The Pharma Innovation Journal 2017; 6(11): 487-493

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating 2017: 5.03
TPI 2017; 6(11): 487-493

www.thepharmajournal.com
Received: 09-09-2017
Accepted: 10-10-2017

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Nutritional status of preschool children in Anganwadi centers of ICDS projects in united Andhra Pradesh with AP food and local food models

Dr. K Uma Maheswari, K Rajeswari and G Anitha

Abstract
The mean intake of all the foods and percent adequacy met by home diet was found to be inadequate in comparison with ICMR RDA among the preschool children of both A.P.F.M and L.F.M centers. However, the supplementary food supplied at Anganwadi centre bridged the deficit gap with regard to calories and more than 50% of proteins in the preschool children of both food models when compared with home diet. Except anemia and skin infections, significantly lower (p<0.05) prevalence of all symptoms of nutritional deficiencies and morbidities were observed in A.P.F.M children as compared to L.F.M children. The A.P Foods had better impact on the nutritional status of the preschool children as evinced by better acceptability, significantly higher anthropometric indices (as measured by height, weight and mid upper arm circumference), better food and nutrient intake and adequacies in comparison with RDA, lower incidence of nutritional deficiency symptoms and morbidities when compared with local food model. Nevertheless, there is a need for improvement of diet in terms of foods and nutrients to meet 1/3 rd requirement of RDA. The attentiveness to be given in meeting the vitamins and minerals requirements for preventing the deficiency problems and to promote health in the children.

Keywords: Nutritional status, preschool children, A.P. food model, local food model

Introduction
Nutrition of the child is of paramount importance because the foundation for lifetime health, strength and intellectual vitality is laid down during this period (Devadas, 1987) [4]. India is home to the largest population with around 1.21 billion constituting 13.12% of children population, who are below the age of 6 years (Censes, 2011). A significant proportion of these children live in low/poor economic and social environment, which predisposes them to poor nutrition and impedes their physical and mental development. (ICDS, 2010) [10].

In the 21st century of miraculous advances in science and technology, the world is busy in devising methods to combat malnutrition, which continues to affect children in significantly large numbers. According to the records of children in India 2012, a statistical appraisal by the Union ministry of statistics and programme implementation, acute malnutrition, as evidenced by wasting, results in a child being too thin for his / her height. While 19.8% of children, under five years of age, are wasted in the country, which indicates that one out of every five children in India is wasted, 43% of children fewer than five years of age are underweight for their age.

Describing malnutrition as India's silent emergency, the World Bank report ( ) says that the rate of malnutrition cases among children in India is almost five times more than in China, and twice than in Sub-Saharan Africa. Nearly half of India's children approximately 60 million are underweight, 45% have stunted growth (too short for their age), 20% are wasted (too thin for their height, indicating acute malnutrition), 75% are anaemic, and 57% are deficient in Vitamin A (Vijay Raghavan, 1998) [23].

To overcome the malnutrition problem in eight selected states, a World Bank aided 'ICDS Systems Strengthening and Nutrition Improvement Project (ISSNIP)' has been approved made effective from November 26, 2012.

ICDS is a major national intervention programme initiated in 1975 by the Government of India with primary emphasis on Supplementary Nutrition Program. It provides the nutritional safety net for the vulnerable and poorest of the poor, even in the remote areas because of its nationwide coverage. The Supplementary Nutrition Program (SNP) is one of the six components of the ICDS scheme of the Ministry of Women and Child Development (MOWCDC. While its purposes have become broader and more complex over time, the main

objective of the SNP is to reduce malnutrition in India's children (Ahmed *et al*, 2006) [1]. ICDS is the only GOI nutrition program whose coverage extends from infants and children below six, to pregnant and lactating women to improve the quality of their performance in future. Its importance as an instrument to secure children's right to food cannot be overstated (National Policy for Children, GOI, 1991) [17].

