at a young age to school children enhances their knowledge and skills required to understand contemporary food and nutrition issues (FAO, 2001). Nutrition education curriculum programmes are unlikely to work well if they are not part of the ‘core’ school curriculum (Stuart and Achterberg, 1995). As Lytle (1994), suggests integrating nutrition education into curricular areas helps to resolve the problem of not having time to teach nutrition. Development of innovative nutrition education component that can be effectively blended along with other health related issues usually included in the science curricula is a continuous and demanding process. Before developing such content, the first step would be to evaluate the nutrition component in the existing school
science textbooks. Content analysis of curricula and textbooks can thus be the basis for improving school-based nutrition education (Kondracki et al., 2002). In the Indian context, there are three different streams of school education - (1) Through the schools affiliated to Central Board of Secondary Education (CBSE) (2) Through the schools affiliated to the Council for the Indian School Certificate Examination that gives Indian Certificate of Secondary Education (ICSE) certification on completion of Class X; and (3) Through the schools that follow the education patterns guided by the respective State School Education Boards.

As on today, there are 9689 schools across the country that are affiliated to CBSE (CBSE, 2008). For the CBSE schools, the syllabus is prescribed by the Board and the schools usually follow the textbooks published by the National Council for Educational Research and Training (NCERT) or by private publishers. There are several thousands of schools affiliated to the respective State Education Boards. These schools follow the syllabi prescribed by the respective Boards. In case of Andhra Pradesh, the textbooks are published by the A.P. State Council for Education Research and Training (APSCERT).

Content Analysis of curricula and textbooks can be the basis for improving nutrition education (Kondracki et al., 2002; FASEB, 1995). Krippendorf (1980:21) defines Content Analysis as “a systematic, replicable technique for compressing many words of text into fewer content categories
based on explicit rules of coding”. He also suggests that it is a technique for making replicable and valid inferences from the text/data to their context (Krippendorff, 1986). It is a technique that is used to develop objective inferences about a subject of interest in any type of communication (Berg, 1998). Neuendorf (2002:10) offers a six-part definition of content analysis, "Content analysis is an in-depth analysis using quantitative or qualitative techniques of messages using a scientific method (including attention to objectivity-inter subjectivity, a priori design, reliability, validity, generalizability, replicability, and hypothesis testing) and is not limited as to the types of variables that may be measured or the context in which the messages are created or presented."

For the present study, the CBSE and AP State Board textbooks were selected with the following objectives:

**Objectives**

1. To analyse the biological science content in relation to the overall general science component of the textbooks of all classes from primary to high school (I - X classes).
2. To do quantitative content analysis for finding out the proportion of space allocated for the nutrition component in relation to the other topics in the biology textbooks.
3. To conduct qualitative analysis of the nutrition component for finding out the topics dealt with, importance assigned to them, continuity of the topics from one class to the other.

**Materials and Methods**

**Sample:** All science text books from Classes I-X of two streams - NCERT and AP State Board were selected for the study. ICSE textbooks were not considered for the study as they are not printed by the Council (which only prescribes the syllabus) and the schools rely on books from private publishers, but the books used by each school differ greatly from the others.

As regards the NCERT and AP State Board textbooks, most schools in Hyderabad use books published by private publishers for classes I-V, for class above VI, the schools use either NCERT or APSCERT books based on their school affiliations. For primary classes (I to V), books published by Navneet publishers were selected for CBSE syllabus and textbooks by Holy Faith Publishers were selected for AP State Board as they are commonly used.

**Methodology and Analyses:** The process of content analysis consists of coding raw messages according to a classification scheme that allows for easy identification, indexing and retrieval of content relevant to research questions (Berg, 1998). For the purpose of the study all the content related to physics, chemistry and environment (excluding sanitation, cleanliness and safety of water) were categorized under ‘Physical and Environmental Sciences’ and
content related to life sciences were categorized as ‘Biology’. Under biology, the terms ‘nutrition’, ‘food safety’, ‘health’ and ‘others’ were operationally defined before carrying out the study. The operational definitions in terms of inclusion and exclusion criteria have been listed in Table-4.

