PHASE I: FORMATIVE RESEARCH

In line with the study objectives, the results have been presented in 5 phases. The phases are as follows:

Phase 1: Formative research

- School profile
- Nutritional status of the municipal school children of Baroda

Phase 2: Process evaluation

- Evaluation of The Akshay Patra kitchen
- Spot observations in the Schools

Phase 3: Impact evaluation

- Impact of The Akshay Patra Foundation supported MDM programme on the following
    - Growth
    - Iron deficiency anaemia
    - Morbidity profile
    - Attendance
    - Scholastic performance

Phase 4: Workshop on Mid Day Meal Programme for Municipal School Teachers of Vadodara

- Feedback from Teachers
- Feedback from Akshay Patra

Phase 5: KAP of Parents, Teachers & Children regarding Mid Day Meal Programme provided by The Akshay Patra Foundation

- Perceptions of Parents
- Perceptions of Teachers
- Perceptions of Children

Phase I: Formative Research

School Profile

There were in all 110 municipal schools in urban Vadodara at the time of the study. Among these, 70 were Gujarati medium, co-ed schools, which were divided into 4 zones of Vadodara city. From each zone 4 schools were randomly selected. Thus in all 16 schools were included for the study. The school details are given in **Table 4.1.1**.

The school profile of the selected schools included the information on number of teachers, strength of boys and girls in the school. Facilities available in the school premises like play ground, audio visual room, computer room was also noted. Availability of adequate rooms for the children and the functioning of Mid Day Meal were also looked into. **Table 4.1.2** shows the facilities available in the school premises.

Infrastructure and basic facilities

- As shown in **Table 4.1.2**, less than one fifth of the schools (18.8%) had less than 5 class rooms. Around 43.7% of the schools had 5 to 10 classrooms, and 37.5% of schools had more than 10 classrooms.
- Library facility was available in 50% of the schools.
- Only 12.5% of the schools reported that they did not have computers for children. Although most of the schools had computers for children, around 68.7% of the schools did not have a separate room for computers.
- Two schools (12.5%) reported having a separate audiovisual room.
- Majority (81.3%) of the schools had playground.
- All the schools had drinking water facility. About 50% of the schools had their own tap for drinking water. Around 25% of the schools reported that they used corporation tap as a source of drinking water. One school used bore-well water

Table 4.1.1: Number of Children Enrolled in the Selected Schools

Sr. No.	Name of the school	Children enrolled (N)	Boys (n)	% of Boys	Girls (n)	% of Girls
1.	Sir Sayajirao Gaekwad Prathmik Shala	253	134	52.9	119	47.1
2.	Pujya Shri Rang Avadhoot Prathmik Shala	422	224	53.1	198	46.9
3.	Maa Veer Bai Prathmik Shala	142	86	60.6	56	39.4
4.	Pujya Shri Dongreji Maharaj Prathmik Shala	648	313	48.3	335	51.7
5.	Dr. Jagdish chandra Bose Prathmik Shala	315	149	47.3	166	52.7
6.	Chandrashekhar Azad PrathmikShala	141	64	45.4	77	54.6
7.	Dr. Hansa Mehta PrathmikShala	333	164	49.2	169	50.8
8.	Vinobha Bhave Prathmik Shala	175	85	48.6	90	51.4
9.	Dr. Baba sahib Ambedkar Prathmik Shala	307	155	50.5	152	49.5
10.	Rushi Vishwamitra Prathmik Shala	549	244	44.4	305	55.6
11.	Swami Vivekan and Prathmik Shala	622	279	44.9	343	55.1
12.	Zaverchand Meghani Prathmik Shala	256	133	52.0	123	48.0
13.	Dr. Rajendra Prasad PrathmikShala	289	137	47.4	152	52.6
14.	Dr. Hedgewar Prathmik Shala	504	250	49.6	254	50.4
15.	Rajaram Mohan Roy PrathmikShala	268	142	53.0	126	47.0
16.	Dr. Shyama Prasad Mukherjee Prathmik Shala	1350	622	46.1	728	53.9
	TOTAL	**6574**	**3181**	**48.4**	**3393**	**51.6**

Table 4.1.2: Infrastructure and Basic Facilities in Schools (N=16)

Variable	N	%
Number of classrooms		
• <5	3	18.8
• 5-10	7	43.7
• >10	6	37.5
Library facility available	8	50.0
Number of computers		
• No computer	2	12.5
• 1-5	9	56.2
• 6-10	5	31.3
Separate room for computers	11	68.7
Audio Visual room	2	12.5
Playground	13	81.3
Drinking water facility	16	100
Source Of drinking water		
• Own Tap	8	50.0
• Corporation	4	25.0
• Bore	1	6.25
• Aqua guard	1	6.25
• Others	2	12.5
Separate space for kitchen	8	50.0
Separate space for dining	5	31.3

as a source of drinking water. One of the schools had an “Aqua-guard”- a water purifier installed in the school.

- About half of the schools (50.0%) had separate space for kitchen where food was prepared earlier for the MDM programme.
- Only 31.3% of the schools had a separate dining space for serving MDM food.
- One of the schools had two separate shifts for boys and girls.

Implementation of MDM

In 58.8% schools, the responsibility of implementing MDM was given to liaison officer or science teacher followed by Principal (35.3%) of the school. Only in one school both the principal and a teacher were responsible for implementation of MDM programme **(Table 4.1.3).**

Tasting of Food

In 47.1% of the schools, it was reported that teachers were responsible for tasting the food. In two of the school’s, principal alone was responsible for tasting the food before serving it to the children.