Telangana Foods (formerly A.P. Foods) is a Govt. of Andhra Pradesh enterprise established in 1974 and functioning under the auspices of A.P. Nutrition Council, Chaired by Chief Secretary to Government, and Executive committee chaired by Principal Secretary Women's Development and Child Welfare, WD& CW, a society which was set up in the year 1976 with the assistance of CARE, UNICEF and GOI for producing and supplying nutritious food to malnourished preschool and school going children, pregnant and lactating mothers (UNICEF, 1990) [21]. The main activity of M/s. AP Foods is manufacturing and supplying fortified nutritious food to 224 ICDS projects benefiting 30.46 of children and women beneficiaries throughout the state of Andhra Pradesh.

In several ICDS projects, a local food model has been initiated ( ) and the ration (raw ingredients i.e. rice, wheat rawa green gram, oil and seasonings) are supplied by the project directors through the district purchasing committee, which is cooked and served in the AWC by the helper. World Bank researchers, using data from the National Family Health Surveys (NFHS) in 1992/93 and 1998/99 (including anthropometric measures), found little evidence that the ICDS program had an impact on child nutritional status (Gellespie, 2001) [5]. However, there are no comparative studies on acceptability, health and nutritional status of beneficiaries receiving food supplied by AP Food and local food models. Hence, the present study was planned with the objective to compare the nutritional status of preschool children attending Anganwadi centers and consuming nutritious food supplied by AP Foods with that of preschool children covered under an alternative model (the 'local food model') in the state of united A.P., India.

Materials and Methods

The present study was planned to evaluate and compare the acceptability, nutritional status (anthropometry, clinical, morbidity and dietary) and nutrient adequacy of preschool children who are attending ICDS centers and consuming nutritious food supplied by AP Foods in comparison with the local food model in the state of united A.P., India.

The study was conducted as a one-time cross sectional, community based study carried out in three regions of Telangana, Andhra and Rayalaseema of Andhra Pradesh states, India by adopting cluster random sampling procedure.

A list of Anganwadi centers covered by Women Welfare and Child Development department, in urban as well as rural areas for both food models was obtained from the Directorate, Department of women development and child welfare, Yusufguda, Hyderabad. One district from each of the three regions was selected randomly where both AP food model as well as local food model is existed. The districts selected were Ranga Reddy from Telangana region, Krishna from Andhra region and Chittor from Rayalaseema region. The following flow chart (Fig 1) shows the experimental design of the study at region, district and anganwadi centers.

From each district 20 Anganwadi centers located in urban (6) and rural (14) areas were selected where both AP food model as well as local food model is available and children are regularly participating (≥75% of feeding days/month) in the supplementary feeding programme.