**Quantitative Content Analysis:** In the present study quantitative and qualitative content analysis methods were used. Physical measurement of space (in terms of pages) allocated, number of illustrations and exercise questions were measured as part of the quantitative analysis (Shepherd and Achterberg, 1992).

**Degree and emphasis for quantitative analysis:**

**Chapters:** While counting the total number of chapters, only those lessons which were completely dedicated to the subjects of interest (nutrition, food safety or health) were considered. Those chapters with one or two units or sub-units dedicated to the topics were not considered.

**Space allocated (no.of pages):** While counting the number of pages allocated for each subject, irrespective of the theme of the chapter, if the topic dealt with fell into the categories of interest (as per the operational definitions / inclusion and exclusion criteria) and was covered in more than a quarter page, then it was counted under the respective subject area.
Illustrations: All illustrations in the science textbooks were categorized into physical and environmental science according to the chapters in which they were placed. Of the illustrations in the biology segment, those occurring in the lessons categorized as Nutrition, food safety and health and hygiene were counted under the respective themes. Of these, all those pictures which showed fruits, vegetables, grains, pulses, eatables or activity of eating were considered under nutrition whereas the visuals related to hand washing, cleanliness, hygiene, street foods, food vending, food in covered containers etc were considered under food safety.

Qualitative analysis of topics was carried out to understand the latent meanings of the content by analyzing quality of narration, illustrations and other general elements like font, print, etc. The latent meanings were first interpreted by the investigator and were later independently reviewed by a sociologist and an expert committee comprising of nutritionists and communication professionals. Only those interpretations that were commonly agreed by all have been included in the results.
<table>
<thead>
<tr>
<th>Theme</th>
<th>Inclusion</th>
<th>Exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrition</td>
<td>All topics that pertain to food, food intake, its functions, nutrients, their role in human health Nutrient deficiencies and diseases or disorders arising there of Food consumption, Unhealthy foods, over nutrition/obesity and lifestyle diseases</td>
<td>Food borne diseases. All human, plant and animal processes like respiration, digestion, reproduction, excretion etc fall under this category. Topics related to food / water handling, storage, preservation and cooking. Food borne illnesses. Food additives and impact on health Disease prevention and cure</td>
</tr>
<tr>
<td>Food Safety</td>
<td>Topics related to food / water handling, storage, preservation and cooking. Food borne illnesses. Food additives and impact on health</td>
<td>Nutrition, nutrition deficiency disorders and related topics mentioned above Disease prevention and cure</td>
</tr>
<tr>
<td>Health</td>
<td>Wellbeing of individual. Disease prevention and cure.</td>
<td>Nutrition, nutrition deficiency disorders and NCDs due to overweight and obesity Food borne diseases Food Safety (as mentioned above)</td>
</tr>
<tr>
<td>Others</td>
<td>All human, plant and animal processes like respiration, digestion, reproduction, excretion etc fall under this category</td>
<td>Health, Nutrition and food safety</td>
</tr>
</tbody>
</table>
Results

Quantitative content analysis showed that the biology component occupied relatively less space in relation to physical and environmental science in the NCERT textbooks in the higher classes, while at least one chapter in them was dedicated to nutrition from I to VII classes, there is no special chapter on nutrition in the high school science textbooks (from VIII to X classes) (Table-5). Similarly, the number of chapters allocated for biology is relatively less when compared to physical and environmental science in classes VI to X even in the AP State Board textbooks. Special chapters on nutrition appear only in classes IV and V. Although nutrition topics are dealt with in the IX and X classes they appear as sub-units in other chapters related to health (Table-6). As regards food safety, there are hardly any dedicated chapters for the subject in the science textbooks of both NCERT and AP Board.