Serving of Food

In majority of the schools, Akshay Patra helpers were responsible for serving the food. In about 30% of the schools, school peons and older school children were given charge of serving MDM. In two schools, teachers were found to be serving MDM.

Table 4.1.3: Implementation of MDM and Health Care Facilities (N=16)

Variable	N	%
Responsibility of MDM implementation		
• Principal	6	35.3
• Liaison/Science teacher	10	58.8
• Both	1	5.9
Responsibility of tasting the food		
• Tasting of food before serving not done	2	11.8
• Principal	2	11.8
• Teachers	8	47.1
• Principal and teachers	5	29.4
Responsibility of serving the food		
• Helpers	14	82.4
• Peons	5	29.4
• Older school children	5	29.4
• Teachers	2	11.8
Health camp in the school	16	100
Distribution of deworming tablets	2	11.8
Distribution of Iron Folic Acid tablets	0	0

Health facilities

All the schools reported that health-camp was conducted once a year. Two schools reported that de-worming tablets were distributed to the children during the health camp. IFA Tablets were not supplied and therefore not distributed in any school.

Children enrolled for the study

All the children from 1st to 7th standard from the selected 16 schools were enrolled for the study. The total number of registered children was 6574 out of which data could be collected on 4905 children. The children who could not be contacted in 3 consecutive visits were excluded from the study. There was almost 25.4% of absenteeism in urban schools (**Table 4.1.4**).

Age Wise Distribution of Children

Out of these 4905 children, 2365 (48.2%) were Boys and 2540 (51.8%) were girls. The children enrolled were of 5-18 years. The age wise distribution of the children is shown in **Table 4.1.5**. A total of 56.1% of children were less than 10 years of age, of which 53.8% were girls and 46.2% were boys. Almost 38% of the boys and 37.2% of the girls were between 10 – 12 years of age. Around 6.3% of the children were above the age group of 13 years. The number of girls aged >13 years were less as compared to the boys. Thus it was observed that maximum number of children were less than 10 years of age.

Table 4.1.4: Number of Children Covered in the Selected Schools

Sr. No.	Name of the School	Boys			Girls			Total		
		En	N	%	En	N	%	En	N	%
1	Sir Sayajirao Gaekwad	134	103	76.9	119	88	73.9	253	191	75.5
2	Pujya Shri Rang Avadhoot	224	182	81.3	198	162	81.8	422	344	81.5
3	Maa Veer Bai	86	67	77.9	56	46	82.1	142	113	79.6
4	Pujya Shri Dongreji Maharaj	313	257	82.1	335	266	79.4	648	523	80.7
5	Dr. Jagdish chandra Bose	149	130	87.2	166	150	90.4	315	280	88.9
6	Chandrashekhar Azad	64	58	90.6	77	71	92.2	141	129	91.5
7	Dr. Hansa Mehta	164	140	85.4	169	148	87.8	333	288	86.5
8	Vinobha Bhave	85	60	70.6	90	59	65.5	175	119	68.0
9	Dr. Baba sahib Ambedkar	155	137	88.4	152	135	88.8	307	272	88.6
10	Rushi Vishwamitra	244	129	52.9	305	150	49.2	549	279	50.8
11	Swami Vivekanand	279	160	57.3	343	200	58.3	622	360	57.9
12	Zaverchand Meghani	133	81	60.9	123	80	65.0	256	161	62.9
13	Dr. Rajendra Prasad	137	99	72.3	152	115	75.7	289	214	74.0
14	Dr. Hedgewar	250	175	70.0	254	191	75.2	504	366	72.6
15	Rajaram Mohan Roy	142	121	85.2	126	116	92.1	268	237	88.4
16	Dr. Shyama Prasad Mukherjee	622	466	74.9	728	563	77.3	1350	1029	76.2
	Total	**3181**	**2365**	**74.3**	**3393**	**2540**	**74.9**	**6574**	**4905**	**74.6**

En denotes Enrolment in School

Table 4.1.5: Age Wise Distribution of Children (N, %)

Age (yr)	Boys		Girls		Total	
	N	%	N	%	N	%
5 – 5.11	146	6.2	178	7.0	324	6.6
6 – 6.11	250	10.6	275	10.8	525	10.7
7 – 7.11	288	12.2	337	13.3	625	12.7
8 – 8.11	263	11.1	334	13.1	597	12.2
9 – 9.11	325	13.7	358	14.1	683	13.9
10 – 10.11	342	14.5	379	14.9	721	14.7
11 – 11.11	333	14.1	323	12.7	656	13.4
12 – 12.11	224	9.5	242	9.5	466	9.5
13 – 13.11	109	4.6	79	3.1	188	3.8
14 – 14.11	47	2.0	23	0.9	70	1.4
15 – 15.11	23	1.0	9	0.4	32	0.7
16 – 16.11	8	0.3	2	0.1	10	0.2
17 – 17.11	6	0.3	1	0.0	7	0.1
18 – 18.11	1	0.0	0	0.0	1	0.0
Total	**2365**	**48.2**	**2540**	**51.8**	**4905**	**100**

Socio Economic Status

The data revealed that majority (84%) of the children were Hindus followed by Muslims (17.7%). Caste wise distribution showed that 36.5% were Other Backward Castes followed by General category (31.7%) and Scheduled Caste (16.5%). Only 15.4% of the children belonged to Scheduled Tribe category**.** Gender wise analysis for caste showed that the enrolment for girls was similar in all the categories except in schedule tribe where enrolment of girls was less. In response to the type of family, around 64% of the children belonged to nuclear family and more number of boys lived in nuclear family as compared to girls (**Table 4.1.6**). On comparing the distribution of boys and girls according to socio economic status, it was found that the girls and boys were homogeneously distributed according to caste and religion. However, gender difference was statistically significant in type of family. The statistical connotation clarified that both nurturing and care of the children are affected by the family type.