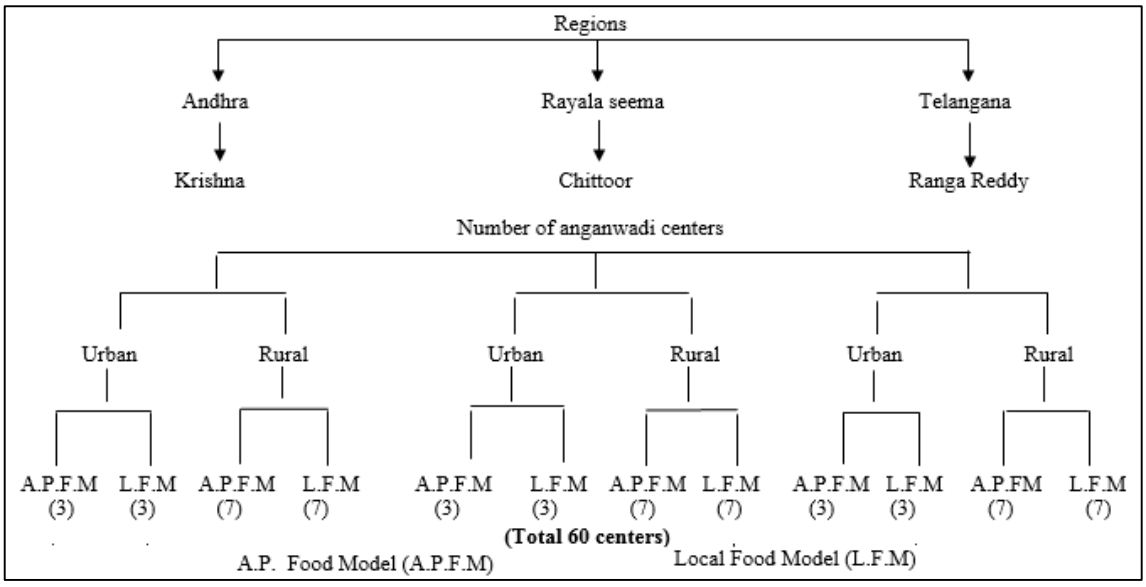

Fig 1: Experimental design of the study

Structured schedules were developed specifically to elicit information on nutritional anthropometry, clinical, morbidity, dietary from preschool children and acceptability of supplementary foods. Pretesting of the developed schedules was done at four anganwadi centers covering both the food models at Rangareddy district.

Assessment of nutritional status was done in preschool Children (3-6years). The parameters covered for the assessment of nutritional status of preschool children were age, anthropometry (height, weight and mid upper arm circumference), clinical signs and symptoms, morbidity pattern, dietary assessment (Jelliffe 1966, Gopalan *et al* 2010, Thimmayamma 2009 and UNICEF 1980) [11, 6, 20]. The preschool children graded according to under nutrition, stunning and wasting using standard deviation classification (WHO 1989) [24] as given below.

SD Classification	Weight for age	Height for age	Weight for height
≥ Median	Normal	Normal	Normal
<Median to Median–1SD			
<Median –1SD to Median±2SD			
<Median –2SD to Median–3SD	Moderate Under weight	Moderate stunting	Moderate wasting
< Median–3 SD	Severe Under weight	Severe stunting	Severe wasting

Information on morbidity of the individual preschool child such as diarrhea, URI, vomiting, fever, ear infection, eye infection, skin infection etc during the preceding 15 days was collected.

Statistical Analysis

The data was compiled and was analyzed statistically by one way ANOVA using Microsoft Excel Package for acceptability of supplementary foods, anthropometric assessment, clinical, morbidity and food and nutrient intake data as per procedures laid down by Snedecor and Cochran.

Results and discussion

Acceptability of Supplementary Foods

The anganwadi centers feeding the children with recipes like sweet porridge, halwa and kitchdi, boiled egg under A.P. food model and boiled egg, rice kitchdi, wheat rawa upma under local food model. The acceptability of supplementary foods indicated that majority of the beneficiaries are satisfied with the foods provided both in A.P.F.M and L.F.M. *Kitchidi* is the highly accepted recipe in both food models (A.P.F.M., 57.7% and L.F.M., 55.6%) followed by *halwa* (53.4%) and *sweet porridge* (52.9%) in A.P.F.M and rice (55.6%) and wheat rawa upma (50.4%) in L.F.M. However, the preschool children (Fig 2) of both the food models accepted very much the eggs compared to other recipes**.**