Table 5. Distribution of number of chapters in NCERT Textbooks

<table>
<thead>
<tr>
<th>Class</th>
<th>Total</th>
<th>Physical &amp; Environmental Science</th>
<th>Biology</th>
<th>Nutrition</th>
<th>Health &amp; Hygiene</th>
<th>Food Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>18</td>
<td>7</td>
<td>11</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>II</td>
<td>19</td>
<td>9</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>III</td>
<td>18</td>
<td>5</td>
<td>13</td>
<td>1</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>IV</td>
<td>14</td>
<td>7</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>V</td>
<td>17</td>
<td>7</td>
<td>10</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>VI</td>
<td>16</td>
<td>11</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>VII</td>
<td>15</td>
<td>9</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>VIII</td>
<td>14</td>
<td>11</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>IX</td>
<td>15</td>
<td>11</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>X</td>
<td>17</td>
<td>12</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 6. Distribution of number of chapters in AP State Board Textbooks

<table>
<thead>
<tr>
<th>Class</th>
<th>Total</th>
<th>Physical &amp; Environmental Science</th>
<th>Biology</th>
<th>Nutrition</th>
<th>Health &amp; Hygiene</th>
<th>Food Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>II</td>
<td>9</td>
<td>4</td>
<td>5</td>
<td>1 unit</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>III</td>
<td>10</td>
<td>6</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>IV</td>
<td>11</td>
<td>7</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>V</td>
<td>11</td>
<td>7</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>VI</td>
<td>11</td>
<td>8</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>VII</td>
<td>11</td>
<td>9</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>VIII</td>
<td>14</td>
<td>9</td>
<td>5</td>
<td>0</td>
<td>3 units</td>
<td>1 unit</td>
</tr>
<tr>
<td>IX</td>
<td>19</td>
<td>13</td>
<td>6</td>
<td>1 unit</td>
<td>1 unit</td>
<td>1 unit</td>
</tr>
<tr>
<td>X</td>
<td>15</td>
<td>11</td>
<td>4</td>
<td>2 units</td>
<td>4 units</td>
<td>0</td>
</tr>
</tbody>
</table>

As regards the space allocation for each of the topics of interest, within the biology component in the school textbooks, nutrition has been provided over 10% of the space in all classes up to VII in the NCERT curriculum. However, it is not the same in the AP State Board syllabus. Food safety got about 1% of all space allocated for biology in primary classes in NCERT (Figure-6). In AP State Board Science syllabus, it was observed that although there were no dedicated chapters for nutrition, 10-23% of the space was allocated for nutrition component in the biology content in the primary classes. About 10% of the biology content was allocated for nutrition in Class –X. However there was almost no allocation of specific space for food safety in AP Textbooks at all, except in V and VII classes where 15% and 5% of space in biology component was allocated respectively (Figure-7).
Physical counting of the illustrations revealed that in the primary classes (I-V), the number of illustrations allocated for biology were more than half of all the illustrations in both NCERT as well as AP State Board science textbooks. However, the number of illustrations related to nutrition was more than 25% of all biology illustrations only in the first two classes. However, the number of illustrations pertaining to biology vis-à-vis nutrition and food safety, decrease in the textbooks of classes of subsequent classes. In the high school text books (VIII-X) there were no illustrations pertaining to nutrition at all, quite obviously because there is no reference to this topic anywhere. Similarly in the AP state textbooks, more than a quarter of all biology illustrations in classes I-IV relate to nutrition while it is almost nil in classes V-X. Food safety related illustrations are almost nil in NCERT textbooks of I through X classes, with the highest of 6% of all biology illustrations only in class IV (Table-7). In the AP State Board textbooks, illustrations related to food safety occupied relatively higher proportion of the biology illustrations. At least one percent of all biology illustrations from classes I–V depicted food safety, with least (1%) in Class-I and highest (15%) in class-V. Thereafter, in higher classes the food safety illustrations were not found except in class-IX, where it was 9% (Table-8).
### Table 7. Subject-wise distribution of number of illustrations in NCERT Textbooks