Education and Occupation of the Parents of Children

The rate of illiteracy in parents differed wherein 8.1% of the fathers and 18.7% of mothers were illiterate. Thus, the illiteracy levels were higher among mothers than fathers. Around 32% of children did not know the educational level of their parents.

Around 31.0% children had mothers, who were educated till primary level, 14.1% mothers till secondary, 2.8% till higher secondary and only 0.2% mothers were graduates and beyond. Mother education is very crucial in child care. So, when boys and girls were compared according to maternal education status it was found that the distribution was not equal. Among girls, more number of mothers was illiterate or had primary education which was statistically different as compared to the boys **(Table 4.1.7).** The distribution of boys and girls were comparable with respect to fathers' education status.

Table 4.1.6: Socio Demographic Profile of The Children (N, %)

CHARACTERISTICS	BOYS (N=2365)		GIRLS (N=2540)		TOTAL (N=4905)		Chi-Square Value (p value)
CASTE	N	%	N	%	N	%	
SC	395	16.7	414	16.3	809	16.5	3.25 (0.35)
ST	382	16.2	373	14.7	755	15.4	
OBC	837	35.4	951	37.4	1788	36.5	
GENERAL	751	31.8	802	31.6	1553	31.7	
RELIGION		**(N=1991)**		**(N=2163)**		**(4154)**	
HINDU	1641	82.4	1759	81.3	3400	81.8	7.97 (0.09)
MUSLIM	339	17.0	396	18.3	735	17.7	
SIKH	1	0.1	4	0.2	5	0.1	
CHRISTIAN	10	0.5	3	0.1	13	0.3	
OTHERS	0	0.0	1	0.0	1	0.0	
TYPE OF FAMILY							
NUCLEAR	1311	65.8	1343	62.1	2654	63.9	11.03 **(0.004)**
EXTENDED NUCLEAR	407	20.4	445	20.6	852	20.5	
JOINT	273	13.7	375	17.3	648	15.6	

Table 4.1.7: Education of the Parents of the Enrolled Children (N, %)

	Boys		Girls		Total		Chi-Square Value (p value)
	N	%	N	%	N	%	
Education of Father							
Illiterate	173	8.7	165	7.6	338	8.1	4.16 (0.654)
Primary (1-7)	551	27.7	619	28.6	1170	28.2	
Secondary (8-10)	455	22.9	497	23.0	952	22.9	
Higher Secondary (11-12)	131	6.6	156	7.2	287	6.9	
Graduate & above	12	0.6	20	0.9	32	0.8	
Don't Know	655	32.9	693	32.0	1348	32.5	
Not Applicable	14	0.7	13	0.6	27	0.6	
Education of Mother							
Illiterate	379	19.0	396	18.3	775	18.7	22.82 **(0.001)**
Primary (1-7)	598	30.0	689	31.9	1287	31.0	
Secondary (8-10)	242	12.2	343	15.9	585	14.1	
Higher Secondary (11-12)	60	3.0	58	2.7	118	2.8	
Graduate & above	2	0.1	7	0.3	9	0.2	
Don't Know	698	35.1	664	30.7	1362	32.8	
Not Applicable	12	0.6	6	0.3	18	0.4	

Parents were involved in varied occupations. Majority of the fathers had service (29.4%) followed by skill based jobs (28.8%) like tailor, driver, painter, cook etc. Nearly 24.0% of fathers were labourers, 4.3% as industrial labourers and 2.2% as agricultural labourers. On the other hand 46.4% of the mothers were housewives and 34.6% of the mothers worked as house maid **(Table 4.1.8).**

Information on MDM

Majority of the boys and girls (85.4%) consumed food provided by TAPF through the MDM program in schools, while 14.6 % of children did not consume MDM food **(Table 4.1.9).** Among the children who consumed MDM in school, 85% children, (almost 52% boys and 45% girls) consumed it 6 days in a week whereas 12% to 13% children consumed MDM 4-5 days in a week. Only 1% of the children consumed for 2 days in a week. **Those children, who consumed the MDM reported that they liked the food provided by TAPF.**

The reason stated by the children (14.6%) who did not consume the MDM was that they ate from home and reported not liking the MDM provided in school. Other reason for not consuming the MDM was not bringing their own plate from home, parents not allowing children to eat, followed by coming late to school and auto rickshaw coming late **(Table 4.1.9)**.

The preference of the children with regard to the MDM provided by TAPF indicated that **Rice (56%) and Dal (52%)** were preferred the most followed by Roti 22%, as depicted in **Table 4.1.10**. Very few children liked Masala roti (0.7%) and Dudhi chana (2.3%). Sukhadi and Dal Dhokli was liked by 7% of the children and about 12% children mentioned that they liked all the food items given to them. Among the children who mentioned liking all food items, majority were boys (14%).