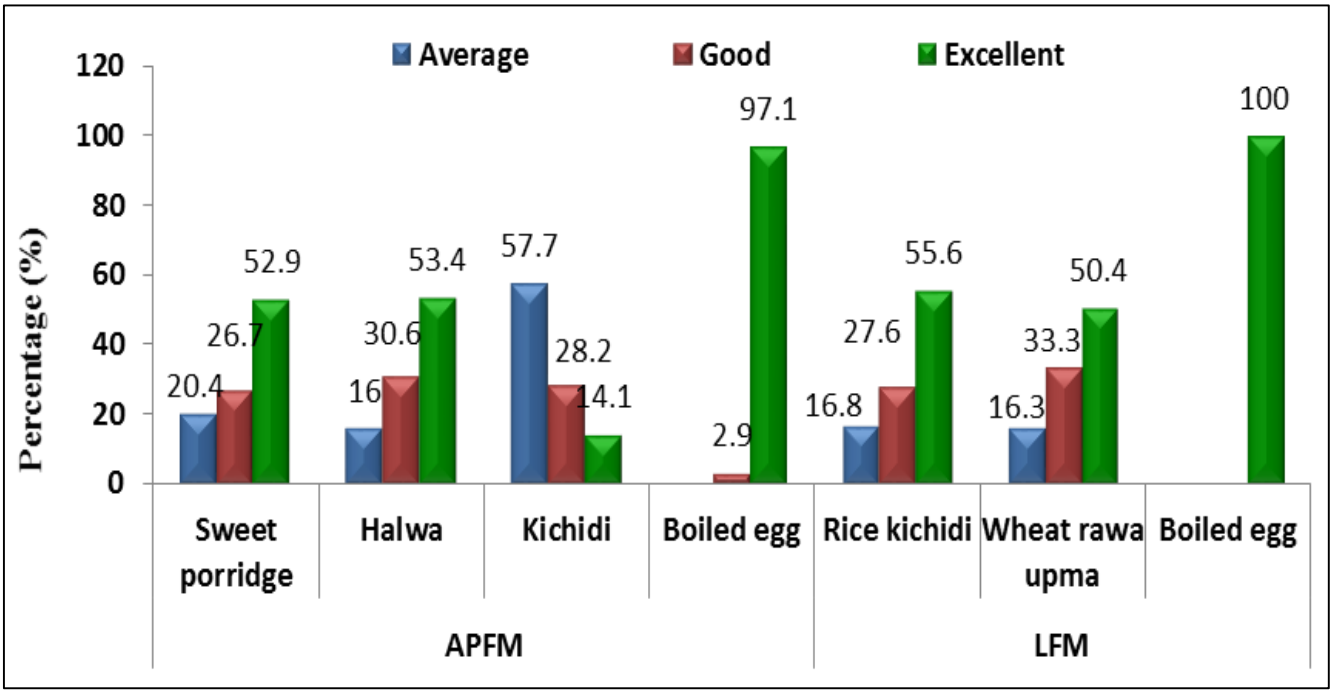

Fig 2: Percentage distribution of preschool children by acceptability of supplementary foods

Food intake

The average daily intake of foods by the preschool children of both the food models is given in Tables 1 to 2. Cereals & millets (A.P.F.M, 103.3% and L.F.M 102.0%) were form the bulk of the diet of the children followed by pulses (A.P.F.M, 87.5% and L.F.M 77.5%), fats and oils (A.P.F.M, 59% and L.F.M 57.6%), milk and milk products (A.P.F.M, 28% and L.F.M 20.2%) and sugar & jaggery (A.P.F.M, 16% and L.F.M 12.4) in both the food models surveyed. The RDI for cereals and pulses was only met and for the remaining foods was not found in both models. None of the food models is providing the vegetables, green leafy, roots & tubers, fruits and flesh foods in anganwadi centres and was only found at home based daily foods in insufficient quantities compared to RDI. The inclusive of milk and milk products were found both at home and anganwadi centres foods. However the quantity did not met the RDI level. Even fats & oils and sugars & jaggery were also not meeting the RDA levels at home and anganwadi centres of both food models. The present findings are in comparable with NNMB (2001) data in which it was reported that intake of all the food stuffs in 4-6 years age group children was below the RDA..

However, the improved food intake through the meal provided at anganwadi center by ICDS had bridged the deficit gap to a greater extent in case of calories and more than 30-40% in case of pulses.

Yet, the quantity of inclusive of pulses, milk and milk products and sugar and jaggery was found higher in A.P.F.M. foods than in L.F.M foods where as cereals and millets in L.F.M foods than A.P.F.M. foods.

Table 1: Mean food intake (g/day) of preschool children (n=75 for each food model)

Food stuff	RDI	A.P.F.M			L.F.M		
		At Home	At AWC	Total	At Home	At AWC	Total
Cereals and Millets	270	228±8.2	52	280	210±9.5	70	280
Pulses & legumes	35	17.7±1.4	13	30.7	17.1±3.6	10	27.1
Green Leafy Vegetables	50	4.0±4.4	1.0	5.0	7.2±6.3	1.0	8.2
Other Vegetables	30	18.0±7.3	-	18.0	20.0±4.9	-	20.0
Roots & Tubers	20	14.0±3.6	-	14.0	11.2±3.6	-	11.2
Nuts	-	0.7±1.3	-	0.7	0.3±1.4	-	0.3
Fruits	-	19.0±3.6	-	19.0	22.7±5.3	-	22.7
Fish	-	2.4±2.2	-	2.4	2.0±2.5	-	2.0
Other flesh foods	-	1.7±1.9	-	1.7	1.2±3.9	-	1.2
Milk & milk products	250	30.2 ±15.7	40.1	70.3	28.0±14.4	22.5	50.5
Fats & Oils	25	5.8±0.4	9	14.8	4.4±2.7	10	4.4
Sugar & Jaggery	40	13.0±1.8	16	29.0	12.4±1.1	-	12.4