<table>
<thead>
<tr>
<th>Class</th>
<th>Total No.</th>
<th>Physical and envmnt. science</th>
<th>Nutrition (% of biology)</th>
<th>Health &amp; Hygiene (% of biology)</th>
<th>Food Safety (% of biology)</th>
<th>Others</th>
<th>Total Biology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>226</td>
<td>36</td>
<td>52 (27.6)</td>
<td>27 (14.3)</td>
<td>0 (0)</td>
<td>111 (58.1)</td>
<td>190</td>
</tr>
<tr>
<td>II</td>
<td>264</td>
<td>85</td>
<td>46 (25.8)</td>
<td>21 (11.7)</td>
<td>1 (0.6)</td>
<td>111 (62)</td>
<td>179</td>
</tr>
<tr>
<td>III</td>
<td>169</td>
<td>45</td>
<td>6 (4.9)</td>
<td>35 (28.4)</td>
<td>0 (0)</td>
<td>83 (66.9)</td>
<td>179</td>
</tr>
<tr>
<td>IV</td>
<td>155</td>
<td>80</td>
<td>11 (16.2)</td>
<td>6 (8.8)</td>
<td>4 (5.9)</td>
<td>47 (69.1)</td>
<td>68</td>
</tr>
<tr>
<td>V</td>
<td>150</td>
<td>78</td>
<td>3 (4.2)</td>
<td>7 (9.7)</td>
<td>1 (1.4)</td>
<td>61 (84.7)</td>
<td>72</td>
</tr>
<tr>
<td>VI</td>
<td>237</td>
<td>146</td>
<td>25 (27.5)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>66 (72.5)</td>
<td>91</td>
</tr>
<tr>
<td>VII</td>
<td>191</td>
<td>116</td>
<td>3 (4)</td>
<td>2 (2.7)</td>
<td>0 (0)</td>
<td>70 (93.3)</td>
<td>75</td>
</tr>
<tr>
<td>VIII</td>
<td>160</td>
<td>113</td>
<td>0 (0)</td>
<td>6 (12.8)</td>
<td>0 (0)</td>
<td>41 (87.2)</td>
<td>47</td>
</tr>
<tr>
<td>IX</td>
<td>170</td>
<td>113</td>
<td>0 (0)</td>
<td>8 (14)</td>
<td>0 (0)</td>
<td>49 (86)</td>
<td>57</td>
</tr>
<tr>
<td>X</td>
<td>196</td>
<td>138</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>58 (100)</td>
<td>58</td>
</tr>
</tbody>
</table>

