CHAPTER - V

SUMMARY AND CONCLUSION

Fisheries have been the means of livelihood for the small-scale coastal fishing communities from times immemorial. There are 12 coastal mandals comprising of 44,476 marine fisher folk families in East Godavari District, Andhra Pradesh. The total fisher folk population of the district is 1,66,577 out of which 43800 are traditional fishermen families and 43,022 families are stated to be below poverty line (BPL) families (CMFRI 2010 Census)**.**

It has been recorded by the CMFRI (2010) reports that 60.57 per cent of the fisher-folk families in India fall under BPL category. Fisher-folk are in a situation where they couldn't get the better of anything and the living conditions of whole fishing community of coastal Andhra Pradesh fall under BPL except for some employees and mechanized boat owners. ,Reports as per CMFRI (2010) show that 97.3 per cent of marine families in Andhra Pradesh fall under BPL category. Figures claim that 1,59,101 fishermen families out of 1, 63,427 are categorized under below poverty line in coastal Andhra Pradesh.

The current research titled, '**Effect of Nutrition Interventions on Vitamin A and Iron Nutriture of School Children (6 – 8 years) from Fishermen Community'** was conducted among artisanal fishermen community of eight fishermen villages namely, Chollangi, Nemam, Vakalapudi, Valasapaka, Uppada, Mulapeta, Ponnada and Konapaapapeta near coastal Kakinada of East Godavari District, Andhra Pradesh.

The early years of a child's life are very important for his or her development. Poverty hampers growth physically, socially, emotionally, and educationally (Yoshikawa et al., 2012). 'Hidden Hunger' (iron, vitamin A and iodine deficiency), influences the health stature, intellectual potential and also prolificacy leading to susceptibility to ill-health and dysfunction giving rise to a casual nexus of undernourishment, impoverishment, and indigence (Thompson and Amoroso, 2011).

Childhood blindness is a reversible vitamin A deficiency which hikes the risk of mortality from common disorders like diarrhoea (UNICEF, 2019). It is perceived as a public health issue in developing and underdeveloped countries.

Nimmathota Arlappa et al. (2016) in their study among rural pre-school children of South Indian states namely, Andhra Pradesh, Tamilnadu, Kerala and Karnataka have

observed that the ubiquity of Bitot's spots, a disorder of vitamin A deficiency is common seen in 0.6 per cent in pre-school children of rural South India.

Approximately two billion of the world's population suffers from micro-nutrient deficiencies. The most common and widespread is the iron deficiency which is seen in almost 34 per cent of the 6.25 billion world's population. Child mortality around 2.8 million each year has been detected in nine impoverished Asian nations which includes India also (Sujatha and Kowsalya, 2018).

In the face of continuing poverty and malnutrition, an alternate strategy of development becomes a priority thus giving rise to several intervention programs. Intervention programmes on nutrition intend to bring about change in nutritional consumption, to improve nutrition-related understanding or attitude, ambient situations or approach to benevolent assistance. Pro-vitamin A-rich orange-fleshed sweet potato is an effective strategy in reducing vitamin A disorders especially in infants, preschool children, young children and women in developing countries (De Brauw et al. 2019).

Intervention programmes on nutrition are an excellent medium to bring about swap in nutritional consumption, improve nutrition-related understanding, attitude and provide ambient situations. Studies that evaluate and estimate nutritional knowledge, understanding of health and practice of good habits (KAP) are beneficial for enhancing positive changes in living and individualized factors of the people's dietary habits. They impart precious inputs for efficient programme and extrapolate planning. In addition, KAP studies are vital for assessing nutrition-education and service interventions, like, tasks that easily aim to enhance nutritional knowledge, attitudes and practices. (FAO, 2014)

Objectives of the study:

The current research work was undertaken with the following objectives:

- Assess the nutritional status of school going children (6-8 years) both boys and girls belonging to fishermen communities in the coastal regions of Rural Kakinada of East Godavari District
- Assess the prevalence of Vitamin A and Iron deficiencies in the selected children of Fishermen community (6-8 years).
- Standardization and evaluation of the Vitamin A rich supplement.
- Assess the effect of supplementation and nutritional education in improving the nutritional health in children.

Methodology of the study:

Study design

The longitudinal study was designed with five phases and was used for this study. It is presented as given below.

Phase I: Selection and screening of Fisherfolk children for VAD and IDA.

A. Selection of the research area and subjects

Artisanal fishermen community of eight fishermen villages namely, Chollangi, Nemam, Vakalapudi, Valasapaka, Uppada, Mulapeta, Ponnada and Konapaapapeta near coastal Kakinada of East Godavari District, Andhra Pradesh. Fisherfolk children 6-8 years were selected for the study.

