REVIEW OF RESEARCH

ISSN: 2249-894X
IMPACT FACTOR : 5.2331(UIF)
VOLUME - 7 | ISSUE - 1 | OCTOBER – 2017

INTEGRATED HEALTH AND NUTRITION ASSESSMENT OF THE CHILDREN AND MOTHERS OF ALTRUSA INTERNATIONAL SCHOOL, GUDDADAHALLI, BANGALORE

Dr. N. Shakuntala Manay[1] , Dr. Navaneetha R.[2] and Dr. Ashwini S.[3]

[1]corresponding author, Retired Head of the Dept of Food and Nutrition and Research centre. Email:shakkubhooma@gmail.com

[2]Assistant professor of Department of Food and Nutrition and Research Centre.

[3]Research scholar ,Department of Food and Nutrition and Research Centre.

Smt VHD Government Central Institute of Home Science, Seshadri Road, Bangalore.

ABSTRACT :

Nutritional problems like Protein energy malnutrition (PEM), Anemia and Vitamin A deficiency continue to plague a large proportion of Indian children. The diets and nutritional status of urban slum children in India is far away from being satisfactory. The nutritional status of slum children is poor amongst all urban groups and is even poorer than the rural average. Most common causes of poor nutritional status include faulty infant feeding practices, impaired utilization of nutrients due to infections and parasites, inadequate food and health security, poor environmental conditions and lack of proper child care practices. Improving nutritional status of urban poor requires a more direct, more focused, and more integrated strategy. Lack of basic amenities like safe drinking water, proper housing, drainage and excreta disposal make this population vulnerable to infections which further compromises the nutrition of those living in the semi urban areas. Good nutrition is important throughout childhood. School going children form an important vulnerable segment of the nation's population .Malnutrition in young children has long-term negative effects on physical and cognitive development. Addressing nutritional problems of urban poor is therefore must for overall development of the country. (Abha Aggarwal and Padam Singh, (2002); K.M. Adhikari, (1999); Krishnaswamy K et.al., (1997); Sr. Elizabeth C.S. (2006);R. Khadgawat,et.al., (1998); S. Rao, et.al., (2000) ;ShallyAwasthi andSiddharth Agarwal, (2003); Shanti Ghosh and Dheeraj Shah, (2004);Vinod Kumar CS et.al., (2003).

India, a developing country accounts for about 40 percent undernourished children in the world mainly due to inadequate dietary intake in relation to their daily requirement. (Mitra et al ., 2007).

Growth and development in school children can be achieved by adequate nutrition. Malnutrition, stunted growth, muscle wasting, reduced work work capacity, poor mental and social development has been observed with inadequate nutrition (Awasthi Kumar, 2000: Manna et al .,2011).

There is an urgent need to promote the importance of balanced diet and preparation of nutrient dense recipes based on locally available food stuffs to improve the nutrient intake among

school children. (Vandana Sati and SarojDahiya, 2015)

Children stunted at school-age are likely to have been exposed to poor nutrition since early childhood and the degree of stunting tends to increase throughout the school-age years. However, children can exhibit catch up growth if their environment improves.(Vijayasree. Bandikolla, 2016)

OBJECTIVES:

1. To assess the anthropometric status of the school children prior to supplementation.
2. To examine the clinical profile of the subjects for prevalence of micronutrient deficiencies.
3. To assess the dietary intake and nutritional status of the school children.
4. To detect worm infestation in school children by Laboratory stool examination.
5. To study the impact of socioeconomic status on the child's health.
6. To investigate changes in clinical profile of the school children following multivitamin and iron pharmaceutical supplementation.
7. To assess the impact of supplementary food on the nutritional status of school children.
8. To assess the impact of imparting nutritional education to the mothers of the selected school children .

SAMPLE:

The study was carried out in Altrusa International school, Guddadahalli, Bangalore. The sample size for the study was 110 children (Out of which 56 were boys and 54 were girls) and ranged between 2 to 7 years of age.

RESEARCH DESIGN:

A survey method was adopted for conducting the study.

MEASURES:

A detailed proforma was developed to collect information on anthropometric data, clinical profile, dietary intake and socio-economic status of the children.

TOOLS:

Anthropometric parameters, Anthropometric measures (Height, Weight, Head & Chest Circumference, Skin Fold measurements and MUAC) Anthropometric Indices (Body Mass Index (BMI), Height for Age or Stunting (H/A) and Weight for Height or Wasting (W/H), Clinical Profile, Dietary assessment and Socio – Economic Data.

Dependent Variables

Keeping the objectives in view the following variables were selected.

1. Anthropometric parameters

Anthropometric parameters were utilised to assess their nutritional status and the energy stores of the body and the conclusion were drawn based on selected indices mentioned in the study.

2. Anthropometric measures

Data on anthropometric measures were obtained as per standard methods to assess the nutritional status of the children.

a) Height

Children were made to stand on the flat floor without footwear, with the arms relaxed on their side and looking straight ahead. The children's height were measured, to the nearest 0.1 cm.

b) Weight

Body weight of the children were taken on a weighing scale. Scale calibration was checked before taking the weights. Subjects were made to stand on the centre of the platform without footwear, without touching anything and looking straight ahead.

c) Skinfold measurement

Skinfold measurement is an estimate of the fat stores, measures a double layer of skin and subcutaneous fat with a skinfold caliper. The measurement was taken at the mid-point between the Acromion process of the scapula (shoulder blade) and the Olecranon process of the ulna (tip of the elbow) of the arm. A child's arm hanging relaxed at the side, the midpoint was grasped posteriorly between the thumb and the forefinger. The fold was raised allowing the underlying muscle to fall back to the bone.

d) Mid Upper Arm Circumference

The mid arm contains both muscle and subcutaneous fat. Measurement of the circumference of the mid upper arm may be used as an index of the nutritional status. Mid upper arm circumference (cm) was measured to the nearest 0.1 cm with a measuring tape with the left arm hanging relaxed. The measurement was taken midway between the tip of the Acromion process and the Olecranon process

e) Head and Chest circumference

The head and chest circumferences are measured with a flexible tape. The chest circumference is taken at the nipple level preferably in mid inspiration. The head circumference is measured passing the tape round the head over the supra-orbital ridges of the frontal bone in front.

3. *AntrhopometricIndices*

Body Mass Index (BMI), Height for Age (H/A) and Weight for Height(W/H) were used to assess the nutritional status of the children. Norms of upper limb fat and muscle area such as, mid upper arm circumference (MUAC) and skin fold were computed to ascertain the energy stores of the body.

4. *Clinical Profile*

A detailed proforma was prepared for clinical assessment of individual child at the time of anthropometric measurements. This included examination of:

Areas of Examination	Clinical signs of good health	Signs known to be of value in Nutritional assessment	Possible Nutritional Disorder
Face	Alert, no puffiness	Diffused, depigmentation, sclorhea (scaling of skin	Riboflavin Deficiency
Hair	Shiny, lustrous, even colouration, healthy scalp	Lack of lustre, dull, dry, sparseness, dispigmentation, easy pluckability	Kwashiorkor
Eyes	Bright, clear, no fatigue circles	Conjunctival Xerosis (Dryness of cornea), Xerophthalmia (conjunctiva becomes discoloured), Keratomalacia (cornea becomes soft and easily infected) Bitot's spot Pale or light pink lower eye lids	Vitamin A deficiency Iron deficiency
Lips	Good colour and moist	Angular stomatitis (lesions on sides of the mouth) Angular scars, chelosis (lips develop cracks and become red)	Riboflavin deficiency

Tongue	Pink colour, no lesions	Oedema, red raw tongue (the tongue is bright red and painful) Magenta colour tongue	Niacin deficiency Riboflavin deficiency Folic Acid deficiency
Gums	No swelling or bleeding	Spongy bleeding gums	Vitamin C deficiency
Glands	No enlargement	Thyroid and parotid enlargement	Iodine Deficiency
Skin	Smooth and slightly moist	Xerosis and dermatitis	PEM and Vitamin A deficiency
Nails	Not brittle and good pink colour	Brittle and spoon shaped	Calcium and iron deficiency
Skeletal System	Long bones development	Beaded ribs, pigeon chest, knock knees, bowed legs	Vitamin D and Calcium deficiency
Nervous system	Alert, good concentration span	Irritable, poor attention span, sleeplessness	

5. *Dietary Intake*

The dietary assessment was done using a food frequency questionnaire (FFQ) to determine the frequency of consumption of major food groups. It included a list of foods (Cereals, Pulses, Fruits, Vegetables, Milk & Milk Products and Meat/Egg/Fish and a series of frequencies such as "daily", “alternate days”, “weekly twice”, “once a week”, “fortnightly,” “once a month” and never. The food frequency provides qualitative data on types and frequency of foods or food groups.