### Table 8. Subject-wise distribution of number of illustrations in AP State Board Textbooks

<table>
<thead>
<tr>
<th>Class</th>
<th>Total No.</th>
<th>Physical and envmnt. science</th>
<th>Nutrition (% of biology)</th>
<th>Health &amp; Hygiene (% of biology)</th>
<th>Food Safety (% of biology)</th>
<th>Others</th>
<th>Total Biology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>316</td>
<td>55</td>
<td>67 (26.1)</td>
<td>8 (3.1)</td>
<td>2 (0.8)</td>
<td>184 (70)</td>
<td>261</td>
</tr>
<tr>
<td>II</td>
<td>222</td>
<td>58</td>
<td>71 (43.3)</td>
<td>20 (12.2)</td>
<td>5 (3.1)</td>
<td>68 (41.4)</td>
<td>164</td>
</tr>
<tr>
<td>III</td>
<td>176</td>
<td>56</td>
<td>29 (24)</td>
<td>11 (9.1)</td>
<td>2 (1.7)</td>
<td>78 (64.8)</td>
<td>120</td>
</tr>
<tr>
<td>IV</td>
<td>105</td>
<td>46</td>
<td>25 (42.5)</td>
<td>7 (11.9)</td>
<td>5 (8.5)</td>
<td>22 (37.2)</td>
<td>59</td>
</tr>
<tr>
<td>V</td>
<td>127</td>
<td>58</td>
<td>0 (0)</td>
<td>7 (10.1)</td>
<td>10 (14.5)</td>
<td>52 (75.4)</td>
<td>69</td>
</tr>
<tr>
<td>VI</td>
<td>184</td>
<td>42</td>
<td>0 (0)</td>
<td>4 (2.8)</td>
<td>0 (0)</td>
<td>138 (97.2)</td>
<td>142</td>
</tr>
<tr>
<td>VII</td>
<td>143</td>
<td>88</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>55 (100)</td>
<td>55</td>
</tr>
<tr>
<td>VIII</td>
<td>187</td>
<td>123</td>
<td>0 (0)</td>
<td>3 (4.7)</td>
<td>0 (0)</td>
<td>61 (95.3)</td>
<td>64</td>
</tr>
<tr>
<td>IX</td>
<td>181</td>
<td>113</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>6 (8.8)</td>
<td>62 (91.2)</td>
<td>68</td>
</tr>
<tr>
<td>X</td>
<td>285</td>
<td>156</td>
<td>7 (5.5)</td>
<td>13 (10.1)</td>
<td>0 (0)</td>
<td>109 (84.4)</td>
<td>129</td>
</tr>
</tbody>
</table>
Figure 6. Subject-wise allocation of space (%) in Biology component of NCERT textbooks