B. Formulation of tools and conduct of socio-economic survey

An interview plan was constructed to bring about the information about the socio-economic background, dietary intake, dietary pattern, anthropometric measurements and clinical assessment and with the aid of the interview schedule, the particulars were recorded personally by the researcher. A total of 15,658 houses were surveyed in the eight villages during the study. It was observed that, out of all the households recorded, 8451 houses belonged to the fishermen families from which 1000 children aged 6-8 years were selected for screening of vitamin A deficiency and iron deficiency anaemia.

C. Screening of children and identifying children with VAD and IDA

The 1000 children aged 6-8 years were identified during the survey for the study. The data was collected through a field survey by using questionnaire to elicit the information regarding the socio-economic background, dietary intake, dietary pattern, anthropometric measurements and clinical assessment for all the 1000 children by purposive sampling method. Two hundred and thirty-four children were identified with vitamin A and iron deficiency anaemia.

Phase II: Assessment of Nutritional status of children with VAD and IDA

1. Anthropometry – Height, Weight, BMI, Weight for age, Height for age, BMI for age for all 234 children was noted.
2. Biochemical Assessment – Blood Serum retinol level and Blood Hemoglobin level were also done with the help of a medical practitioner.

3. Clinical Assessment – VAD, IDA, and other micronutrient deficiencies were identified with the help of a medical practitioner.

4. Dietary Survey – 3-day 24-hr dietary recall, food frequency was recorded with the assistance of parents, care takers and teachers.

Phase III: Selection, Preparation and Nutritional analysis of boiled sweet potato for intervention

A. Selection of sweet potato variety abundant in beta-carotene.

An orange-fleshed sweet potato variety known as 'Kamala Sundari' was selected for the supplementation due to its high beta-carotene levels and its availability in the study area.

B. Preparation and acceptability of orange fleshed sweet potato for intervention.

The orange fleshed sweet potatoes were boiled. The boiled sweet potato were evaluated for their acceptability by children, parents and caretakers at randomly selected schools.

C. Nutrient analysis of the sweet potato

The boiled orange fleshed sweet potatoes were subjected to nutrient analysis namely energy, moisture, protein, fat, carbohydrate, fibre, calcium, iron, thiamine, riboflavin, vitamin B_6, vitamin A, and vitamin C was estimated at the School of Food Technology, JNTUK, Food Testing Laboratory. High-performance Liquid Chromatography (HPLC) was used to analyse energy, carbohydrates, proteins, water-soluble vitamins and fat-soluble vitamins. Gas Chromatography (GC) technique is used for moisture, fat and fibre analysis and atomic spectroscopy was used to analyse iron and calcium.

Phase IV: Supplementation and assessing the impact of the boiled sweet potato and nutrition education to the selected group of children

A. Grouping of Fishermen children (N=234)

The selected 234 subjects comprise of 121 were boys and 113 were girls, out of which 40 boys and 40 girls were 6 years old, 41 boys and 35 girls were 7 years old and 40 boys and 38 girls were 8 years old.

Group 1: Supplemented with boiled sweet potato along with school meal (N=56).

Group2: Supplemented with boiled sweet potato, school meal and nutritional education (N=59)

Group 3: Nutrition education with school meal (N=61).

Group 4: Control group provided only with school meal (N=58)

B. Conduct of Supplementation – The supplementation of OFSP and Nutrition education was carried for a period of 6 months

Phase V: Statistical Analysis

Tools and techniques

Accurate digital weighing machine was used throughout the study. The weighing machine was checked daily for accuracy by weighing an adult five times in the same machine. Only those machines were used to the record weight of children within ± 100 grams. The standard wall mounted steel tape certified by Department of Weights and Measures was used to assess the height of the children. The meter used for measuring height has a tape length of 2 meters and with instrument accuracy of 0.1 cm. Venipuncture method was adapted for the collection of blood sample by trained professionals for estimating blood serum retinol and hemoglobin levels. Posters, pamphlet, nutrition exhibition, power point presentations, paper education notebook activity and positive deviance hearth were adapted as nutritional education aids.

The salient findings of the present study.

Phase I: Prevalence of VAD and IDA among Fisherfolk Children

A. Socio- Economic Background of Fisherfolk children

- The data collected during the study period have indicated that, many fishermen families were Christians (56 per cent) mostly converted to Christianity from other religions, Hindus (38 per cent) and Muslims (6 per cent). They were also categorized into scheduled caste also called as ‘Palle’, the lowest sector in fishing community and scheduled tribe who involved in net making ang boat construction works.
- It was observed that, out of the 1000 fishermen children surveyed, only 47 per cent of their families have got own houses. Amongst the owned houses, 16 per cent

were constructed by the Government (in various schemes and tsunami relief houses). Out of the total number of houses surveyed, 13 per cent live in concrete houses, 28 per cent live in tiled houses 21 per cent live in thatched houses, and 38 per cent of the fishermen live in litter roofed houses.