Table 2: Percent adequacy of food intake in preschool children (n=75 for each food model)

Food stuff	A.P.F.M			L.F.M		
	At Home	At AWC	Total	At Home	At AWC	Total
Cereals and millets	84.3	19.0	103.3	77.7	26.0	102.0
Pulses & legumes	50.5	37.0	87.5	49.0	28.5	77.5
Green Leafy Vegetables	8.0	1.0	9.0	14.4	1.0	15.4
Other Vegetables	60.0	0.0	60.0	26.6	0.0	26.6
Roots & Tubers	90.0	0.0	90.0	56.0	0.0	56.0
Milk & milk products	12.0	16.0	28.0	11.2	9.0	20.2
Fats & Oils	23.0	36.0	59.0	17.6	40.0	57.6
Sugar & Jaggery	32.5	40.0	72.5	31.0	0.0	31.0

Nutrient intake

Table 3 and 4 gives information regarding the nutrient intake of the children through home and anganwadi diet. The mean intake of all the nutrients through home diet in children of both the food models was below the RDA except protein and energy. The intake of protein and energy by the preschool children of both the food models through their home diet was more than 80.0% (A.P.F.M:96.5%, 85.6% and L.F.M:93.5%, 87.3%) which was meeting the RDA without supplementary food provided at AWCs. As in the case of other nutrients, the extent of deficit was higher with respect to vitamin A (A.P.F.M75%, L.F.M:70.2), vitamin C (A.P.F.M:69.3%, L.F.M:61.3%) and iron (A.P.F.M 27.7%, L.F.M:25.7%) and thiamine (A.P.F.M 38.5%, L.F.M:54.4%) in both models.

Foods provided at AWCs revealed that the mean intake of calcium, iron, thiamin and riboflavin was high in A.P.F.M children as compared to L.F.M children with respect to 1/3 RDA provided by one meal. Similarly, the intake of fat was found to be adequate with inclusion of supplementary foods. Vitamin A intakes was found lower in LFM (6.2%) compared with APFM (17.4%)

Table 3: Mean nutrient intake (per day) of preschool children (n=75 for each food model)

Nutrient	RDA	1/3 RDA	APFM			LFM		
			At Home	At AWC	Total	At Home	At AWC	Total
Protein (g)	20.1	6.7	19.4±2.4	10.12	29.52	18.8±1.7	9.65	28.45
Total Fat (g)	25	8.3	10.8±1.8	11.32	22.12	9.2±1.1	10.68	19.88
Energy (K.Cal)	1350	450	1156±267	388	1544	1179±232	369	1548
Calcium (mg)	600	200	264±68.2	173.1	437.1	218±54.7	22.5	240.5
Iron (mg)	13	4.3	5.3±0.6	4.1	7.4	7.9±0.9	1.79	9.69
Vitamin-A (µg)	400	133	94.2±5.8	6.2	100.4	102±4.7	17.4	119.4
Thiamin (mg)	0.7	0.23	0.3±0.3	0.13	0.4	0.2±0.4	0.12	0.32
Riboflavin (mg)	0.8	0.26	0.6±0.3	0.04	0.64	0.5±0.4	0.03	0.53
Vitamin-C (mg)	40	13.3	12.0±1.3	0.28	12.28	15.2±1.7	0.28	15.48

Table 4: Percent nutrient adequacy (per day) of preschool children (n=75 for each food model)