6. *Socio-Economic Data*

Data on the family income and education level of the parents were collected to gain some understanding of societal conditions that are known to affect people’s access to food. Nutritional knowledge and attitude of the mothers was also assessed by a detailed talk on the food groups, hygiene and sanitary practices, and other aspects of health and nutrition. Questions related to the talk were framed and given to the respondents and the feedback were analysed.

INTERGRATED INTERVENTION PROGRAMME

The intervention was done at two phases. Phase I was the introduction of pharmaceutical supplementation in the form of multivitamin and iron syrup and drops to alleviate all signs of clinical deficiencies.

Phase II was intervention with supplementary foods in the form of dates (rich in iron, calcium, carbohydrate, no pre-preparation required, longer shelf –life) to improve anthropometric status.

To inculcate the values of health, hygiene and sanitation to the mothers through formal and interactive talks on the above subject.

RESULTS & DISCUSSION

SURVEY I

Table 1. Anthropometry data – Survey I

Class	Stunting		Wasting		BMI			Head cir 'ence,Chest		MUAC	
	Normal	Stunting	Normal	Wasting	Normal	Underwt	Obese	Normal	Abnormal	Normal	Abnormal
Creche	19	6	14	11	19	6	-	24	1	22	3
Nursery	1	28	10	19	23	6	-	25	4	20	9

LKG	6	27	20	13	25	7	1	33	0	27	6
UKG+I+II	1	22	14	9	19	2	2	21	2	21	2
Total	27	83	58	52	86	21	3	103	7	90	20
Mean	6.75	21	14.50	13.00	21.50	5.25	1.50	25.75	1.75	22.50	5.00
SD	8.50	10	4.12	4.32	3.00	2.22	0.71	5.12	1.71	3.11	3.16
T test	-2.112		0.502		62.441*			8.888		7.892	
p-value	0.079		0.633		**<0.001**			**<0.001**		**<0.001**	
* ANOVA test; p-value in bold implies significance of the test with p-value<0.05											

Nutritional anthropometry status of children before intervention with supplementary foods.

According to height for age (< H/A: Stunting) criteria, the overall prevalence of stunting in was about 75% and only 25% were normal.

Trend seen for weight for height (<W/H: Wasting) showed that the total percentage wasted were 47%.

The BMI calculated on the basis of weight and height revealed that of the 110 students 78% were normal, 19% were underweight and about 3% were obese. The mean of BMI was significantly different between the normal (M=21.50), underweight (M=5.25) and obese (M=1.50) individuals with p-value<0.001 About 94% children had chest circumference that exceeded head circumference indicating normal growth. The mean of head/chest circumference was significantly different between normal (M=25.75) and abnormal (M=1.75) with p<0.001

The MUAC measurements showed that 75% were normal and 25% fell below the recommended standards. The mean MUAC measurement was significantly different between the normal (M=22.50) and abnormal groups (M=5.00) with p<0.001.

Table 2. Clinical Profile of the Children expressed as percentage – Survey I

Areas of Examination	Normal %	Abnormal %
A. Face	98	2
B. Hair	100	0
C. Eyes	77	23
D. Lips	100	0
E. Tongue	100	0
F. Teeth	82	18
G. Gums	99	1
H. Glands	100	0
I. Skin	96	4
J. Nails	92	8
K. Skeletal System	96	4
L. Digestive System	81	19
M. Nervous System	95	5
Worm infestation	64	36
Mean	91.43	8.57
SD	11.12	11.12

T test	19.714
p-value	**<0.001**
P value in bold implies significant test with p-value <0.05	

Clinical Profile- Survey I

The children were examined for signs of clinical deficiencies before intervention with pharmaceutical supplementation. The data revealed that :

- About 2% showed abnormalities in face
- 23% were found to have paleness in their lower eye lid indicating possible signs of anemia
- 18% were observed to have dental carries or other tooth problems
- About 1% of the children showed abnormalities in gums
- 4% of the children showed skin conditions which were not normal
- About 8% showed brittle nails which was a sign of anemia and calcium deficiency
- 4% showed abnormalities in their skeletal system.

Out of the 110 children only 81% showed normal digestive system status, the rest were abnormal. Clinical examination also revealed that about 5% of the children had poor attention span. A total of 64% of the children did not show any signs of worm infestation where as the rest of the 36% indicated clinical signs of worm infestation.

The t test was performed in order to find if there is mean difference between the mean features between normal and abnormal group. It was observed that the mean features was significantly different between normal (M=91.43) and abnormal (M=8.57) group with p-value <0.001.

Dietary Assessment – Survey I

The dietary assessment showed that 76% of the children consumed breakfast, 90% consumed lunch, and 61 % consumed tea and 90 % dinner daily.

Table 3. Dietary Assessment

Meal	YES	NO
Breakfast	84	26
Lunch	100	10
Tea	67	43
Dinner	99	11
Mean	87.50	22.50
SD	15.50	15.50
T Test	5.93	
p-value	**0.001**	
p-value in bold represents significant test with p-value<0.05		

T test was performed to see if the mean of responses was significantly different between whether the children consume meal (M=87.50) or not (M=22.50) with p-value =0.001.

Data on Food Groups – Survey I

Percentage of children that consumed cereals on a daily basis was 96%.

About 39% of the children consumed pulses weekly twice. A large section of the children, 31% ate fruits once a week.

About 15% of the total never consumed vegetables. A similar trend was observed with the intake of milk, 72% consumed milk daily, 2% on alternate days and about 26% of the total never consumed milk as part of their diets.

Table 4.Consumption of various Food Groups – Survey I

Foods	Daily	Alternate days	Weekly twice	Once a week	Fortnightly	Once a month	Never
Cereals	106	4					
Pulses	5	23	43	20	4	1	14
Fruits	29	10	17	35	9	5	5
Vegetable	64	13	15	1	0	0	17
Milk	80	1	0	0	0	0	29
Meat/Fish	5	19	16	37	16	3	14
Mean	48.17	11.67	18.20	18.60	5.80	1.80	15.80
SD	41.72	8.48	15.51	17.78	6.79	2.17	8.64
ANOVA Test	3.3						
p-value	**0.013**						
Post Hoc tests	0.003*, 0.018^, 0.020@, 0.001+,0.001-,0.011#						
p-value in bold indicates significant test with p-value <0.05; * daily Vs alternate days, ^daily Vs Weekly twice, @ daily Vs weekly once, + daily Vs fortnighty, - daily Vs once a month, # daily Vs Never							

The Analysis of variance was performed to test if there is significant difference in the mean responses on the food intake between the frequencies of intake. The ANOVA test was significant implying that the mean responses was significantly different among the frequency of intake with daily intake has the maximum mean response (M=48.17) followed by once a week (M=18.60) and twice a week (M=18.20) with ANOVA test p-value=0.013.