Table 4.1.8: Occupation of the Parents of the Enrolled Children (N, %)

	Boys		Girls		Total	
	N	%	N	%	N	%
Occupation of Father						
Laborer	479	24.1	520	24.0	999	24.0
Industrial worker	93	4.7	87	4.0	180	4.3
Agricultural Worker	46	2.3	47	2.2	93	2.2
Self Employed	585	29.4	612	28.3	1197	28.8
Service	572	28.7	648	30.0	1220	29.4
Vegetable/Food Vendor	57	2.9	63	2.9	120	2.9
Others	2	0.1	6	0.3	8	0.2
Unemployed	13	0.7	23	1.1	36	0.9
Don’t know	79	4.0	88	4.1	167	4.0
Not Applicable	65	3.3	69	3.2	134	3.2
Occupation of Mother						
House wife	873	43.8	1054	48.7	1927	46.4
House maid	701	35.2	735	34.0	1436	34.6
Laborer	74	3.7	69	3.2	143	3.4
Industrial worker	17	0.9	11	0.5	28	0.7
Agricultural worker	29	1.5	29	1.3	58	1.4
Self-Employed	134	6.7	127	5.9	261	6.3
Service	94	4.7	82	3.8	176	4.2
Don’t know	39	2.0	41	1.9	80	1.9
Not Applicable	30	1.5	15	0.7	45	1.1

Table 4.1.9: Information about Children Consuming MDM Food

Sr. No.	Variable	Boys (N=1954)	Girls (N=2071)	Total (N=4025)
	Consume MDM Food			
1	Yes	87.7 (1747)	83.0 (1794)	85.3 (3541)
2	No	12.3 (244)	17.0 (368)	14.61 (612)
	Frequency of consumption of MDM food/week			
1	0	0.17 (3)	0.45 (8)	0.31 (11)
2	1	0.85 (15)	1.11 (20)	0.99 (35)
3	2	2.23 (39)	1.95 (35)	2.09 (74)
4	3	8.59 (150)	10.37 (186)	9.49 (336)
5	4	11.51 (201)	14.66 (263)	13.10 (464)
6	5	17.17 (300)	15.05 (270)	16.10 (570)
7	6	59.47 (1039)	56.41 (1012)	57.92 (2051)
	Like the food?			
1	Yes	87.7 (1747)	83.0 (1794)	85.3 (3541)
2	No	12.3 (244)	17.0 (368)	14.61 (612)
	If No, (Reason)			
1	Ate from their home	45.90 (112)	41.30 (152)	37.69 (264)
2	Don't bring plate	10.25 (25)	12.23 (45)	11.54 (70)
3	Don't like the food given	35.66 (87)	34.51 (127)	36.50 (214)
4	Don't allow by parents	5.74 (14)	10.87 (40)	9.00 (54)
5	Coming late from home	1.64 (4)	1.09 (4)	1.19 (8)
6	Rickshaw coming early/late	0.82 (2)	1.63 (6)	1.36 (8)

Values in parenthesis indicates number

Table 4.1.10: Food Item Liked Most by the Children

Sr. No.	Food Item Most Liked	Boys (N=1747)	Girls (N=1794)	Total (N=3541)
1	Dal	50.89 (889)	53.46 (959)	52.19 (1848)
2	Rice	54.49 (952)	57.30 (1028)	55.92 (1980)
3	Roti	24.73 (432)	20.23 (363)	22.45 (795)
4	Masala roti	0.63 (11)	0.72 (13)	0.68 (24)
5	Khichadi	9.33 (163)	10.14 (182)	9.74 (345)
6	Mix Vegetable	13.11 (229)	13.32 (239)	13.22 (468)
7	Dudhichana	2.29 (40)	2.40 (43)	2.34 (83)
8	Dal-dhokali	7.04 (123)	7.64 (137)	7.34 (260)
9	Sukhadi	7.27 (127)	8.14 (146)	7.71 (273)
10	All the food items	14.14 (247)	9.92 (178)	12.00 (425)

Values in parenthesis indicates number

Rank List

Rank	Food Item
1.	Rice
2.	Dal
3.	Roti
4.	Mix Vegetable
5.	All the food Items
6.	Khichadi
7.	Sukhadi
8.	Dal Dhokli
9.	Dudhi Chana
10.	Masala Roti

Anthropometric Measurements

Mean weight and height of the children were segregated according to gender and is presented in **Table 4.1.11** and **4.1.12.** The mean weight of boys was 23.1kgs and that of girls was 22.7kgs. The mean weight of boys and girls were comparable. However, the mean weight of boys was significantly higher at 6 years of age. Although there was no significant gender difference in the mean values of weight among 7–10 years old, substantial differences was noted in those aged 11 to 13 years old where the mean weight of girls was significantly higher than boys. The reason could be due to earlier onset of pubertal growth spurt in girls than boys.

The mean height of boys and girls were 125.9cms and 124.4cms respectively as depicted in **Table 4.1.12.** The mean height of boys was significantly higher as compared to the girls. Gradual increase in mean height was seen with increase in age regardless of gender. However, the mean height of boys was significantly higher in the age group of 5-6 years while the mean height of girls was significantly higher at 12 years of age as compared to their counterparts.