Nutrient	APFM			% surplus/ deficit	LFM			% surplus/ deficit
	At Home	At AWC	Total		At Home	At AWC	Total	
Energy (K.Cal)	85.6	28.7	114.4	+14.4	87.3	27.3	114.7	+14.7
Protein (g)	96.5	50.3	146.9	+46.9	93.5	48.0	141.5	+41.5
Total Fat (g)	43.2	45.3	88.5	-11.5	36.8	42.7	79.5	-20.5
Calcium (mg)	44.0	28.9	72.9	-27.1	36.3	3.8	40.1	-59.0
Iron (mg)	40.8	31.5	72.3	-27.7	60.8	13.8	74.5	-25.5
Vitamin-A (µg)	23.5	1.5	25.0	-75.0	25.5	4.3	29.8	-70.2
Thiamine (mg)	42.9	18.6	61.5	-38.5	28.5	17.1	45.6	-54.4
Riboflavin (mg)	75.0	5.0	80.0	-20.0	62.5	3.8	66.3	-33.7
Vitamin-C (mg)	30.0	0.7	30.7	-69.3	38.0	0.7	38.7	-61.3

Nutritional Deficiency Signs

From the table 5 it was observed that out of 750 children in each food model about 7.8% of A.P.F.M children and 9.2% of L.F.M children had one or more clinical signs of nutritional deficiency symptoms. While none of the children were observed with clinical symptoms of kwashiorkor and marasmus. The percentages of children's with nutritional deficiencies were found to be significantly higher at 5% (p<0.05) in anganwadis with local food model than with AP food model. The prevalence of Bitot spots, an objective sign of vitamin A deficiency, was found to be about 1.0% in A.P.F.M children and 1.6% in L.F.M children. Prevalence of conjunctival xerosis in A.P.F.M children was 0.8% and L.F.M children were 1.2%. About 2.0% of A.P.F.M and 2.4% L.F.M children had angular stomatitis, indicative of B-complex deficiency**.** It was also observed that the prevalence of anemia in A.P.F.M children (2.0%) was high as compared to L.F.M children (1.0%). It is well recognized that in the communities subsisting on cereal- pulse based plant foods, iron bioavailability is poor due to several interfering substances (NNMB, 2002). Dental fluorosis was also observed in the children of both the food models (A.P.F.M:2.0% and L.F.M:3.0%).

Findings in the present study are in comparable with the NNMB (2002) reported values of prevalence of Bitot spots, an objective sign of vitamin A deficiency, was found to be about 0.8%.

Vedhavalli and Usha (2005) [22] conducted a study in Tamil Nadu on the nutritional status and prevalence of Vitamin A deficiency among 1 to 6 years children. According to the study, the prevalence of malnutrition was 88.2% and Vitamin A Deficiency was 5.2%.

Table 5: Prevalence (%) of Nutritional Deficiency Signs in preschool children (n=750)

Nutritional deficiency signs	APFM (n=750)	LFM (n=750)
Normal Children	692 (92.2)	681 (90.8)
Children identified with nutritional deficiency signs	58 (7.8)	69 (9.2)
Conjunctival Xerosis (XIA)	6 (0.8)	9 (1.2)
Bitot Spots (XIB)	7 (1.0)	12 (1.6)
Angular Stomatitis	15 (2.0)	18 (2.4)
Paleness of eye lids / tongue (anemia)	15 (2.0)	8 (1.0)
Dental - Fluorosis	15 (2.0)	22 (3.0)
S.E.d	0.271	
C.D(0.05)	0.127*	

Significant at 5% (p<0.05)
(Figures in parenthesis indicate percentages)

Morbidity

History of morbidity of children in both food models during the previous fortnight was elicited from the mothers. As compared to A.P.F.M children (10%) L.F.M children (12.5%) showed significantly higher (p<0.05) prevalence of morbidity (Table 6). The morbidities viz. fever, diarrhea, respiratory infections, vomiting, fever, ear infection and skin infection during the preceding 15 days were prevailed in the children of both the food models

According to the Lancet Series on maternal and child nutrition report (2013), malnutrition is now responsible for around 3·1 million (45%) deaths in children under five annually. Each year, malnutrition is implicated in about 40% of the 11 million deaths of under five children in developing countries (WHO 2005) [25].