Socio-Economic data – Survey I

The data on socio-economic particulars revealed that 78% of children came from families whose family size was less than five members and the rest of the 22% came from families, where the number of family members exceeded five.

Data on the type of family showed that 76% came from nuclear families and 24% from joint families.

Table 5. Frequency table about family

No. of family members	Frequency	Percentage
<5	86	78.18
>5	24	21.82
Type of family	Frequency	Percentage
Nuclear	84	76.36
Joint	26	23.64

Figre 1. Bar diagram representing family details

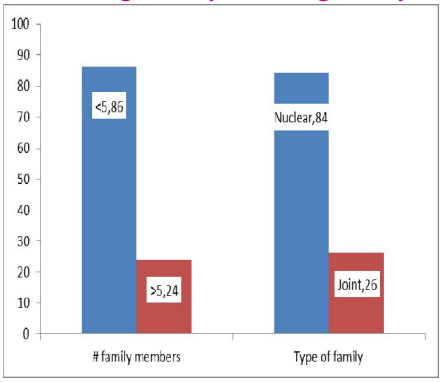


Table 6.Monthly Income Patterns of Families

Monthly Income	Rs 500- Rs 1000 (%)	Rs 2000- Rs3000 (%)	More than Rs3000 (%)
No. of families	20 (18.18)	33 (30.00)	57 (51.82)

Figure 2. Bar Diagram representing monthly income patterns

About 18% of the children came from families whose monthly income ranged between Rs 500- Rs 1000, 30% had monthly income that ranged between Rs 2000-Rs 3000 and 52% of the families of children had a monthly earnings that exceeded Rs 3000.

Table 7. Education levels of parents

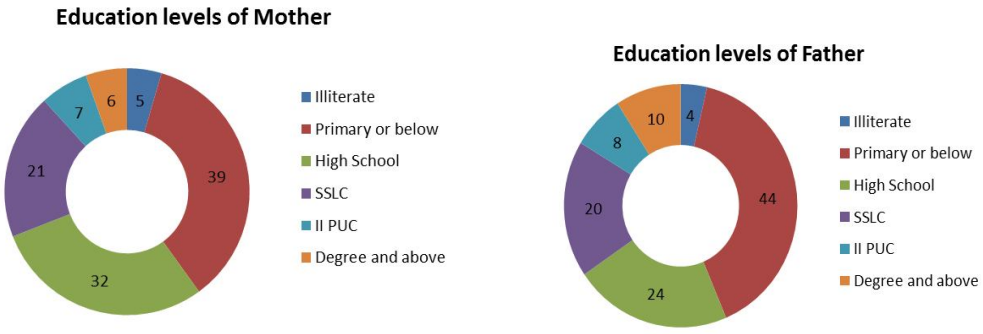
Education	Illiterate	Primary or below	High School	SSLC	II PUC	Degree and above	Mean	SD	T test statistic, p-value
Mother	5	39	32	21	7	6	18.33	14.69	0.000, 1.000
Father	4	44	24	20	8	10	18.33	14.65	
n = 110	9	83	56	41	15	16			

Education Level of Parents

4% parents were illiterate, 38% of them had an education level of primary or below primary, 25% had passed High School, 17% had completed their SSLC, about 7% had attained their PUC and the rest of the 7% had an education level of degree and above.

T test was performed to find if there is any significant mean difference between mothers 'and fathers 'education. The mean of mothers' (M=18.33) and fathers' (M=18.33) education are not significantly different with p-value =1.00.

Figure 3. Education levels of parents represented by Doughnut chart



RESULTS & DISCUSSION SURVEY II (Phase I)

Objectives achieved in Survey II

Changes in anthropometric status of the children following multivitamin and iron pharmaceutical supplementation were investigated.

Clinical profile of the subjects for prevalence of micronutrient deficiencies and changes in the same after supplementation was examined.

Laboratory stool examination for detecting worm infestation in the children.

Assessed the impact of imparting nutritional education to the mothers.

Table 8. Anthropometry data – Survey II

Class	Stunting		Wasting		BMI			Head< Chest		MUAC	
	Normal	Stunting	Normal	Wasting	Normal	Underwt	Obese	Normal	Abnormal	Normal	Abnormal
Creeche	21	2	11	12	10	13	0	22	1	21	2
Nursery	3	21	7	17	5	19	0	20	4	20	4
LKG	15	16	15	16	16	15	0	31	0	27	4
KUG/Std I/Std II	5	16	12	9	11	10	0	19	2	21	0
Total Surey II	44	55	45	54	42	57	0	92	7	89	10
Mean	11.00	13.75	11.25	13.50	10.50	14.25	0.00	23.00	1.75	22.25	2.50
SD	8.49	8.18	3.30	3.67	4.51	3.77	0.00	5.48	1.71	3.20	1.91
T Test statistic	-0.467		-0.908		-1.275			7.408		10.588	
p-value	0.657		0.399		0.249			**<0.001**		**<0.001**	

T test was performed to find if the mean stunting values are significantly different between normal and stunting. The mean of Normal (M=11.00) was not significantly different from the mean stunting (M=13.75) with p-value =0.657.

Similarly, the t test was performed to find if the mean normal (M=11.25) and mean wasting (M=13.50) was significantly different. The means were not significantly different with p-value= 0.399.

T test performed to find if the mean BMI was significantly different between normal (M=10.50) and Underweight (M=14.25) groups. The means were not significantly different with p-value=0.249. While there was no one in the obese category.

T test was performed to find if the mean Head, Chest circumference were significantly different between normal (M=23.00) and abnormal (M=1.75) groups. The means were significantly different with p-value <0.001.

T test was performed to find if the mean MUAC were significantly different between normal (M=22.25) and abnormal (M=2.50) groups. The means were significantly different with p-value <0.001.

Nutritional anthropometry status of children - Survey II

The number of children that were stunted in survey I decreased in survey II. However number of children who were wasted increased in survey II in comparison to survey I

There was increase in the number of under-weight subjects in survey II, this is because the intervention included only clinical supplementation (phase I) and not dietary supplement (phase II). Increase in weight and subsequent anthropometric indices were anticipated with the onset of phase II intervention (introduction of dietary supplements in the form of dates).

However the numbers of children with abnormal head to chest circumference ratio have remained stagnant in both the surveys.

The children showed improvements in their mid-upper arm circumference measurements in the follow-up survey.

Table 9. Clinical Profile of the Children following phase I pharmaceutical supplementation – Survey II

Areas of Examination	Normal (%)	Abnormal (%)
A.Face	100	0
B.Hair	100	0
C.Eyes	100	0
D.Lips	100	0
E.Tongue	100	0
F.Teeth	82	18
G.Gums	100	0
H.Glands	100	0
L Skin	100	0
J.Nails	100	0
K.Skeletal System	100	0
L.Digestive System	100	0
M.Nervous System	100	0
Mean	98.62	1.38
SD	4.99	4.99
T test statistic	49.655	
p-value	**<0.001**	

T test was performed to find if there is significant difference between mean areas of examination. The mean normals (M=98.62) and mean abnormals (M=1.38) were significantly different for the areas of examination with p-value <0.001.

Clinical profile- Survey II

The children were examined for signs of clinical deficiencies after intervention with pharmaceutical supplementation for 3 months.

Clinical intervention had led to alleviating all clinical deficiencies related to abnormalities in face, paleness in their lower eye lid indicating possible signs of anemia, abnormalities in gums, skin conditions, brittle nails which was a sign of anemia and calcium deficiency, and abnormalities in their skeletal system and digestive system.

However the percentage of children with dental cavities (18%) remained the same in both the surveys.

Clinical re-examination also revealed that children's attention span had also improved.

Although survey I reported 36% of the children to have clinical signs of worm infestation, laboratory stool examination revealed negative results for presence of cyst or ova in the examination to confirm the clinical observation.