- During the survey it was observed that about 86 per cent of the fishermen houses were provided with electricity and 78.6 per cent of the households in the coastal villages of fishermen do not have any household toilets. 81 per cent of the fisherfolks households in the selected villages were using public water taps available on the streets provided by the Government of Andhra Pradesh. The remaining 19 per cent of the fisherfolk rely on well water or bore-well water for drinking purpose.
- The fisherfolk of the coastal villages have a total mean literacy rate of 61.08 per cent in which the male literacy rate was 62.25 per cent and the female literacy rate was 47.85 per cent. A greater per cent of the fisherfolk is educated at primary or secondary school level only. The majority of them are school-dropouts. And it could be seen evidently that the female literacy rate is far below average when compared with the male literacy rate.
- If we analyze the data collected for the study, it is clearly evident that out of the 59,663 total fishermen population in the eight villages surveyed, 23,725(39.7 per cent) of them which includes men and women, work on fishing as their source of income.
- An overall of 62.2 per cent of the fisher-*folk children were living in joint families and 37.8 per cent abided in nuclear families. Thus, it is evident that relatively high per centage of the fisher-folk believe and live-in joint family system as they believe that it would help them cut down on labour and increase income.
- As per the data collected, 3.5 per cent of the fishermen families earn a very low income of Rs. 2000/- or less than Rs. 2000/- monthly, which clearly states their poverty level. Maximum number of the fishermen families, i.e., 90.7 per cent earn Rs.2001/- to Rs.5000/- and 5.8 per cent earn an income between Rs.5001 to Rs.10,000/- per month. Their per capita income was observed very low and thereby categorized under below poverty line.

- On calculation, a mean expenditure of Rs.9520/- per month has been observed in the fisherfolks living and if we compare between the income generated and the expenditure of the fisherfolk of the study area, it is clearly evident that their income meets only up to 48.8 per cent of the total expenditure in 91 per cent of the fishermen families. This indicates that the fishermen are drowning more and more into debts to sustain a living.

B. Clinical Symptoms of VAD and IDA among the Fisherfolk Children

- The average occurrence rate of Bitot's spots in fisherfolk children, a sign of vitamin A disorder was 0.8 per cent and is more when compared with the cut off value (of > 0.5 per cent) suggested by WHO (2007). VAD is a significant health issue of the public among the children of the fisherfolk community screened in the present study.
- The mean prevalence of conjunctival xerosis in fisherfolk children, a sign of VAD was 0.7 per cent, with Chollangi having 0.1 per cent, Vakalapudi 0.1 per cent, Uppada 0.1 per cent, Mulapeta 0.2 per cent, Ponnada and Konapaapapeta 0.1 per cent and Nemam having 0.1 per cent.
- The mean prevalence of Koilonychia, the most visible symptom of Iron Deficiency Anaemia in fisherfolk children was 2.2 per cent, with Chollangi having 0.2 per cent, Vakalapudi 0.3 per cent, Uppada 0.4 per cent, Mulapeta 0.2 per cent, Valasapaka 0.5 per cent, Ponnada and Konapaapapeta 0.2 per cent and Nemam having 0.3 per cent.
- The mean occurance of Emanciation, a disorder of Protein-Energy Malnutrition in fisherfolk children was 1.6 per cent, with Chollangi having 0.3 per cent, Vakalapudi 0.3 per cent, Uppada 0.3 per cent, Mulapeta 0.3 per cent, Valasapaka 0 per cent, Ponnada and Konapaapapeta 0.1 per cent and Nemam having 0.3 per cent.
- Other than the Vitamin A and Iron deficiency symptoms, other deficiencies were also observed among children. The occurrence of B- complex disorders like, Glossitis was 1.5 per cent, dry and brittle hair was observed in 3.3 per cent. Prevalence of phrynoderma was 0.9 per cent. Bleeding gums, a sign of Vitamin C deficiency was observed among 1.1 per cent children.

- Lack of hygiene has been anticipated by symptoms such as Gingivitis in 0.9 per cent children and dental caries in 4.3 per cent. Dermatitis was seen in 2.7 per cent children and Angular stomatitis, a B-complex deficiency in 5.1 per cent of the fisherfolk children of the current research.
- In the present study, out of 1000 fisherfolk children aged between 6-8 years, 258 children had clinical symptoms showcasing multiple vitamin and mineral deficiencies and energy protein malnutrition.