The mean BMI values increased linearly with age in case of both boys and girls; however a contrasting downward trend in BMI was seen at 10 years of age **(Table 4.1.13)**. The mean BMI for girls (14.35kg/m^2) was significantly higher than that of boys (14.24 kg/m^2) especially in the age group of 10-14 years.

The height, weight and BMI followed a normal distribution in all the age groups except at 16-18 years where the sample size was very small.

Prevalence of Undernutrition

Based on the anthropometric measurements obtained for the children, the prevalence of undernutrition was calculated using CDC 2000 standards and the

Table 4.1.11: Mean Weights of the Children Cross Tabulated by Age & Gender (Mean ± SD, Kg)

Age (yr)	Boys (N=2365)	Girls (N=2540)	Total (N=4905)	't' value (p value)
5-5.11	15.3±2.3	14.8±2.4	15.0±2.3	1.84(0.06)
6-6.11	16.6±2.1	16.1±2.5	16.3±2.3	2.58(0.01)**
7-7.11	18.1±2.5	18.0±2.7	18.0±2.6	0.29(0.76)
8-8.11	19.9±2.8	20.1±3.2	20.0±3.0	0.93(0.35)
9-9.11	24.0±3.9	23.7±5.3	23.7±5.0	0.29(0.76)
10-10.11	23.4±4.1	23.6±4.6	23.5±4.4	0.89(0.37)
11-11.11	27.0±4.9	28.0±5.5	27.5±5.2	2.40(0.01)**
12-12.11	29.2±5.5	31.2±6.0	30.3±5.9	3.76(0.000)***
13-13.11	31.2±4.8	33.0±5.0	31.9±5.0	2.49(0.01)**
14-14.11	34.8±6.5	36.7±6.8	35.4±6.6	1.12(0.26)
15-15.11	40.7±9.5	40.7±9.5	40.7±9.3	0.00(1.00)
16-16.11	39.8±6.9	36.6±11.9	39.2±7.4	0.53(0.61)
17-17.11	45.6±11.8	34.0	43.9±11.6	
18-18.11	32.0	–	32.0	
Total	23.1±6.8	22.7±7.0	22.9±6.9	1.67(0.09)

** - denotes P<0.01 *** - denotes P<0.001
't' value: Comparison between boys and girls

Table 4.1.12: Mean Heights of the Children Cross Tabulated by Age & Gender (Mean ±SD, cms)

Age (yr)	Boys (N=2365)	Girls (N=2540)	Total (N=4905)	't' value
5-5.11	105.6±6.2	104.2±5.5	104.8±5.9	2.174 (0.03)*
6-6.11	110.5±5.6	108.7±5.9	109.5±5.8	3.53(0.000)***
7-7.11	114.9±5.9	114.9±6.1	114.9±6.0	0.08(0.93)
8-8.11	119.8±5.7	120.3±6.2	120.1±6.0	0.99(0.32)
9-9.11	128.3±5.7	127.0±7.7	127.4±7.2	0.84(0.39)
10-10.11	128.1±7.3	127.9±7.6	128.0±7.4	0.50(0061)
11-11.11	135.2±7.0	135.9±7.1	135.5±7.0	1.19(0.23)
12-12.11	138.8±7.3	140.7±7.5	139.8±7.5	2.82(0.005)**
13-13.11	143.8±7.2	143.2±6.4	143.5±6.9	0.56(0.57)
14-14.11	148.6±8.7	146.8±5.9	148.0±7.9	0.90(0.37)
15-15.11	155.0±9.4	150.8±6.6	153.8±8.8	1.23(0.22)
16-16.11	154.3±8.4	140.0±7.8	151.5±9.9	2.18(0.06)
17-17.11	159.9±6.1	137.5	156.7±10.2	
18-18.11	150.0	–	150.0	
Total	125.9±13.5	124.4±13.4	125.1±13.5	3.94(0.000)***

* - denotes P<0.05 ** - denotes P<0.01 *** - denotes P<0.001
't' value: Comparison between boys and girls

Table 4.1.13: Mean BMI of the Children Cross Tabulated by Age & Gender (Mean ±SD, Kg/m^2)

Age (yr)	Boys (N=2365)	Girls (N=2540)	Total (N=4905)	't' value
5-5.11	13.67±1.09	13.61±1.23	13.64±1.17	0.45(0.65)
6-6.11	13.60±1.02	13.56±1.07	13.58±1.04	0.36(0.71)
7-7.11	13.63±1.12	13.56±1.19	13.59±1.16	0.78(0.43)
8-8.11	13.80±1.16	13.83±1.40	13.82±1.30	0.33(0.73)
9-9.11	14.54±2.05	14.53±1.82	14.53±1.88	0.03(0.97)
10-10.11	14.16±1.37	14.32±1.71	14.24±1.55	1.91(0.05)*
11-11.11	14.67±.1.60	15.04±1.98	14.85±1.80	2.69(0.007)**
12-12.11	15.07±1.83	15.66±2.04	15.38±1.96	3.25(0.001)***
13-13.11	15.01±1.49	16.05±1.94	15.45±1.76	4.14(0.000)***
14-14.11	15.61±1.62	16.94±2.52	16.05±2.04	2.68(0.009)**
15-15.11	16.73±2.56	17.78±2.91	17.02±2.66	1.00(0.32)
16-16.11	16.68±2.31	18.42±4.01	17.03±2.55	0.85(0.41)
17-17.11	17.64±3.64	17.98	17.69±3.32	
18-18.11	14.22	–	14.22	
Total	14.24±1.54	14.35±1.81	14.29±1.69	2.21(0.02)*

* - denotes P<0.05 ** - denotes P<0.01 *** - denotes P<0.001
't' value: Comparison between boys and girls

WHO 2007 standards. The prevalence of undernutrition was ascertained using Z scores for 3 anthropometric indices namely WAZ (underweight), HAZ (stunting) and BMIZ (thinness).