Table 10. Dietary Assessment – Survey II

Meal	YES n=99	NO n=99
Breakfast	99	0
Lunch	99	0
Tea	99	0
Dinner	99	0

Meal pattern of the children – Survey II

The data on dietary assessment collected in Survey II revealed that 100% (76% in survey I) of the children consumed breakfast.

100% (90% in survey I) consumed lunch, 100% (61% in survey I) consumed tea and 100% (90% in survey I) dinner daily.

The major changes in meal pattern consumption are attributed to the talks to the mothers which emphasized on timely and regular meals to the children.

The data on the meal pattern collected in survey II showed that all the children consumed breakfast, lunch, tea and dinner on a regular basis when compared to survey I where some percentage of the children skipped one of the four meals.

Table 11. Consumption of various Food Groups – Survey II

Foods	Daily	Alternate days	Weekly twice	Once a week	Fortnightly	Once a month	Never
Cereals	99	-	-	-	-	-	-
Pulses	17	23	38	13	4	1	3
Fruits	45	9	20	17	3	3	2
Vegetables	71	6	10	4	-	-	8
Milk	85	1	2	2	-	-	9
Meat/Fish	2	12	21	16	2	7	9
Mean	53.17	8.50	15.17	8.67	1.50	1.83	5.17
SD	38.54	8.46	14.20	7.53	1.76	2.79	3.97
ANOVA Test statistic	7.504						
P-VALUE	**<0.001**						
Post Hoc tests		<0.001*	<0.001^	<0.001#	<0.001&	<0.001@	<0.001+

p-value in bold represents significant test with p-value <0.05; * Daily Vs Alternate days, ^ daily Vs weekly twice, # daily Vs once a week, & daily Vs fortnightly, @ daily Vs once a month, + daily Vs Never

The Analysis of variance was performed to test if there is significant difference in the mean responses on the food intake between the frequencies of intake. The ANOVA test was significant implying that the mean responses was significantly different among the frequency of intake with daily intake has the maximum mean response (M=53.17) followed by twice a week (M=15.17) and once a week (M=8.67) with ANOVA test p-value<0.001.

Data on Food Groups – Survey II

Percentage of children that consumed cereals on a daily basis was 100% in survey II as compared to 96% in survey I.

The percentage of children who did not consume pulses as part of their dietary pattern decreased from 14% in survey I to 3% in survey II.

About 45% of the children consumed fruits daily compared to the 26% in survey I.

About 71% consumed vegetables on a daily basis when compared to 65% in survey I.

A similar trend was observed with the intake of milk, 72% (58% in survey I) consumed milk daily, 6% (2% in survey I) on alternate days and about 8% (26% in survey I) of the total never consumed milk as part of their diets.

RESULTS & DISCUSSION SURVEY II (Phase II)

Objectives achieved in Survey III

1.Changes in anthropometric status of the school children following food, multivitamin and iron pharmaceutical supplementation were investigated.

2.Prevalance of trace micronutrient deficiency was assessed among selected school children

3.The improvements in dietary intake and nutritional status of the school children was analysed.

4.To assess the impact of imparting nutritional education to the mothers of selected school children.

Table 12. Anthropometry data – Survey III

Class	Stunting		Wasting		BMI			Head < Chest		MUAC	
	Normal	Stunting	Normal	Wasting	Normal	Underwt	Obese	Normal	Abnormal	Normal	Abnormal
Creche	21	2	15	8	15	8	-	19	4	23	-
Nursery	9	15	14	10	15	9	-	22	2	14	10
LKG	21	10	21	10	10	21	-	29	2	28	3
UKG Std I /Std II	14	7	20	1	2	19	-	20	1	20	1
Total Survey III	65	34	70	29	42	57	-	92	7	90	9
Mean	16.25	8.5	17.50	7.25	10.5	14.25	0	22.5	2.25	21.5	3.5
SD	5.85	5.45	3.51	4.27	6.14	6.7	0	4.51	1.26	5.85	4.91
T test statistic	1.939		3.707		-0.825			8.651		4.805	
p-value	0.101		**0.01**		0.441			**<0.001**		**0.003**	
p-value in bold represents significant test with p-value <0.05											

As a result of t test, there is significant difference between the mean responses between normal (M=17.50) and wasting (M=7.25) with p-value =0.010.

The t test result to find the difference in the mean measurements between normal (M=22.50) and abnormal (M=2.25) with respect to the head chest measurements resulted in a significant test with p-value <0.001.

Based on t test, the mean MUAC between normal (M=21.50) and abnormal (M=3.5) was significantly different with p=0.003

Nutritional anthropometry status of children- Survey III

The number of children who showed stunting and wasting in survey III was less in comparison to survey II and I.

There was decrease in the number of under-weight subjects in survey III, this is because the intervention included both pharmaceutical and dietary supplementation [(phase I) and (phase II)].

Increase in weight and subsequent anthropometric indices which was anticipated with the onset of phase II intervention (introduction of dietary supplements in the form of dates) was thus achieved.

The children with normal head to chest circumference ratio was a stagnant number in survey II & III.

The children showed improvements in their mid upper arm circumference measurements in the second follow-up survey.

Clinical profile- Survey III

The children were examined for signs of clinical deficiencies after intervention with pharmaceutical supplementation in survey III

Results of clinical intervention that had led to alleviating all clinical deficiencies related to abnormalities in face, paleness in their lower eye lid indicating possible signs of anemia, abnormalities in gums, skin conditions, brittle nails which was a sign of anemia and calcium deficiency, and abnormalities in their skeletal system and digestive system in survey II continued in survey III.

However the percentage of children with dental cavities (18%) remained the same in all the surveys.

Table 13. Dietary Assessment – Survey III

Meal	YES n=99	NO n=99
Breakfast	99	0
Lunch	99	0
Tea	99	0
Dinner	99	0

The meal pattern confirmed that improvements in survey II further continued in survey III as 100% of the children consumed breakfast, lunch, tea and dinner everyday

Table 14. Consumption of various Food Groups – Survey III

Foods	Daily	Alternate days	Weekly twice	Once a week	Fortnightly	Once a month	Never
Cereals	99	-	-	-	-	-	-
Pulses	20	38	23	17	1	-	-
Fruits	54	20	17	8	-	-	-
Vegetables	81	10	4	4	-	-	-
Milk	94	1	2	2	-	-	-
Meat/Fish	2	12	21	46	-	9	9
Mean	58.33	13.50	11.17	12.83	0.17	1.50	1.50
SD	40.25	14.11	10.30	17.33	0.41	3.67	3.67

ANOVA Test statistic	7.702						
P-VALUE	**<0.001**						
Post Hoc tests		<0.001*	<0.001^	<0.001#	<0.001&	<0.001 @	<0.001+

p-value in bold represents significant test with p-value <0.05; * Daily Vs Alternate days, ^ daily Vs weekly twice, # daily Vs once a week, & daily Vs fortnightly, @ daily Vs once a month, + daily Vs Never

The Analysis of variance was performed to test if there is significant difference in the mean responses on the food intake between the frequencies of intake. The ANOVA test was significant implying that the mean responses was significantly different among the frequency of intake with daily intake has the maximum mean response (M=58.33) followed by alternate days (M=13.50) and then once a week (M=12.83) and twice a week (M=11.17) with ANOVA test p-value<0.001.

Survey III showed considerable improvements in consumption of various food groups and their frequency.

Interactive sessions with the Mothers

The interaction began with a discussion on their hygiene and sanitary practices.

Introduction of Basic Food Groups through the Food Guide Pyramid.

Follow-up assessment through questionnaire related to the talk.