C. Nutritional Anthropometry of the Fisherfolk Children

- The average height of all children in this research was observed to be below than the WHO and ICMR standards irrespective of age and gender.
- The mean height of the 6-year-old boys in the study is 101.8±1.68 cm, 7-year-old age-group it is observed to be 111.57±2.3 cm and in the 8-year-old group it was 121.01±2.44cm.
- The observed mean height of the girls in 6-year age-group was 101.55 ±1.8cm and the 7-year-old girls were more stunned than all the children, which was 105.37±1.6 cm, showing a huge variation of -22.23 cm when compared with the WHO standards. The 8-year age-group girls mean height was observed to be 118.38±2.44 cm.
- The mean weight of 6 years age-group boys was 18.13±1.55kgs, 7 years boys was 19.54±1.0kgs and the mean of 8 years age-group boys weighed 21.76±0.98kg which is lesser by 2.37kg, 3.16kg and 3.54kg respectively when compared with the WHO standard weights.
- The average weight of girls in 6 years age-group was 15.02±0.93kgs, 7 years was 16.83±0.71kgs and 8 years age-group girls weighed 19.8±1.02kg which is lesser by 5.43kg, 5.47kg and 5.2 kg respectively when compared with the WHO standard weights.
- The average HAZ was lower than those of NCHS for both boys and girls at 6,7 and 8 years. The occurrence of stunting (Height for age< Median -2SD) in fisher-folk children was 99.9 per cent in which 0.4 per cent of children had moderate stunting and 99.5 per cent had severe stunting.

- In the study, 0.4 per cent of the boys were normal, 2.2 per cent were moderately underweight and 97.4 per cent were severely underweight. Coming to girls, all of them, irrelevant of age-groups fall under severely underweight category.
- It has been observed that 13.4 per cent of the subjects had normal BMI for age, 28.6 per cent of were observed to have moderately low BMI for age and 68 per cent had severely low BMI for age.

D. Dietary Pattern of the Fisherfolk Children

- In the current study, all the fisher-folk were non- vegetarians and follow a three meal schedule every day.
- Rice is the staple food of the fishermen. Dried fish and dried shrimp is the most regularly eaten food but in less quantity.
- Majority of adults, irrespective of gender and caste consume alcohol, tobacco and paan.
- The most predominant method of cooking cereals, pulses, vegetables and non-vegetarian foods was boiling.
- Raw rice is the staple for all the fisherfolk and is the only cereal eaten by all the children every day. Parboiled rice is also consumed weekly by 12 per cent and puffed rice weekly by 17.4 per cent.
- Pulses are not cooked at fishermen households on a regular basis but the children get to eat them for meal at school. So, children attending school get to eat dal almost daily.
- Big onions are the only tuber consumed by all children. 44.8 per cent of the fishermen children consumed it daily.
- Green leafy vegetables are hardly found to be included in the diets of the fisherfolk children except for the use of curry leaves in the curries, which was unfortunately removed while eating. Other green leafy vegetables were cooked once a month or occasionally by a few fishermen families.
- Other vegetables such as bottle gourd, brinjal, cucumber, drumstick, ladies finger, pumpkin and snake gourd were consumed by children monthly once. Beans, bitter

gourd, cluster beans, cauliflower and ridge gourd were also consumed occasionally by fisherfolk children.

- Fruits such as amla, banana, guava, lemon and watermelon were consumed by the children monthly and fruits like apple, grapes, jackfruit, mango, papaya and pineapple occasionally. Dates, musk melon, pears, sapota, custard apple were not consumed at all.
- Non- vegetarian foods like dried fish was consumed daily by 75.1 per cent of fisherfolk children, while 24.9 per cent consumed it weekly. Fresh fish which is very much the fishermen's catch is surprisingly not consumed by them daily.
- Egg was served once a week at school, 85.4 per cent children consumed it once a week while 10 per cent ate it monthly and 4.6 per cent occasionally.
- Dried shrimp was also weekly consumed by 31.5 per cent, monthly by 42.1 per cent and occasionally by 26.4 per cent. Crabs, chicken and mutton was consumed occasionally by the children.
- Palm oil is the daily consumed cooking oil used by all the families of fisherfolk. Refined oil is occasionally used by some.
- Sugar was consumed by 69.8 per cent weekly and 30.2 per cent monthly. Jaggery was consumed by some occasionally.
- Milk and curd aren't consumed on regular basis but buttermilk is taken daily by 86.4 per cent of the children, 12.9 per cent weekly, while 0.7 per cent do not like consuming it.
- The mean intake of food stuff consumed by fisherfolk children was below the RDA. Cereals and millets consumption met 68.8 per cent - 85 per cent, pulses 56.6 per cent- 727 per cent, green leafy vegetables 15 per cent- 18 per cent, roots and tubers 47 per cent-51 per cent, other vegetables expect tomato were consumed once a week. Milk and milk products 25 per cent – 30 per cent, fats and oils 50 per cent – 60 per cent the suggested dietary allowances.
- The nutrient consumption in all subjects was lower than the recommended dietary allowances (ICMR 2010). The average energy from the food intake for 6,7 and 8-years age-group was observed to be in a range of 69.2 – 85.1 per cent. Protein intake was in between 44.7 – 62.8 per cent, Fat 33.3 – 50 per cent,

Calcium 52.5 – 62.8 per cent, Vitamin A 38.1- 52.5 per cent, β- carotene 31.8 – 52.5 per cent, Vitamin C 60 – 65 per cent, Iron 53.1 – 61.5 per cent, and Thiamine 50 – 62.5 per cent was observed.