Figure 7. Subject-wise allocation of space (%) in Biology component of AP State Board textbooks
Qualitative content analysis revealed that in both NCERT and AP State Board syllabi, the first nutrition related content in the first three classes was devoted to recognizing various foods, creating awareness about the foods that are derived from plant and animal sources. Thereafter in higher classes wherever nutrition topics are covered, topics like food groups, functions of foods and nutrition deficiency disorders are dealt with in greater or lesser detail (Tables-9 and Table-10). The data also indicated that the colour visuals and tables have been interspersed in the NCERT textbooks both for visual relief and easy understanding. However, in AP State textbooks, text dominates and visuals are simple black and white line drawings which sometimes are not easily comprehensible (Fig-8 & 9). In both the syllabi in all classes except in Classes I and II, the nutrition lessons appear in the back pages of the books. The illustrations depicting good food habits, eating habits, cooking etc., in the NCERT science textbooks of the primary classes seem to have an urban bias with pictures of children consuming foods on a ‘dining table’ using modern cutlery and crockery (Fig-10).
<table>
<thead>
<tr>
<th>Class</th>
<th>NCERT</th>
<th>AP State Board</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>‘Plants around us’ illustrations of fruits and veg. are given</td>
<td>Plants give us food - Grains, vegetables, fruits, oils pulses and spices (illustrations for easy identification)</td>
</tr>
<tr>
<td></td>
<td>‘Food from Plants’ – cereals, pulses, nuts, fruits (illustrations)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>‘Good Habits’ – Eat at regular intervals, take just enough, Don’t waste / over eat, chew</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>“Uses of Plants” - ‘Plants give us food’ – cereals, pulses, oilseeds, tubers, roots leaves, veg (colour illustrations)</td>
<td>Small unit in Chapter on ‘Plant Life” deals with plants as sources of foods</td>
</tr>
<tr>
<td></td>
<td>Lesson ‘Our food’ – functions of foods</td>
<td>A Unit on ‘Animal Life’ - Milk, poultry and meat shown as foods from animals</td>
</tr>
<tr>
<td></td>
<td>Energy yielding, body building and protective.</td>
<td>Under the chapter on Human body, a unit on “food for health’ deals with kinds of food</td>
</tr>
<tr>
<td></td>
<td><strong>Eat food four times a day</strong></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>o One complete chapter on nutrition ‘Food for body’</td>
<td>o One complete chapter on ‘Food’</td>
</tr>
<tr>
<td></td>
<td>o Food groups</td>
<td>o What is food? Functions of food, why do we eat food</td>
</tr>
<tr>
<td></td>
<td>o Milk highlighted as ‘complete Food’</td>
<td>o Food sources</td>
</tr>
<tr>
<td></td>
<td>o Foods – raw and cooked</td>
<td>o Food groups</td>
</tr>
<tr>
<td></td>
<td>o Advantages of cooking – kills germs, easy to digest, made soft &amp; tasty</td>
<td>o Carbohydrates -rich foods</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Fats -rich foods</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Protein –rich foods</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Vitamins and minerals – foods rich in these</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o In a brief running text towards the end of the page “The food which contains all the nutrients in required quantities needed by the body is called balanced diet” (not even highlighted)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o “Population and food shortage”</td>
</tr>
<tr>
<td>Class</td>
<td>NCERT</td>
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| IV    | In a lesson on ‘Uses of plants and animals’, Under uses of plants, “Plants give us food is discussed with illustrations – roots, tubers, cereals, fruits, nuts etc. Similarly in half a page, foods from animals also discussed – egg, chicken, meat | o One Complete chapter on Nutrition under the title “Food we eat” -  
 o Raw foods - Why fruits and vegetables salads/ sprouts  
 o Care in selecting raw foods  
 o Why should we cook food and methods of cooking  
 o protecting foods from flies and insects  
 o “population and shortage of food” discussed with illustration |
| V     | o Under “Our body, diseases and sanitation” , a unit on ‘Deficiency diseases’, which discusses ‘Balanced diet’  
 o Recommended intakes of cereals, pulses GLVs etc. given in a table  
 o Discussion on Deficiency disorders – protein def., energy def. Vit A, B, C, D Def, Mineral Def. (iron and iodine)  
 o Causes for deficiencies – diarrhoea and hookworm infestation  
 o Culminates in importance of washing vegetables  
 o Do not over wash and do not overcook | No Chapter on Nutrition |
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<tr>
<td>VII</td>
<td>Chapter ‘Our food”</td>
<td>No Chapter on Nutrition</td>
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<tr>
<td></td>
<td>What is food</td>
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<td>Why do we need food, Foods we consume</td>
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<td>Nutrition, Need for variety of foods</td>
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<td>What are nutrients –</td>
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<td></td>
<td>Chart on balanced diet</td>
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<td></td>
<td>Components of foods</td>
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<td></td>
<td>Box item on Saturated fatty acids (SFAs), Hydrogenated oils and ill-effects on heart</td>
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<td></td>
<td>Vegetable oils – Unsaturated fats food for health</td>
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<td></td>
<td>Combination of Saturated fatty acids (SFAs) and Unsaturated fats</td>
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<td>Food substitution with low cost nutritious food...</td>
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<td></td>
<td>Examples given in a table</td>
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<td>A table on cutting energy consumption by food replacement a list of 21 items given</td>
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<tr>
<td>VIII</td>
<td>No chapter</td>
<td>No Chapter on Nutrition</td>
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<tr>
<td>IX</td>
<td>No chapter</td>
<td>None on human nutrition Nutrition in Animals as a unit in “Life processes” - Nutrition in various animals, Need for digestion and digestive enzymes,</td>
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<tr>
<td>X</td>
<td>No Chapter</td>
<td>One complete chapter titled ‘Nutrition’ Nutritional requirements – Macro and Micro nutrients and their importance for body Carbohydrate, protein and fat, vitamins and minerals and Balanced diet Deficiency diseases - Calorie Malnutrition, Protein Malnutrition, PEM, Kwashiorkar, Marasmus, Obesity. Vit Deficiency Diseases - Vit A, Vit D, Vit E, Vit K (Vit B with pellagra illustration Vit D Deficiency with line drawings) Table showing vitamins - deficiency disorders - rich foods</td>
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| I     | “Our needs and House” half a page on ‘Good food’ – defined as fresh and nourishing, helps in growth and health. Clean food | • Need for safe food and safe water is briefly discussed in a lesson on ‘Human Body, Health and Hygiene’  
• Main messages - clean water, its need, need to boil; if water is impure it may cause some disease  
• Clean food, fresh food, dirt and germ-free food, food from covered containers |
| II    | “Our food” – Clean, covered food is good  
Do not buy from street vendors  
Washing hands, rinsing mouth | “Air, water and weather” a Unit deals with ‘Clean water for drinking”. With illustrations, discusses about why water should be clean for drinking. Discusses filtering and boiling |
| III   | “Food for healthy body” deals with nutrition  
 o How can we take care of our food  
 o Washing fruits and veg  
 o Fruits and salads to be consumed fresh  
 o Cover the food  
 o Don’t over cook  
 o Washing fruit and veg in salt water | o Types of diseases’  
 o Dysentery as food borne disease  
 o Messages – Cover the food, wash vegetables and foods before cooking, boil and cool the drinking water |
| IV    | “our body and food” – Food nutrients and microbes boiling, steaming, frying, fermented. Microbes, Useful and harmful microbes | o Under “Food we eat”  
food selection, protection from insects and flies, ways of preserving food and methods of cooking food, storage of foods |
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<td>V</td>
<td>o In “Communicable diseases” there is a passing reference to food and water borne diseases like cholera, typhoid, jaundice, dysentery. Causes for deficiencies – diarrhoea and hookworm infestation. Culminates in importance of washing vegetables. Do not over wash and do not overcook.</td>
<td>Preservation of fruits and vegetables’ Need for preservation. Methods of preserving fruits and vegetables – freezing, storing in plastic bags, preservation in dried form, pickling fruit jams and juices (Only one illustration of a refrigerator with some foods). Under ‘Health education’, food borne diseases are discussed – cholera, typhoid and itch are given as food borne diseases two illustrations one on fly swarming foods and the other depicting itch.</td>
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<tr>
<td>VI</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>VII</td>
<td>“our food” – Nutrition and Perishable, non-perishable, storing at room temperature, refrigeration, cold-storage, deep freezing. Food sanitation – personal hygiene of food handlers, cleanliness of surroundings, utensils etc., half cooked or uncooked animal foods may cause disease. Food poisoning- by microbes, salmonella, clostridium is mentioned. “Health and diseases” quality of food, hygiene, unwashed fruits, roadside eateries.</td>
<td>None</td>
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| VIII  | None   | One unit on ‘Storage and preservation of food’  
|       |        | ○ What is food poisoning  
|       |        | ○ Importance of storage of cooked uncooked foods  
|       |        | ○ Methods to prevent spoilage of food  
|       |        | ○ Different methods of food preservation (Drying,  
|       |        | smoking, mechanical drying, salting, freezing,  
|       |        | pasteurisation, use of high temp., canning, pest  
|       |        | control discussed elaborately.  
|       |        | ○ **NO illustration at all** |
| IX    | None   | None |
| X     | None   | None |
Figure 8. Depiction of food items in NCERT textbook (IV Std.) Vs. Depiction of cereals, pulses, nuts, roots etc. in AP State Board books