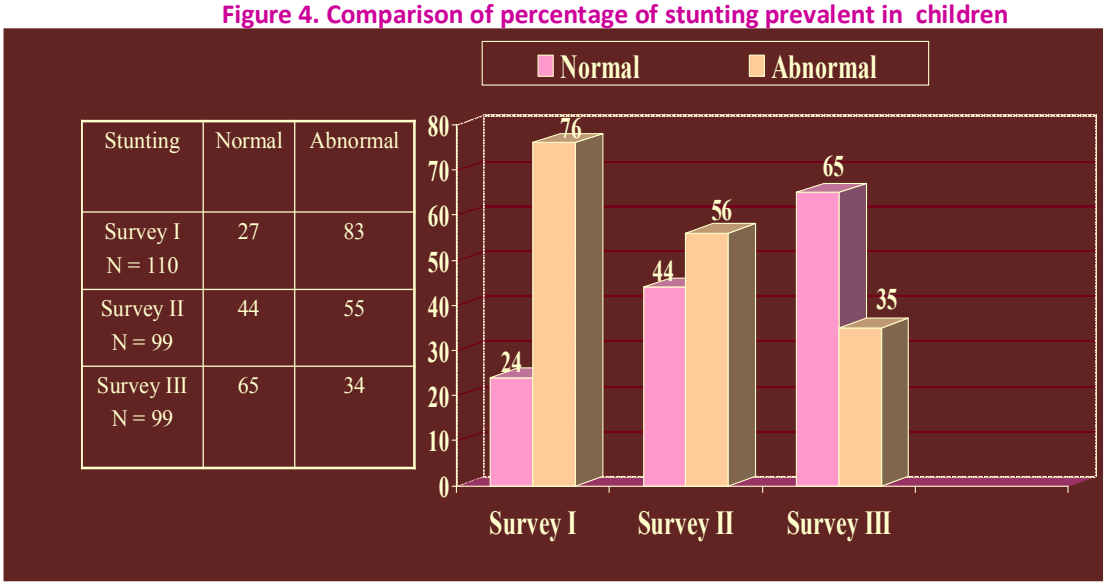
Practical demonstration on the healthy cooking method to retain the nutrients and the need to incorporate malted & roasted ragi and other food groups in their dietary patterns.

Most of them understood the concept of incorporating the different food groups rich in Cereals (carbohydrate), Pulses, egg, fish, meat (protein), oils & fat, Fruits and vegetables (vitamins and minerals) in their daily meal pattern.

Talks on improving the economic status of the family by supplementary income from vocational training (eg: tailoring, handicrafts, embroidery, candle making etc)

ANTHROPOMETRY

Figure 4. Comparison of percentage of stunting prevalent in children

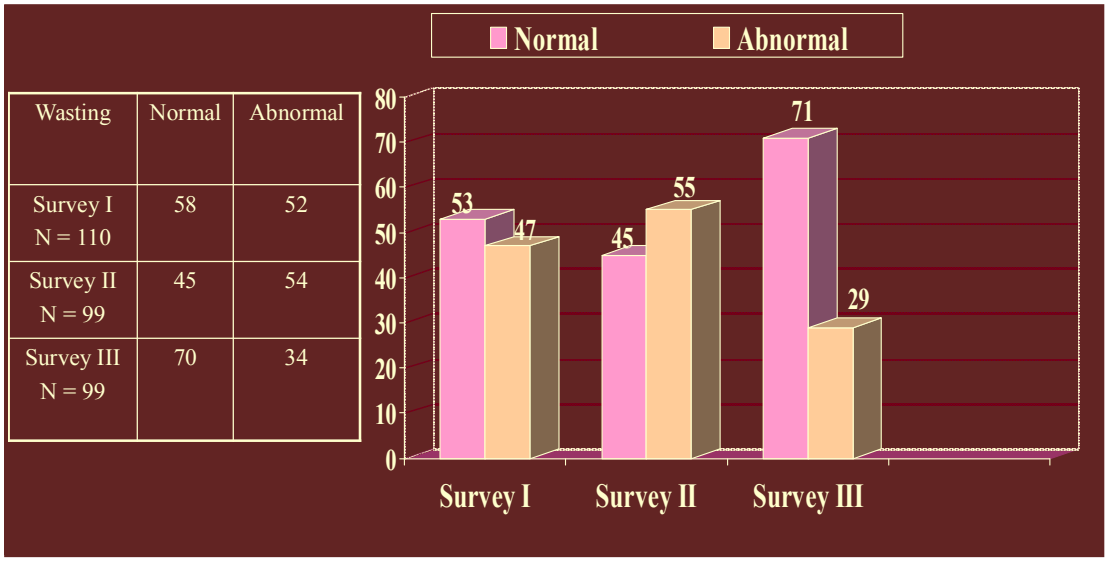


Stunting	Normal	Abnormal
Survey I N = 110	27	83
Survey II N = 99	44	55
Survey III N = 99	65	34

P<0.001, χ^2=35.700(df=2), significant**

ANTHROPOMETRY

Figure 5. Comparison of percentage of wasting prevalent in children



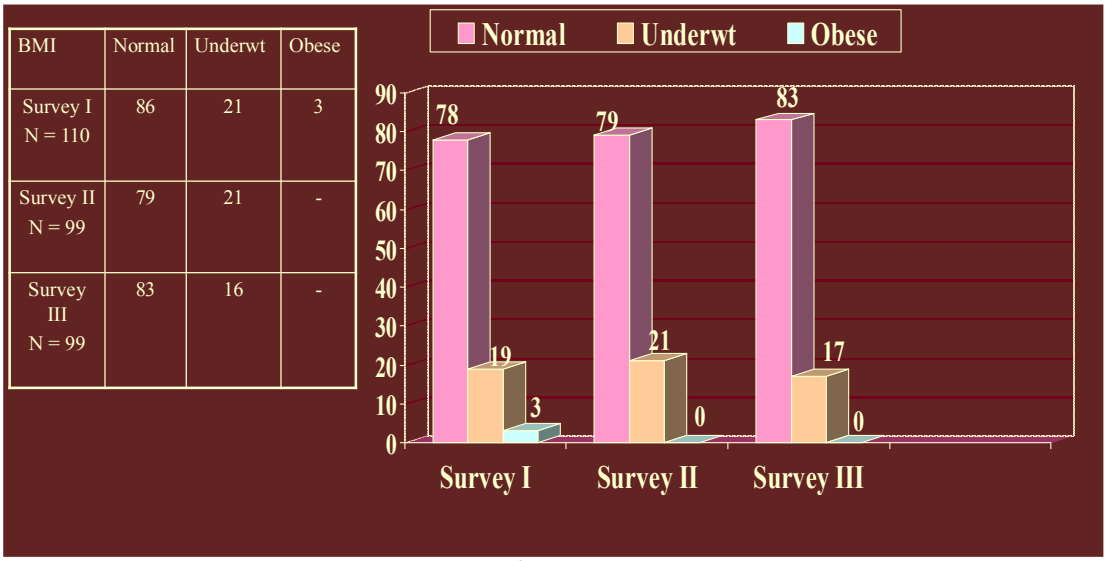
Wasting	Normal	Abnormal
Survey I N = 110	58	52
Survey II N = 99	45	54
Survey III N = 99	70	34

P=0.006, χ^2=10.20(df=2), significant**

ANTHROPOMETRY

Figure 6. Comparison of BMI prevalent in children

BMI	Normal	Underwt	Obese
Survey I N = 110	86	21	3
Survey II N = 99	79	21	-
Survey III N = 99	83	16	-