The age and gender specific distribution of children according to WHO 2007 standards Z-scores, are depicted in **Table 4.1.14** for mean±SD of weight for age (WAZ), **Table 4.1.15** for height for age (HAZ) and **Table 4.1.16** for BMI for age (BMIZ). Mean z scores had negative values in both boys as well as girls for all the anthropometric indices. The overall mean±SD for WAZ, HAZ and BMIZ were -2.09±1.05, -1.70±1.05 and -1.59±1.08, respectively. The data indicates that both boys and girls had lower weight, lower height and lower BMI as compared to WHO 2007 growth standards. These observations indicate that the children are not able to keep the pace of growth, and early preventive care is strongly recommended for their optimal growth.

According to CDC 2000 growth standards, overall mean±SD for WAZ, HAZ and BMIZ were -2.34±1.3, -1.72±1.1 and -1.79±1.3, as shown in **Table 4.1.17, Table 4.1.18** and **Table 4.1.19** respectively. Using both the standards, mean Z scores were lower than the reference standards.

The mean HAZ of boys and girls were comparable. However, the mean WAZ and BMIZ were significantly different across the gender indicating that more number of boys were underweight and thin as compared to their counterparts with regards to both the standards.

The prevalence of undernutrition in school children is shown in **Table 4.1.20.** The prevalence of underweight was 60.6% according to CDC 2000 standards while it was 54.3% according to WHO 2007 standards. The number of children included for calculation of weight for age were 2810, and for the prevalence of underweight it was 1526 as children less than 10 years of age were only included. This is because in WHO 2007 weight for age reference data are not available beyond the age of 10 years.

Table 4.1.14: Mean WAZ of the Children According to WHO 2007 Growth Standards Cross Tabulated by Age & Gender (Mean ±SD, Z scores)

Age (yr)	Boys		Girls		Total		't' value
	N	Mean±SD	N	Mean±SD	N	Mean±SD	
5	146	-2.05±1.1	178	-2.05±0.9	324	-2.05±1.0	0.05
6	250	-2.16±0.9	275	-2.04±1.0	525	-2.09±0.9	-1.41
7	288	-2.31±1.1	337	-1.96±1.0	625	-2.12±1.0	-4.21***
8	263	-2.27±1.0	334	-1.95±1.1	597	-2.09±1.1	-3.65***
9	325	-1.80±1.1	358	-1.84±1.2	683	-1.83±1.2	-1.29
10	27	-2.15±1.1	29	-2.09±1.1	56	-2.12±1.1	0.67
Total	**1299**	**-2.19±1.0**	**1511**	**-2.00±1.1**	**2810**	**-2.09±1.1**	**-4.73*** **

* - denotes P<0.05 ** - denotes P<0.01 *** - denotes P<0.001
't' value: Comparison between boys and girls

Table 4.1.15: Mean HAZ of the Children According to WHO 2007 Growth Standards Cross Tabulated by Age & Gender (Mean ±SD, Z scores)

Age (yr)	Boys		Girls		Total		't' value
	N	Mean±SD	N	Mean ±SD	N	Mean±SD	
5	146	-1.68±1.3	178	-1.76±1.1	324	-1.72±1.2	0.57^{EVNA}
6	250	-1.68±1.1	275	-1.73±1.1	525	-1.71±1.1	0.56
7	288	-1.76±1.1	337	-1.55±1.0	625	-1.65±1.1	-2.57**
8	263	-1.72±0.9	334	-1.55±1.0	597	-1.63±.9	-2.06*
9	325	-1.38±0.9	358	-1.57±1.2	683	-1.51±1.1	0.90^{EVNA}
10	342	-1.52±1.0	379	-1.71±1.1	721	-1.62±1.1	3.50***
11	333	-1.57±0.9	323	-1.83±1.0	656	-1.70±1.0	3.32**
12	224	-1.82±1.0	242	-1.82±1.1	466	-1.82±1.0	0.01
13	109	-2.02±1.0	79	-2.11±0.9	188	-2.05±.9	0.62
14	47	-2.21±1.1	23	-2.00±0.9	70	-2.14±1.0	-0.80
15	23	-2.00±1.2	9	-1.65±0.9	32	-1.90±1.1	-0.76
16	8	-2.57±1.1	2	-3.34±1.1	10	-2.72±1.1	0.92
17	6	-2.08±0.8	1	-3.84±0.0	7	-2.33±0.9	2.06
18	1	-3.58±0.0	0	0.0±0.0	1	-3.58±0.0	
Total	**2365**	**-1.68±1.0**	**2540**	**-1.71±1.1**	**4905**	**-1.70±1.1**	**1.05**

* - denotes P<0.05 ** - denotes P<0.01 *** - denotes P<0.001
EVNA – Equal Variance Not Assumed
't' value: Comparison between boys and girls

Table 4.1.16: Mean BMIZ of the Children According to WHO 2007 Growth Standards Cross Tabulated by Age & Gender (Mean ±SD, Z scores)