Table 6: Prevalence (%) of Morbidities (Previous fortnight) in Preschool children

Illness	APFM (n=750)	LFM (n=750)
Children without complain of morbidities	675 (90)	656 (87.5)
Children identified with various morbidities	75 (10)	94 (12.5)
Diarrhoea	9 (1.2)	12 (1.6)
URI	6 (0.8)	9 (1.2)
Vomitings	11 (1.5)	14 (1.9)
Fever	35 (4.7)	38 (5.1)
Ear Infection	3 (0.4)	7 (0.9)
Skin infection	11 (1.5)	14 (1.9)
S.E.d	1.348	
C.D(0.05)	1.982*	

*Significant at 5%
(Figures in parenthesis indicate percentages)

Nutritional status of children by Anthropometry – Height, Weight and Mid Upper Arm Circumference

Measurement of weight, height and mid-upper arm circumference (MUAC) are commonly recognized as important indices of nutritional status of pre school children. Height is primarily a reflection of cumulative or past nutritional status, whereas, other measures refer more to current or transitory nutritional status.

Weight for Age

Prevalence of malnutrition was assessed using SD classification and is presented in Fig 3. The figure indicated that the percentage of children in normal grade was high (88.0%) among A.P.F.M children which was significant (p<0.05) as compared to L.F.M children (80.0%). The remaining children were found to fall in various grades of under nutrition i.e. moderate (< Median – 2 SD) and severe (<Median–3SD) which is 5% and 7% in A.P.F.M children and 15% and 5% in L.F.M children respectively. A study was conducted by Meshram *et al*. (2012) [13] among 14,587 children, 0-5 years in Integrated Tribal Development Agency (ITDA) Areas in nine States of India (Andhra Pradesh, Gujarat, Kerala, Karnataka, Maharashtra, Madhya Pradesh, Orissa, Tamil Nadu and West Bengal) reported that the overall prevalence of underweight was about 49%, of which 19% were severely underweight.

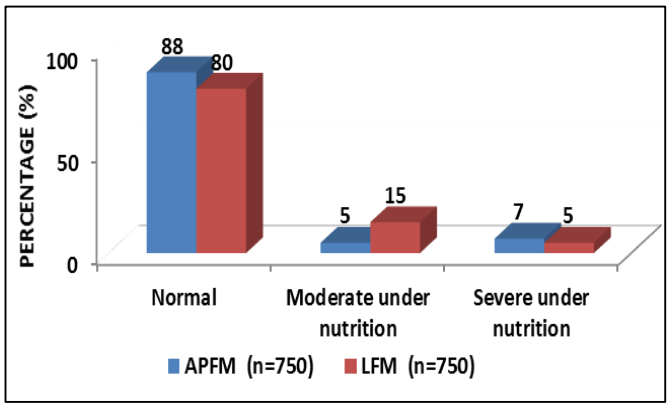

Fig 3: Preschool children (%) according to weight for age by SD classification using WHO standards

Height for Age

The extent of stunting was assessed using height for age and is presented in Fig 4. Both A.P.F.M and L.F.M children showed almost similar percentage value for normal grades, moderate stunting and severe stunning and found to be not significant.

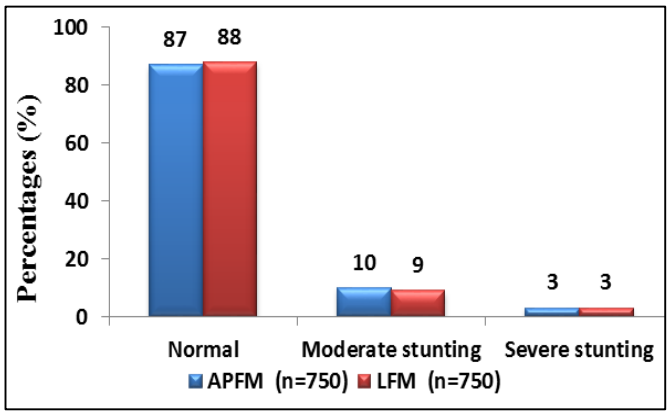

Fig 4: Distribution (%) of Preschool Children according to height for age by SD classification using WHO standards

Weight for Height

Prevalence of wasting was assessed using SD classification and results are shown in Fig 5. The percentage of children in normal grades, which was high (90.0%) among A.P.F.M children and was significant (p<0.05) as compared to L.F.M children (81.0%). The remaining children were found to fall in various grades of wasting i.e moderate wasting (< Median – 2 SD) and severe wasting (<Median–3SD) which is 7% and 3% in A.P.F.M children and 15% and 4% in L.F.M children.