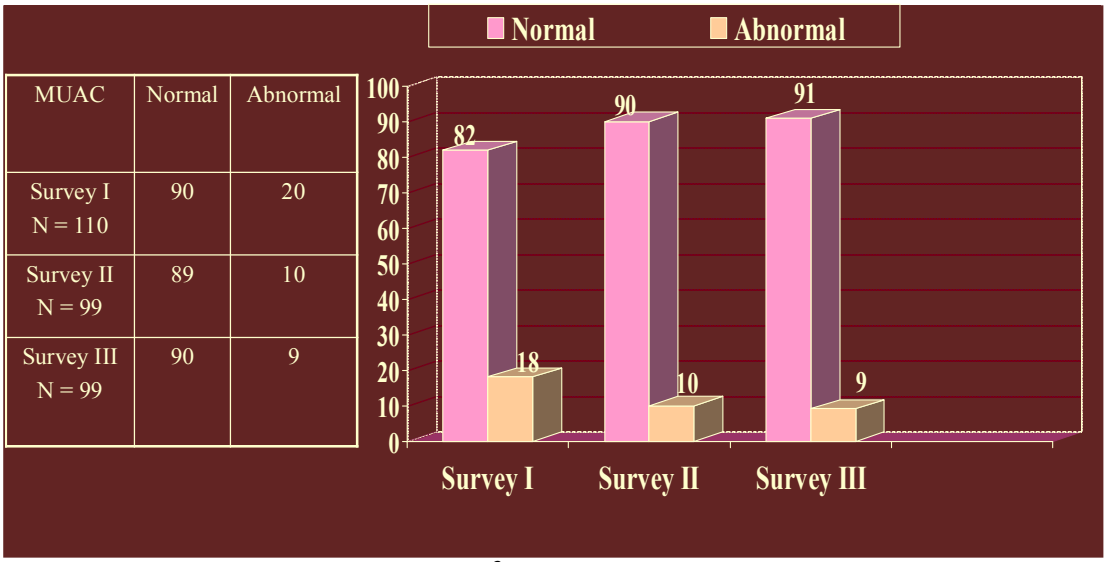


P=0.549, χ^2=1.20(df=2), Not significant

ANTHROPOMETRY

Figure 7. Comparison of percentage of children with normal and abnormal MUAC

MUAC	Normal	Abnormal
Survey I N = 110	90	20
Survey II N = 99	89	10
Survey III N = 99	90	9



P=0.093, χ^2=4.76(df=2), significant(P<0.10)

Table 15. Comparison of clinical profile of children

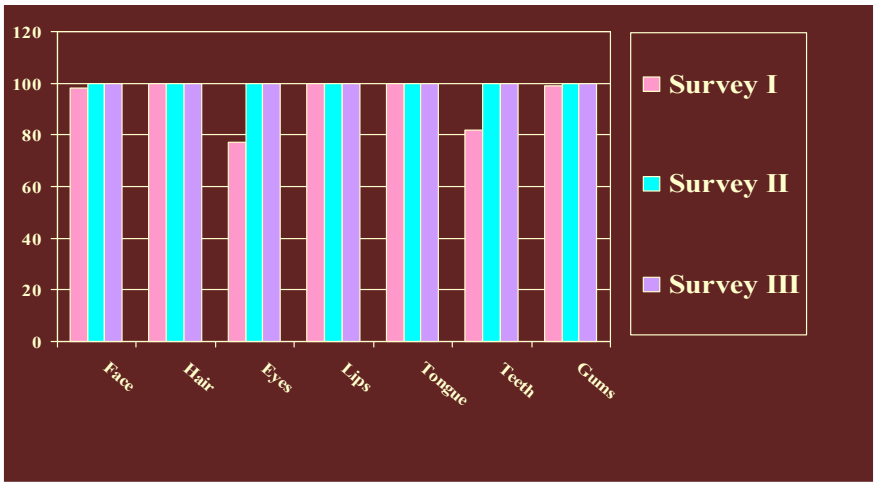
Areas of Examination	SurveyI_Normal	SI_Abnormal	SII_Normal	SII_Abnormal	SIII_Normal	SIII_Abnormal
A. Face	108	2	100	0	100	0
B. Hair	110	0	100	0	100	0
C. Eyes	85	25	100	0	100	0
D. Lips	110	0	100	0	100	0
E. Tongue	110	0	100	0	100	0
F. Teeth	90	20	82	18	82	18
G. Gums	109	1	100	0	100	0
H. Glands	110	0	100	0	100	0
I. Skin	106	4	100	0	100	0
J. Nails	101	9	100	0	100	0
K. Skeletal System	106	4	100	0	100	0
L. Digestive System	89	21	100	0	100	0
M. Nervous System	105	5	100	0	100	0
Mean	103.00	7.00	98.62	1.38	98.62	1.38
SD	9.00	9.00	4.99	4.99	4.99	4.99
T test	27.195		49.655		49.655	
p-value	**<0.001**		**<0.001**		**<0.001**	
p-value in bold implies significant test with p-value <0.05, S represents Survey						

The t test was performed in order to find if there is mean difference between the mean features between normal and abnormal group. It was observed that for the Survey I, the mean features were significantly different between normal (M=103.00) and abnormal (M=7.00) group with p-value <0.001.

For Survey II, the mean features were significantly different between normal (M=98.62) and abnormal (M=1.38) group with p-value <0.001.

For Survey III, the mean features were significantly different between normal (M=98.62) and abnormal (M=1.38) group with p-value <0.001.