Figure 9. Colourful pictures in an NCERT textbook (left) Vs. single colour line drawn depictions of food groups in AP State Board Textbook (right)
Figure 10. Urban bias in illustrations in NCERT textbooks?

Discussion

In various national plans and policies, the government has time and again reiterated its unequivocal commitment to incorporate nutrition into the school curriculum. For instance the National Nutrition Policy 1993 and the National Plan of Action on Nutrition (NPAN), 1995 in its indirect policy measure through the Ministry of Education, clearly emphasizes the need for incorporating ‘nutrition’ in school text books (FNB, 1995a). The National Policy of Education (1986 – modified in 1992) and National Curricular Frame Work (2005) also highlight the need and importance of nutrition and physical activity as part of health education in schools (WHO-India, 2008). The
analysis of nutrition component in school curricula reveals that despite all the above policy measures, nutrition seems to have not got its due in the school curricula. This observation is in concurrence with an earlier review of school health programmes in 10 Indian states, which observed that there is no priority for health promotion in actual practice due to lack of commitment from education departments (WHO-India, 2008). The present analysis of curricula also indicated that there are too many inconsistencies in presentation of topics related to nutrition. This observation is in concurrence with an earlier study carried out in Delhi in 1996 to assess the micronutrient nutrition related content in the school curricula, which also observed inconsistencies in presentation of topics related to micronutrients (ICCIDD, 1996).