Phase II: Background Information and Nutritional Status of the Supplementation Group Children

A. Socio- Economic Background of the Supplementation Group Children

- All 234 fisherfolk children were observed to be malnourished having VAD and IDA symptoms and were selected as subjects.
- On the whole 62 per cent abided in joint-families and 38 per cent lived in individualized families.
- In the current study the the ratio of boys and girls was almost equal (51.7 per cent boys and 48.3 per cent girls).
- In this research 94.2 per cent of the surveyed families were under BPL and only 5.8 per cent were in the low-income group.
- Though the majority of these fishermen families were below poverty line, it shocking to note that on an average 35.6 per cent of all the families spent their money on paan, betelnut, tobacco and alcoholic drinks. 14.5 per cent was spent on food, 5.7 per cent on clothing, 6.4 per cent on household needs, 7.5 per cent on transportation, 16.4 per cent on house or boat rent and 13.6 per cent on loans and debts.

B. Nutritional Status of the Supplementation Children

- The mean heights of all children of 6, 7, and 8 years age-group and both the genders were below the standard values by a difference ranging from 3.2 cm to 19.3cm.
- The mean weights of all children of all age-group and both the genders were below the standard values by a difference ranging from 2.9kg to 5.9kg.
- The mean haemoglobin values of all children of all age-group and both the genders were below the standard value which is > 11.5g/dl (WHO 2001) by a difference ranging from 0.4g/dl to 2 g/dl. The average blood haemoglobin count of all boys and girls were relevant at one per cent and five per cent levels.

- All the boys and girls of age-groups 6 and 8 were noted to be anaemic. In this study, anaemia can be a significant health problem as 96.6 per cent of the children were identified to be anaemic. A total of 3.4 per cent subjects had normal haemoglobin count, 6 per cent had mild anaemia, 69.7 per cent had moderate anaemia and 20.9 per cent children had severe anaemia.
- Iron consumption and haemoglobin levels have relevant straight relationship with $p<0.005$ with a positive correlation which means that both iron intake and haemoglobin tend to rise together.
- The mean serum retinol of all the children was significantly below ($p< 0.01$) the standard values (0.2-0.5 mg/L) irrelevant of age and gender.
- The significance of the association between Vitamin A and serum retinol is a statistically significant linear relationship. There is a weak positive correlation which signifies that these two variables tend to increase together. This clearly proves the fact that vitamin A intake may improve the vitamin A nutritional status.
- The correlation coefficient between haemoglobin levels and serum retinol levels is 0.059 with p-value of 0.59 in six years age-group, 0.047 in seven years age-group with the p-value of 0.68 and 0.016 in eight years age-group with a p-value of 0.88. We could say that the significance of the association between the variables is weak but not undeniable. This proves the fact that low serum retinol may be associated with anaemia.
- Bitot's spots, a vitamin A disorder was noted in 3.6, 5.1, 1.6 and 3.4 per cent of children in Group 1, 2, 3 and 4 respectively.
- Conjunctival xerosis was observed among 1.8, 3.4, 3.3 and 3.4 per cent of Group 1, 2, 3 and 4 children respectively.
- Koilonychias, also known as spoon nails, a prominent symptom of iron deficiency anaemia was seen in 8.9, 10.2, 11.5 and 8.6 per cent in Group 1, 2, 3 and 4 respectively.
- Emanciation or wasting was observed in 7.14 per cent in Group 1, 8.47 per cent in Group 2, 8.19 per cent in Group 3 and 3.44 per cent in Group 4 children.

- Phrynoderma, a vitamin A deficiency symptom was observed in 3.57 per cent in Group 1, 5.08 per cent in Group 2, 4.91 per cent in Group 3 and 1.72 per cent in Group 4 children.
- Prevalence of dry and brittle hair were seen in 10.34 per cent to 16.94 per cent, bleeding gums in 3.27 per cent to 7.14 per cent, glossitis in 5.35 per cent to 6.89 per cent, gingivitis in 1.78 per cent to 5.08 per cent.
- Dermatitis was observed in 6.89 per cent to 16.09 per cent, dental caries in 18.03 per cent to 26.78 per cent, and angular stomatitis in 18.64 per cent to 23.21 per cent.