Figure 8. Comparison of clinical profile of children



Comparison of clinical profile of children

Figure 9. Food consumption pattern

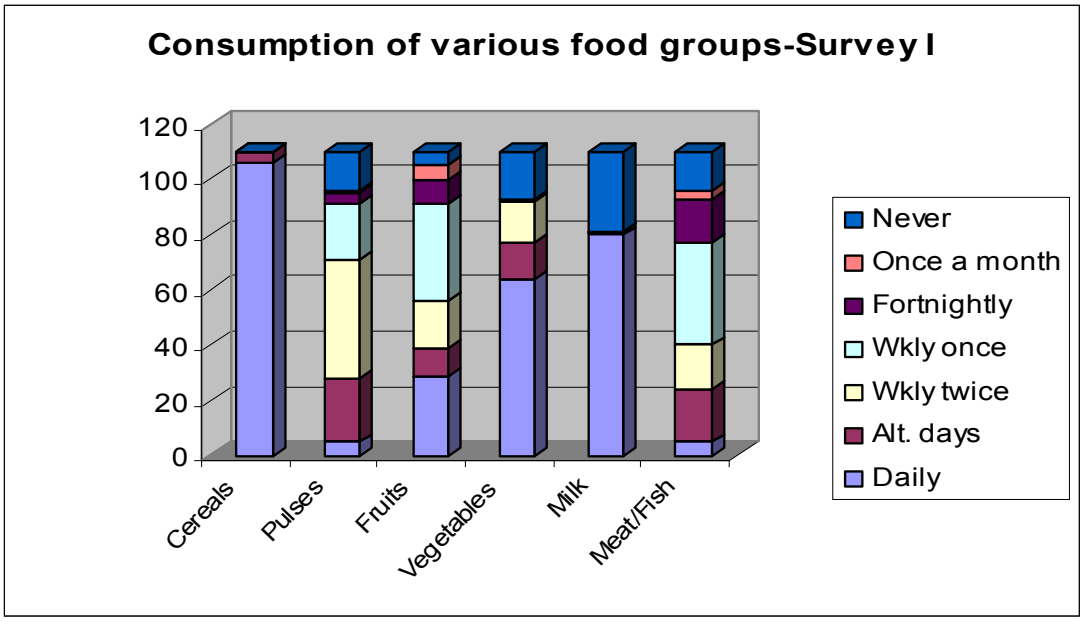


Figure 10. Food consumption pattern

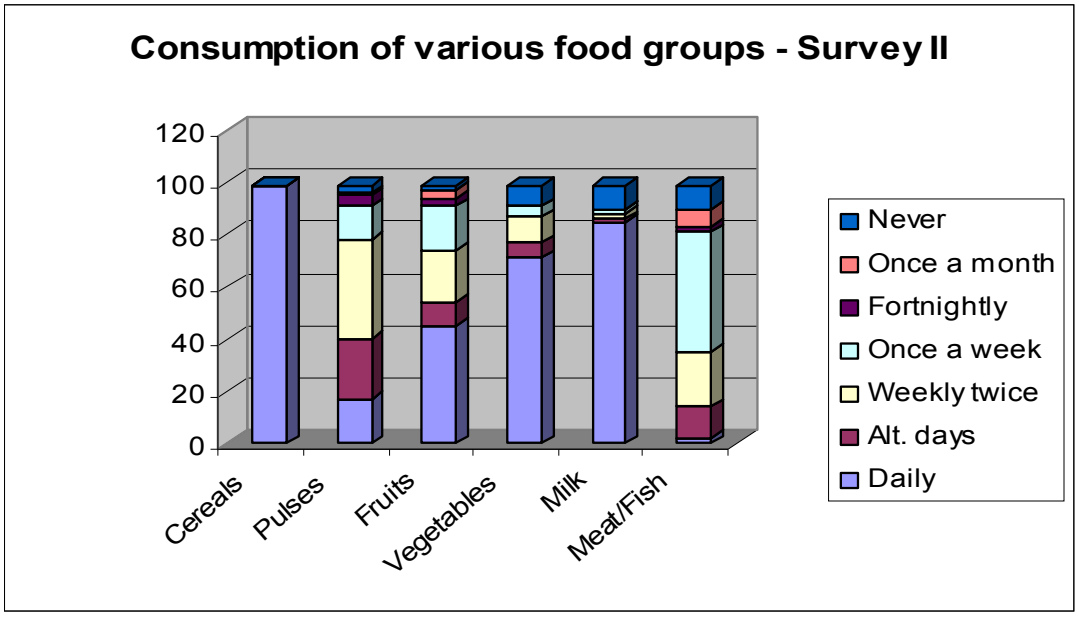


Figure 11. Food consumption pattern

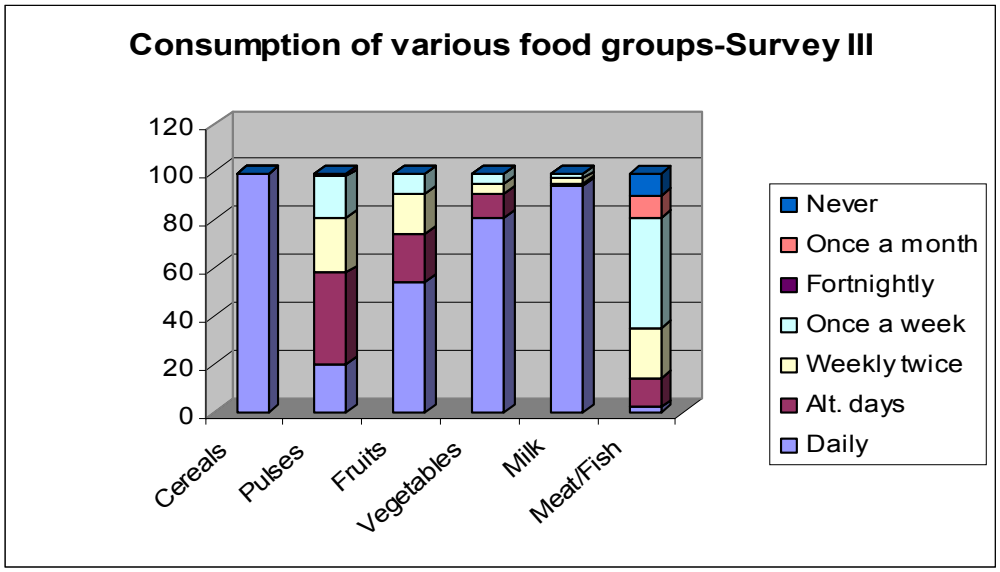


Figure 12. Meal pattern of the children

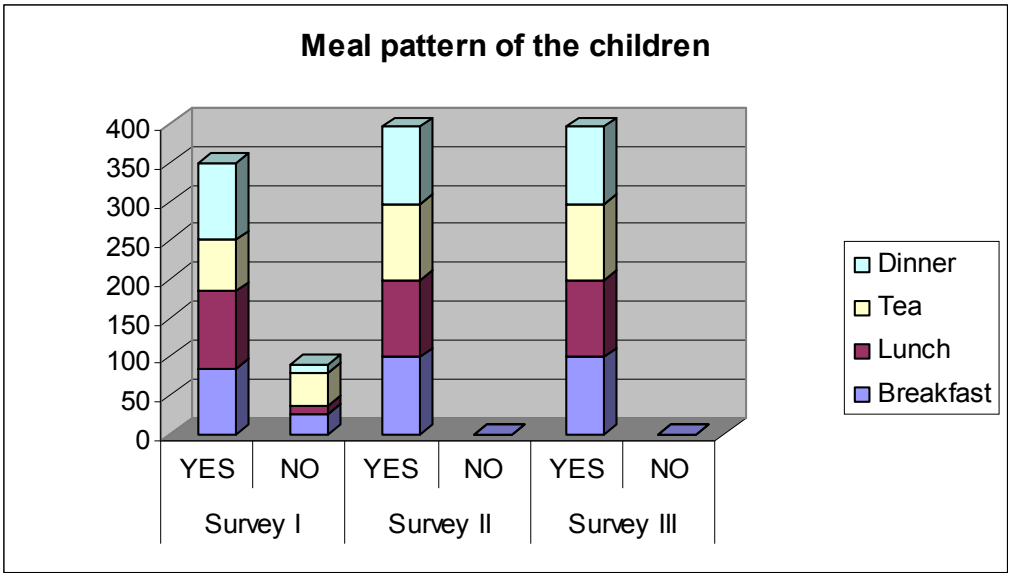


Figure 13. Socio - Economic Data

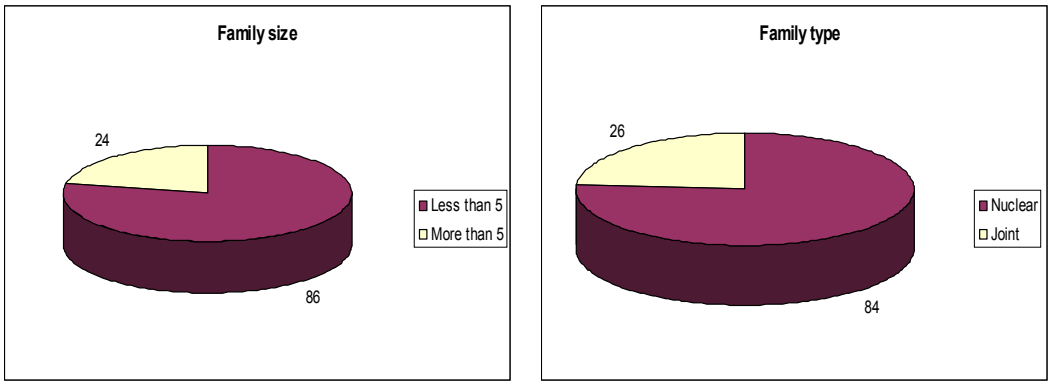


Figure 14. Socio - Economic Data

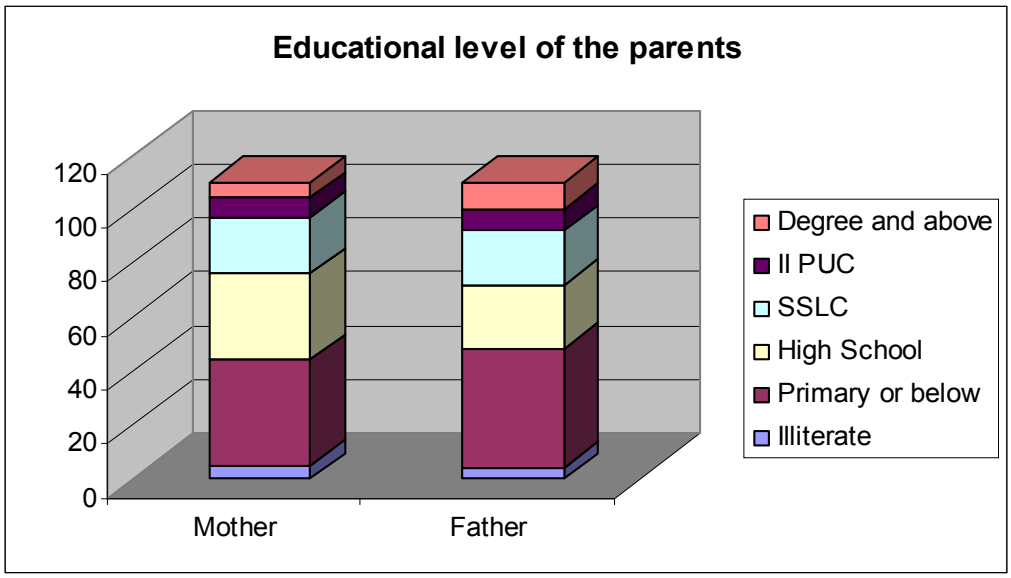


Figure 15. Socio - Economic Data

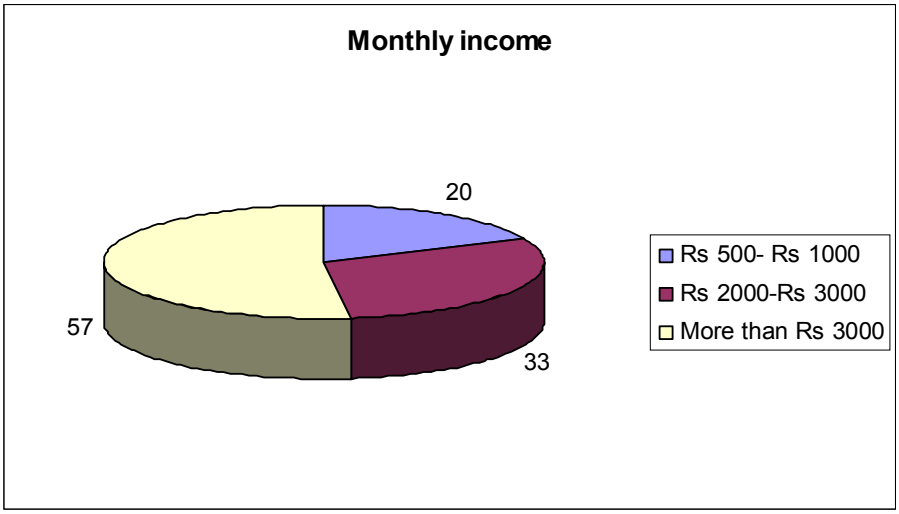
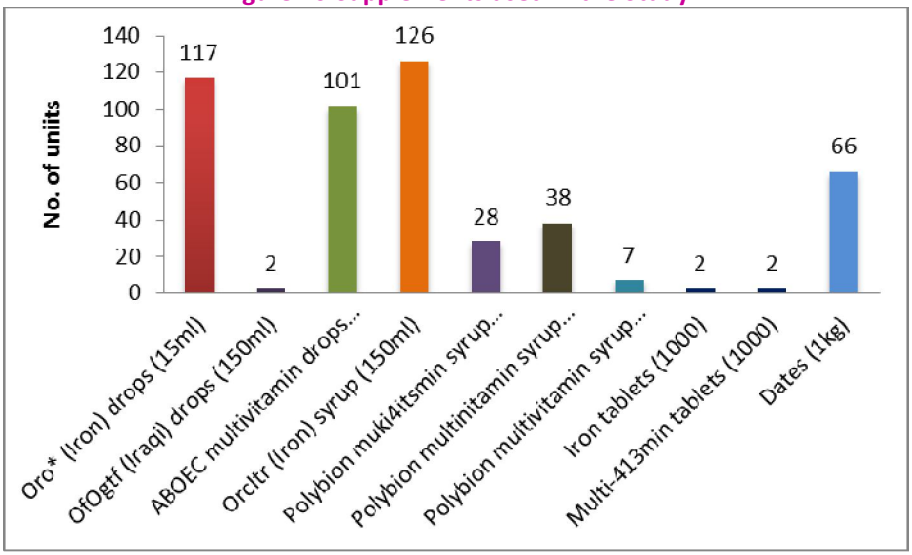


Table 16. Particulars of the Supplements used in the Study

S. No.	Particulars	Quantity	No. of units
1	Oro* (Iron) drops	15ml	117
2	OfOgtf (Iraqi) drops	150ml	2
3	ABOEC multivitamin drops	15ml	101
4	OrcItr (Iron) syrup	150ml	126
5	Polybion muki4itsmin syrup	250ml	28
6	Polybionmultinitamin syrup	400ml	38
7	Polybion multivitamin syrup	100ml	7
8	Iron tablets	1000	2
9	Multi-413min tablets	1000	2
10	Dates	1kg	66

Figure 16.Supplements used in the Study



PHOTOGRAPHS

Figure A: Creche children included in the research study

Figure B :Interactive sessions with the mothers

Figure C :Interactive sessions with the mothers

Figure D :Interactive sessions with the mothers

Figure E: Anthropometric measurement; Dr. Navaneetha taking the Fat fold of a child

Figure F: Ms. Ashwini taking the head circumference of a child

Figure G: Children of Nursery, LKG, UKG, Std I & II

Figure H :Food & Pharmaceutical supplements used in the intervention study; Dates distributed in the intervention study

Figure I :Iron & Multi-vitamin supplements distributed in the intervention study

CONCLUSION

The children showed an overall improvement in the anthropometric, clinical and dietary status

The stunting pattern in children decreased from 76% to 35%

The wasting indice in children decreased from 47% to 29%

The children under normal BMI increased from 78% to 83%, while the underweight decreased from 19% to 17%

The MUAC measurement showed an improvement from 82% to 91%