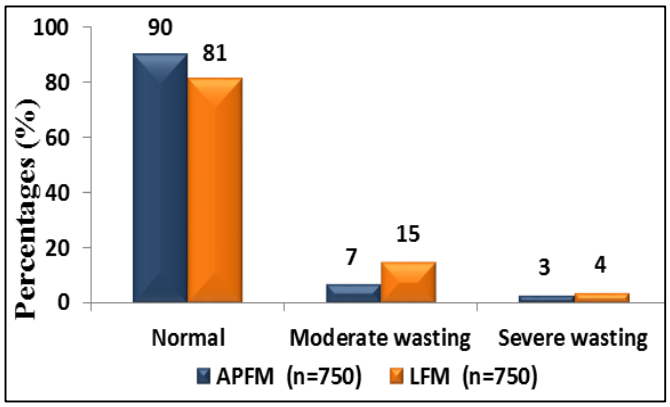

Fig 5: Distribution (%) of Preschool Children according to weight for height for age by SD Classification

Mid upper arm circumference

The preschool children were distributed according to mid upper arm circumference by Standard deviation classification and the results are depicted Fig 6. It indicates that the percentage of children in normal grades was high (92.0%) among A.P.F.M children which is significant (p<0.05) as compared to L.F.M children (90.0%). The remaining children were found to fall in various grades of wasting i.e moderate energy malnutrition (< Median – 2 SD) and severe malnutrition (<Median–3SD) which is 6% and 7% in A.P.F.M children and 2% and 3% in L.F.M children.

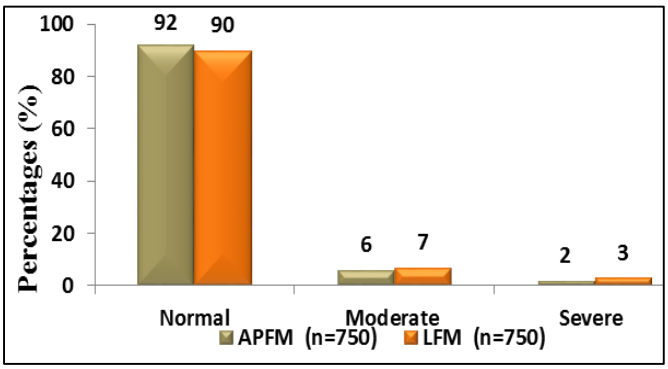

Fig 6: Distribution (%) of Preschool children according to MUAC by SD Classification

Krishna *et al* (2001) [12] conducted the study among 480 pre-school children of urban and rural areas of Jabalpur. It was observed that the prevalence of malnutrition was 64.17% in the rural areas and 40.0% in urban areas in children 1 to 5 years based on mid arm circumference which are higher to this findings.

Conclusion

From the study it can be concluded that the A.P Food model had better impact on the nutritional status of the preschool children as evinced by better acceptability, significantly higher anthropometric indices (as measured by height, weight and mid upper arm circumference), better food and nutrient intake and adequacies in comparison with RDAs, lower incidence of nutritional deficiency symptoms and morbidities and non-significant differences in the mean values of hemoglobin and blood vitamin A levels when compared with local Food model.

Nevertheless, there is a need for improvement of diet in terms of foods and nutrients to meet 1/3 rd requirement of RDA. The attentiveness to be given in meeting the vitamins and minerals requirements for preventing the deficiency problems and to promote health in the children.

Acknowledgements

The Authors would like to place on record of sincere gratitude to the authorities of M/s. A.P. Foods, Hyderabad, and Andhra Pradesh, India for granting and extending financial support to carry out the research project.

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