Dietary Patterns

- All fishermen ate non-vegetarian foods and ate three meals per day which was mostly rice.
- Boiling the cereals, pulses and meat for consumption was done by all the households. 83.7 per cent boiled their vegetables while 6.14 roasted them and 9.8 shallow fried them.
- 14.1 per cent of the families shallow fried green leafy vegetables and the others boiled them.
- Eggs were consumed by boiling by 79.05 per cent while other shallow fried them. Fish was boiled by 62.3 per cent and shallow fried by 37.6 per cent.

Phase III: Acceptability and Nutritive Value of Orange Fleshed Sweet Potato

- Orange fleshed sweet potato due to its bright colour, soft texture and sweet taste scored passive results in acceptability trails with a score of 3.97 on a score scale of 5.
- In the present study, 1 serve i.e.,100 gm of boiled Orange fleshed Sweet Potato selected for intervention provides 788µg of Retinol Activity Equivalents (RAE).
- It also provides 72gm of moisture, 1.4g of protein, 0.1g of fat, 17.7g of carbohydrates, 2.5g of fibre, 12.8mg of vitamin C, 0.17mg of Vitamin B6, 0.05mg of riboflavin, 0.06mg of thiamine, 0.7mg of iron and 27mg of calcium.

Phase IV: Impact of Interventions on Nutritional status and KAP

A. Impact of Supplementation of Orange Fleshed Sweet Potato on Nutritional Status, Clinical and Biochemical Profile

- The boy's average height after intervention has shown that they had grown significantly taller than their previous measured height. Though there was improvement in height, it did not meet the standard height values recommended by WHO (2006).
- The range of height increase in a duration of 6 months was 2.2 ± 0.71 cm to 2.3 ± 0.59 cm ($p<0.01$ and 0.05) in Group 1. In the Group 2, the range in height increase was 1.8 ± 0.42 to 2.3 ± 0.59 cm ($p<0.01$ and 0.05). In the Group 3 boys, the range in height increase was 1.9 ± 0.36 to 2.2 ± 0.44 cm ($p<0.01$ and 0.05). In the Group 4 boys, the range in height increase was 0.8 ± 0.26 to 1.1 ± 0.5 cm ($p<0.01$ and 0.05). It could be evaluated that Groups 1,2, and 3 who received intervention showed almost twice the increase in height when compared to the Group 4 (control group).
- The range of height increase in a duration of 6 months was 2.2 ± 1.2 cm to 2.4 ± 0.99 cm ($p<0.01$ and 0.05). In the Group 2, the range in height increase in girls was 1.5 ± 0.51 to2.6 ± 0.67 cm ($p<0.01$). Though a significant increase was observed, the standard height required was not attained. In the Group 3 girls, the range in height increase was 1.6 ± 0.4 to 1.9 ± 0.72 cm ($p<0.01$). In the Group 4 girls, the range in height increase was 0.7 ± 0.38 to 1.1 ± 0.29 cm ($p<0.01$). The height graph which was skewed initially significantly paced up by the end of supplementation.
- In the Group 1, range of weight increase in boys was 1.4 ± 0.34 to 1.5 ± 0.34 kg ($p<0.01$ and 0.05). In the Group 2 also increased to a significant extent of 1.4 ± 0.43 to 1.5 ± 0.33 kgs ($p<0.01$ and 0.05). Both Group 1 and 2 showed almost the same improvement in weight gain. Group 3 boys mean final weight ranged between 1.3 ± 0.29 to 1.7 ± 0.81kgs ($p<0.01$ and 0.05) and Group 4 boys mean final weight ranged between 0.2 ± 0.19 to 1.1 ± 0.5 kg ($p<0.01$ and 0.05) which wasn't a remarkable improvement when compared with other groups
- In the Group 1, the weight increase among girls was observed to be ranging between 0.9 ± 0.43 to 1.2 ± 0.4 kg ($p<0.01$ and 0.05) which was statistically

significant. Similarly, the mean final weight of girls in the Group 2 also increased to a significant extent with an increase of 1.4 ± 0.27 to 1.6 ± 0.42 kgs ($p<0.01$). Group 3 girls gained weight between 0.5 ± 0.35 to 1.1 ± 0.27 kgs ($p<0.01$ and 0.05) which was good sign of improvement. The Group 4 girls increase in weight ranged between 0.1 ± 0.21 to 0.4 ± 0.3 kgs ($p<0.01$ and 0.05) which wasn't good enough when compared with other groups.