The results of the head to chest circumference ratio of the children, remained the same in all the surveys.

The pharmaceutical supplements let to alleviating all clinical signs and symptoms of micronutrient deficiency in the children.

Data on dietary assessment showed improvements in the intake of all major food groups except for meat & fish, which may be attributed to the prevalent cost of food.

Most of the mothers understood the concept of incorporating the different food groups rich in Cereals, Pulses, egg, fish, meat, oils & fat, Fruits and vegetables in their daily meal pattern, and the need for better health and hygiene in their routines.

World health Organisation defines Health as a state of complete physical, mental, spiritual and social well-being, not merely as the absence of disease or infirmity.

Our study kept this integral approach in identifying the objectives. Integration leads people to get in touch with their own inner power to being whole and wholesome. All aspects of internal needs

are to be considered if the creative learning is to be kindled. The physical aspect of health with pharmaceutical supplements, later with food supplements has been fully taken care off.

The data reveals that a hundred percent elimination of all disease and clinical symptoms.

The talks to the mothers improved the dietary pattern of the family. Mothers were very happy seeing their children perform better in school and their eating habits also improved.

Teachers saw remarkable improvements in social skills with children and their mothers.

This sense of fulfillment and happiness gave all of us immeasurable joy. To see integral change in the physical, emotional, social and environmental hygienic well being has given Ecological Ecstatic joy of Spiritual height beyond the economics of the project.

This study has given that unique creative gift to the subjects under study also tremendous overall fulfillment to us who have conducted this study on behalf of Altrusa International Inc., of Atlanta and Bangalore.

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corresponding author, Retired Head of the Dept of Food and Nutrition and Research centre. Email:shakkubhooma@gmail.com