In their analysis of the nature of science and technology presentation in NCERT science textbooks for classes IV through X, the development of conceptions on some physical science topics (like force, work, and energy); Koul and Dana (1997) found that there was ‘excessive’ physical science content with prime emphasis on established concepts, laws, and theories. Similar observation was also made earlier by Ramanathan and Siddiqi (1994). In the current study too we found that the emphasis on physical sciences was increasing in classes VI through X allocating lesser proportion of space for the biology component, thereby, limiting the scope for coverage of nutrition and food safety. Some researchers have suggested integration of nutrition into diverse curricular areas (Lytle, 1994), but in the present study, we found that
integrating nutrition and food safety related topics in subjects other than science, say in physical and environmental sciences actually dilutes the importance of nutrition and food safety education because it gets masked under other related topics. For instance, although nutrition (more precisely, importance of regular but small meals) and food safety (importance of washing hands before eating) were covered in some primary classes in the lessons pertaining to ‘good habits’ along with aspects like ‘sitting in good posture’, ‘wearing washed clothes’, ‘combing hair’ etc., understandably this does not give adequate scope for the child to comprehend the scientific rationale or importance of inculcating the above nutritional or food safety habits.

Considering that India’s adolescents are confronted with the problems of undernutrition (NNMB, 2006) on the one hand and overweight and obesity on the other (Laxmaiah et al., 2007; Krishnaswamy, 1999), the school system can be effectively used to educate the school-going children. The science textbooks of all classes after class III in both NCERT and AP syllabi, however, only deal with food groups or nutrient deficiency disorders. There is hardly any mention of important deficiency disorders like anaemia and iodine deficiency disorders and steps to be taken to control them. Similarly, there is hardly any information on contributing factors to overweight and obesity like consumption of unhealthy / junk foods, lifestyle factors etc. Similarly there is no mention of obesity and resultant chronic diseases like diabetes, hypertension and cardiovascular diseases.
The need to take food safety related education beyond safe handling, consumption and preservation of foods is time and again stressed. In the present scenario, when there are shifts away from meals to snacks and from at-home to away-from-home meals, children should be made aware of food additives and contaminants and they should also be taught to read and understand the food labels in order to help them make healthy food choices (Subba Rao and Sudershan, 2007). However, the present study indicates that food safety in whichever class it appears, deals mostly with cleanliness of surroundings and not consuming fly swarming or insect infested foods and sometimes with techniques of preservation.

Conclusions

The present study revealed that the space allocation for biology in relation to physical sciences is lesser in higher classes. Nutrition component is dealt at primary school level but very little at high school level. Nutrition when covered after class III in both NCERT and AP syllabi, only deals with food groups or nutrient deficiency disorders. Similarly, food safety deals only with cleanliness of surroundings, not consuming fly swarming or insect infested foods.

Our study clearly brings out the lacunae in the nutrition component covered in the school curricula. It could be recommended that many important topics such as nutrition and growth, link between childhood malnutrition and non-communicable diseases in adulthood, adolescent
nutrition, nutrition for girl child, hidden hunger, lifestyle factors and obesity, nutrition during pregnancy and lactation, importance of breast feeding, unhealthy foods, fortification etc. be covered in the curricula. Considering that many of our earlier studies indicated that school based nutrition education is preferred mode of learning and effective way of education, the results of this study will be useful during future revisions of the textbooks for strengthening the nutrition and food safety components.