- When compared with the standard values, the average initial haemoglobin values in all four groups were identified to be below than required. But after supplementation, the average of the final haemoglobin levels had increased significantly at one per cent and below five per cent level.
- In the Group 1, range of haemoglobin increase in boys was 0.26 ± 0.25 to 0.68 ± 0.47 gm/dl($p< 0.05$).The range in haemoglobin increase of girls of group 1 is 0.26 ± 0.23 to 0.69 ± 0.34 gm/dl ($p<0.01$ and 0.05). The mean final value of haemoglobin in boys of Group 2 also increased to a significant extent ranging from 0.37 ± 0.31 to 0.85± 0.35 gm/dl ($p<0.01$ and 0.05) and in girls the increase in the range of haemoglobin value was 0.26 ± 0.23 to 0.65 ± 0.43 gm/dl ($p<0.01$ and 0.05). Group 3 boys mean final haemoglobin increase ranged between 0.31 ± 0.25 to 0.8 ± 0.66 gm/l ($p < 0.05$) which was good sign of improvement and the range in haemoglobin increase of girls was 0.2 ± 0.19 to 0.73 ± 0.64 gm/dl ($p < 0.05$) which was statistically significant at one and five per cent levels. The Group 4 boys mean final haemoglobin increase ranged between 0.13 ± 0.13 to 0.34 ± 0.4 gm/dl ($p<0.05$) and in girls it was 0.08 ± 0.09 to 0.34 ± 0.31 gm/dl ($p<0.05$) which wasn't a remarkable improvement when compared with other groups.
- Before supplementation, 8 children were normal, mild anaemia was seen in 30 children, moderate anaemia was observed in 149 and severe anaemia was noted in 47 children. But after supplementation 24 children had normal haemoglobin levels, while mild anaemia was seen in 28 children, moderate anaemia was observed in 143 and severe anaemia was noted in 41 children.
- In the Group 1, range in hemoglobin increase of boys was 0.009 ± 0.005 to 0.014 ± 0.01 mg/l ($p < 0.01$), whereas in girls of Group 1 was 0.011±0.007 to 0.02±0.01 mg/l ($p < 0.01$ and 0.05). Similarly, the mean final value of serum retinol in boys in the Group 2 also increased to a significant extent with a range of 0.02 ± 0.009 to

0.028 ± 0.08 mg/l ($p < 0.01$) and in girls also an increase in serum retinol levels ranging between 0.011±0.009 to 0.023±0.008 mg/l ($p<0.01$ and 0.05) was observed. Group 3 boys the rise in mean serum retinol after supplementation was between 0.006 ± 0.005 to 0.016 ± 0.007mg/l ($p < 0.01$ and 0.05) and in girls was 0.01±0.0 to 0.014±0.01 mg/l ($p < 0.01$ and 0.05) which was statistically significant at one and five per cent levels. In the Group 4 boys and girls, increase in serum retinol levels was noted to be very minimal which ranged between 0.006 ± 0.007 to 0.01 ± 0.008 mg/l ($p<0.05$) and 0.005±0.005 to 0.007±0.006 ($p<0.05$) respectively.

- The prevalence of Bitot's spots before supplementation was seen to be 3.6, 5.1, 1.63 and 3.4 per cent in children in Group 1, 2, 3 and 4 respectively. After supplementation for 6 months, it was reduced to 3.4 per cent in only Group 2 children while the it remained the same in other groups.
- Conjunctival xerosis before was observed among 1.8, 3.4, 3.3 and 3.4 per cent of Group 1, 2, 3 and 4 children respectively. After supplementation Group 1 children had zero per cent, Group 2 had 1.7 per cent, Group 3 and Group 4 remained unchanged.
- Koilonychias before supplementation was seen to be 8.9, 10.2, 11.5 and 8.6 per cent in Group 1, 2, 3 and 4 respectively, which reduced to 5.35, 5.08, 8.19 and 8.62 per cent respectively after supplementation.
- Emanciation or wasting before was observed in 7.1 per cent in Group 1, 8.5 per cent in Group 2, 8.2 per cent in Group 3 and 3.4 in per cent in Group 4 children. After supplementation the symptoms dropped to 3.6 and 3.4 in group 1 and 2 respectively whereas Group 3 and 4 showed no difference.
- Dry, brittle hair was seen in 16.1, 16.9, 13.1 and 10.34 per cent in Group 1, 2, 3 and 4 respectively before supplementation which reduced to 5.35 per cent in Group1, 3.4 per cent in Group 2,8.2 per cent in Group 3, and 6.9 per cent in Group 4 after supplementation.
- Bleeding gums was observed before in 7.1, 5.1, 3.3, 3.4 per cent of children and after supplementation in 1.8, 1.7, 1.6, and 3.4 per cent respectively in Group 1, 2, 3 and 4 respectively.
- Glossitis, a deficiency of vitamin B 12 was seen before in 5.4 per cent in Group 1, 6.8 per cent in Group 2, 6.6 per cent in Group 3 and 6.9 per cent in Group 4

children. After supplementation it reduced to 1.8 per cent, 3.9 per cent, 4.2 per cent, and 5.2 per cent in Group 1,2,3, and 4 respectively.