Age (yr)	Boys		Girls		Total		't' value
	N	Mean±SD	N	Mean±SD	N	Mean±SD	
5	146	-2.00±1.5	178	-1.75±1.6	324	-1.86±1.6	-1.41
6	250	-2.01±1.3	275	-1.67±1.2	525	-1.83±1.3	-3.03**
7	288	-2.00±1.3	337	-1.75±1.2	625	-1.86±1.2	-2.48*
8	263	-1.92±1.3	334	-1.68±1.3	597	-1.79±1.3	-2.29*
9	325	-1.91±1.3	358	-1.62±1.2	683	-1.76±1.2	-3.12**
10	342	-1.90±1.2	379	-1.62±1.2	721	-1.75±1.2	-3.08**
11	333	-1.93±1.2	323	-1.55±1.1	656	-1.74±1.2	-4.19***
12	224	-1.97±1.3	242	-1.43±1.1	466	-1.69±1.2	-4.75***
13	109	-2.32±1.2	79	-1.50±1.2	188	-1.98±1.3	-4.59***
14	47	-2.27±1.3	23	-1.35±1.2	70	-1.97±1.3	-2.84**
15	23	-1.98±1.5	9	-1.27±1.6	32	-1.78±1.5	-1.19
16	8	-2.37±1.4	2	-1.13±1.9	10	-2.12±1.5	-1.05
17	6	-2.28±1.9	1	-1.33±0.0	7	-2.15±1.8	-0.45
18	1	-5.24±0.0	0	0.0±0.0	1	-5.24±0.0	
Total	**2365**	**-1.75±1.1**	**2540**	**-1.45±1.1**	**4905**	**-1.59±1.1**	**-9.80*** ** EVNA

* - denotes P<0.05 ** - denotes P<0.01 *** - denotes P<0.001
EVNA – Equal Variance Not Assumed
't' value: Comparison between boys and girls

Table 4.1.17: Mean WAZ of the Children According to CDC 2000 Growth Standards Cross Tabulated by Age & Gender (Mean ±SD, Z scores)

Age (yr)	Boys		Girls		Total		't' value
	N	Mean±SD	N	Mean±SD	N	Mean±SD	
5	146	-2.38±1.3	178	-2.40±1.2	324	-2.39±1.3	0.13
6	250	-2.43±1.2	275	-2.46±1.3	525	-2.45±1.3	0.29
7	288	-2.61±1.4	337	-2.34±1.3	625	-2.46±1.3	-2.65**
8	263	-2.57±1.3	334	-2.21±1.2	597	-2.37±1.3	-3.50***
9	325	-2.43±1.3	358	-2.19±1.2	683	-2.30±1.3	-2.52*
10	342	-2.28±1.3	379	-2.16±1.2	721	-2.22±1.2	-1.23
11	333	-2.30±1.2	323	-2.15±1.2	656	-2.23±1.2	-1.74
12	224	-2.41±1.2	242	-2.07±1.3	466	-2.23±1.2	-2.97**
13	109	-2.67±1.1	79	-2.38±1.2	188	-2.55±1.1	-1.75
14	47	-2.80±1.4	23	-2.38±1.5	70	-2.66±1.4	-1.19
15	23	-2.58±1.7	9	-2.27±1.7	32	-2.49±1.7	-0.45
16	8	-3.51±1.5	2	-4.12±3.9	10	-3.63±1.9	0.22^{EVNA}
17	6	-3.18±2.2	1	-5.09±0	7	-3.45±2.1	0.80
18	1	-7.24±0	0	–	1	-7.24±0	
Total	**2365**	**-2.45±1.3**	**2540**	**-2.24±1.2**	**4905**	**-2.34±1.3**	**-5.72*** **

* - denotes P<0.05 ** - denotes P<0.01 *** - denotes P<0.001

EVNA – Equal Variance Not Assumed
't' value: Comparison between boys and girls

Table 4.1.18: Mean HAZ of the Children According to CDC 2000 Growth Standards Cross Tabulated by Age & Gender (Mean ±SD, Z scores)

Age (yr)	Boys		Girls		Total		't' value
	N	Mean±SD	N	Mean ±SD	N	Mean±SD	
5	146	-1.48±1.3	178	-1.68±1.2	324	-1.59±1.2	1.50
6	250	-1.60±1.0	275	-1.87±1.1	525	-1.74±1.1	2.83**
7	288	-1.83±1.1	337	-1.81±1.1	625	-1.82±1.1	-0.21
8	263	-1.88±0.9	334	-1.76±1.1	597	-1.81±1.0	-1.31
9	325	-1.74±0.9	358	-1.68±1.2	683	-1.71±1.1	-0.78[EVNA]
10	342	-1.54±1.1	379	-1.53±1.0	721	-1.53±1.1	-0.12
11	333	-1.57±0.9	323	-1.59±0.9	656	-1.58±0.9	0.24
12	224	-1.77±0.9	242	-1.75±0.9	466	-1.76±0.9	-0.20
13	109	-1.92±0.9	79	-2.26±0.9	188	-2.06±0.9	2.43*
14	47	-2.12±0.9	23	-2.19±0.9	70	-2.14±0.9	0.29
15	23	-1.97±1.1	9	-1.76±1.0	32	-1.92±1.0	-0.50
16	8	-2.56±0.9	2	-3.52±1.2	10	-2.75±1.0	1.19
17	6	-2.12±0.8	1	-3.94±0.0	7	-2.38±0.9	2.15
18	1	-3.62±0.0	0	0.0±0.0	1	-3.62±0.0	
Total	**2365**	**-1.71±1.0**	**2540**	**-1.72±1.1**	**4905**	**-1.72±1.1**	**0.57**