- Phrynoderma, a vitamin A deficiency symptom was observed zero per cent in Group 1, 1.7 per cent in Group 2, 3.3 per cent in Group 3 and 1.7 per cent in Group 4 children after supplementation which was initially 3.57 per cent in Group 1, 5.08 per cent in Group 2, 4.9 per cent in Group 3 and 1.7 per cent in Group 4 children.
- Gingivitis was before seen in 1.8, 5.1, 3.3 and 3.4 per cent children and after supplementation it was seen in zero per cent, 1.7, 3.3, and 3.4 per cent of Group 1, Group 2, Group 3 and Group 4 respectively.
- Dental caries before was observed in 26.8 per cent children in Group 1 and after supplementation it was seen in 8.9 per cent, 22.0 per cent before in Group 2 and 10.2 per cent after supplementation, 18.3 per cent before in Group 3 and after supplementation it was 13.1 and per cent in Group 4 children before it was seen in 24.1 per cent and after it was 22.4 per cent.
- Dermatitis was seen in 16.09 per cent before and 5.35 per cent after, 10.16 per cent before and 3.38 per cent after, 11.47 per cent before and 6.55 per cent after and 6.89 per cent before and after remains the same 6.18 per cent in children of Group 1, 2, 3 and 4 respectively.
- Angular stomatitis was observed in 23.2 per cent in Group 1 which was reduced to 7.1 per cent after supplementation, 18.6 per cent in Group 2 before and 5.1 per cent after supplementation, 22.1 per cent before and 16.4 after in Group 3 and 20.7 per cent before and 19.0 after supplementation in Group 4 children.
- The amount of mean food consumption by each group before supplementation was more or less the same. But after supplementation there was an increase in intake of cereals and millets by 28g, consumption of pulses was also increased by 11g, 13g, 5g, and 5g in Groups 1,2,3 and 4 respectively.
- Intake of vegetables,green leafy vegetables, roots and tubers, fruits, milk and milk products, sugar and jaggery and fats and oils has incredibly increased in the Groups 1,2, and 3 but no change has been observed in the consumption of green leafy vegetables, fruits, milk and milk products and fats and oils in Group 4.

- An increase in the intake of all nutrients has been observed in Group 1, 2, and 3, but in Group 4, no increase has been recorded in the intake of iron, thiamine and vitamin C intake.

B. Impact of Nutrition Education on KAP

- Nutrition education has shown a very good impact on knowledge, attitude and practice of the mothers or care takers and the children. The scores observed initially and after intervention in mothers / care takers and children clearly show that there was a lot of improvement.
- The scores of mothers and care takers in knowledge have increased from 3.5 to 8.2. the scores in attitude have increased from an initial score of 3.1 to 7.9. The scores in practice have shot up from 4.6 to 7.2 with a difference of 2.6.
- The scores of children in knowledge have increased from 2.1 to 7.9. The scores in attitude have increased from an initial score of 2.9 to 8.0. The scores in practice have shot up from 3.6 to 7.6.
- It has been observed that a significant increase in knowledge, attitude and practice has been evolved in the mothers / caretakers and children of the fisherfolk.

Conclusion

The study on the fisherfolk children and its results revealed that the fisherfolk community are the poorest sector almost at the bottom of the social ladder living lives below poverty line. They are unable to get the basic nourishment that is required for their wellbeing. It can be concluded that VAD and IDA is a public health problem observed in the fisherfolk children. The prevalence of diseases related to hunger and malnutrition such as Bitot's spots, conjunctival xerosis, koilonychia, emaciation, phrynoderma, cheilosis, glossitis, gingivitis, dry and brittle hair, dental caries, bleeding gums and dermatitis proves the fact of malnourishment in their community. The survey shows that the staple food consumed by the children is rice. Dry fish was used daily in curries. Consumption of pulses is minimum. All the surveyed fishermen families were non-vegetarians. They regularly eat fish, especially dried and salted fish and occasionally eat meat of chicken, goat and pork. Consumption of vegetables and green leafy vegetables is very less. Use of dried prawn is also common. They hardly consume fruits as they cannot afford to buy. Milk is rarely consumed by the children except a few of them who can afford buying it. The supplementation of boiled orange fleshed sweet potatoes showed a significant impact

on food and nutrient intakes and also showed significant improvement on clinical symptoms, nutritional anthropometry, haemoglobin and serum retinol levels when compared to the control group. Nutrition education proved to more effective on KAP of mothers, caretakers and children also.

Recommendations

- Organize and conduct large scale and long-term intervention programmes among the fisherfolk communities to enhance their nutritional status.
- Introduce nutritional education in the school curriculum to enhance good food habits and nutritional status among children.
- Organize community welfare programmes which educates the lower sector regarding availability of different low cost, nutritional crops and foods that enhance their wellness and quality of living.
- Conduct in depth longitudinal studies on fishermen community assessing their health, nutritional status and diseases prevailing.
- Provide rehabilitation centers for deaddiction programmes, health improving interventions for alcoholics and smokers among fisherfolk communities.