* - denotes P<0.05 ** - denotes P<0.01 *** - denotes P<0.001

EVNA- Equal Variance Not Assumed
't' value: Comparison between boys and girls

Table 4.1.19: Mean BAZ of the Children According to CDC 2000 Growth Standards Cross Tabulated by Age & Gender (Mean ±SD, Z scores)

Age (yr)	Boys		Girls		Total		't' value
	N	Mean±SD	N	Mean±SD	N	Mean±SD	
5	146	-1.48±1.3	178	-1.68±1.2	324	-1.59±1.2	1.50
6	250	-1.60±1.0	275	-1.87±1.1	525	-1.74±1.1	2.83**
7	288	-1.83±1.1	337	-1.81±1.1	625	-1.82±1.1	-0.21
8	263	-1.88±0.9	334	-1.76±1.1	597	-1.81±1.0	-1.31
9	325	-1.74±0.9	358	-1.68±1.2	683	-1.71±1.1	-0.78 EVNA
10	342	-1.54±1.1	379	-1.53±1.0	721	-1.53±1.1	-0.12
11	333	-1.57±0.9	323	-1.59±0.9	656	-1.58±0.9	0.24
12	224	-1.77±0.9	242	-1.75±0.9	466	-1.76±0.9	-0.20
13	109	-1.92±0.9	79	-2.26±0.9	188	-2.06±0.9	2.43*
14	47	-2.12±0.9	23	-2.19±0.9	70	-2.14±0.9	0.29
15	23	-1.97±1.1	9	-1.76±1.0	32	-1.92±1.0	-0.50
16	8	-2.56±0.9	2	-3.52±1.2	10	-2.75±1.0	1.19
17	6	-2.12±0.8	1	-3.94±0.0	7	-2.38±0.9	2.15
18	1	-3.62±0.0	0	0.0±0.0	1	-3.62±0.0	
Total	**2365**	**-1.97±1.3**	**2540**	**-1.63±1.2**	**4905**	**-1.79±1.3**	**-9.72*** EVNA**

* - denotes P<0.05 ** - denotes P<0.01 *** - denotes P<0.001

EVNA –Equal Variance Not Assumed
't' value: Comparison between boys and girls

Table 4.1.20: % Prevalence of Undernutrition (Z score<-2SD) in Children

Nutritional Status	Boys	CI at 95%	Girls	CI at 95%	Total	CI at 95%
WAZ						
CDC	64.0	62.0-66.0	57.4	55.4-59.4	60.6	59.2-62.0
CDC (Upto 10y)	64.9	62.3-67.5	59.4	59.6-61.9	61.9	60.1-63.7
WHO	58.0	55.3-60.7	51.1	48.5-53.7	54.3	52.4-56.2
Difference	**6.9↓**		**8.3↓**		**7.6↓**	
HAZ						
CDC	37.6	35.6-39.6	38.8	36.9-40.7	38.2	36.8-39.6
WHO	37.0	35.0-39.0	38.8	36.9-40.7	37.9	36.5-39.3
Difference	**0.6↓**		**0**		**0.3↓**	
BMIZ						
CDC	45.3	43.3-47.3	34.3	32.4-36.2	39.6	38.2-41.0
WHO	39.0	37.0-41.0	28.2	26.4-30.0	33.4	32.1-34.7
Difference	**6.3↓**		**6.3↓**		**6.2↓**	

The graphical representation of prevalence of underweight by both the standards is given in **Figure 4.1.1.** With regard to thinness characterized as BMI for age less than -2SD, the prevalence was 39.6% and 33.4% using CDC 2000 and WHO 2007 standards respectively. **(Figure 4.1.2)**

There was no variation in the prevalence of stunting (Height for age) by both the standards. The prevalence of stunting was 38.2% and 37.9% according to CDC 2000 and WHO 2007 standards respectively as depicted in **Figure 4.1.3.** The prevalence of stunting ranged from 36.5-39.3% indicating chronic malnutrition among 1/3rd of school children. The graphical presentation of prevalence of undernutrition (all the three anthropometric indices) in school children is shown in **Figure 4.1.4.**

The nutritional status of school children was stratified by gender **(Table 4.1.21)**. It was found that the prevalence of underweight and thinness was significantly higher in boys as compared to the girls. Conversely, more number of girls were stunted as compared to boys with regards to both the standards but the difference was not significant.

Severity of undernutrition among school children is depicted in **Table 4.1.22**. It can be seen that only 13 to 14 % of the children belonged to normal category according to weight for age. Based on WHO 2007 classification, 18.5% children were severely underweight while around 35.8% were moderately underweight. Severe stunting was seen in almost 10% of the children and 28% of the children belonged to the moderate category using both the standards. Based on WHO 2007 classification, 9.9% of the children were severely undernourished (SUN) and 23.6% were moderately undernourished (MUN). The prevalence of moderate and severe thinness was higher according to CDC 2000 standards as compared to WHO 2007 standards.

Figure 4.1.1: Prevalence of Underweight in Children by CDC & WHO

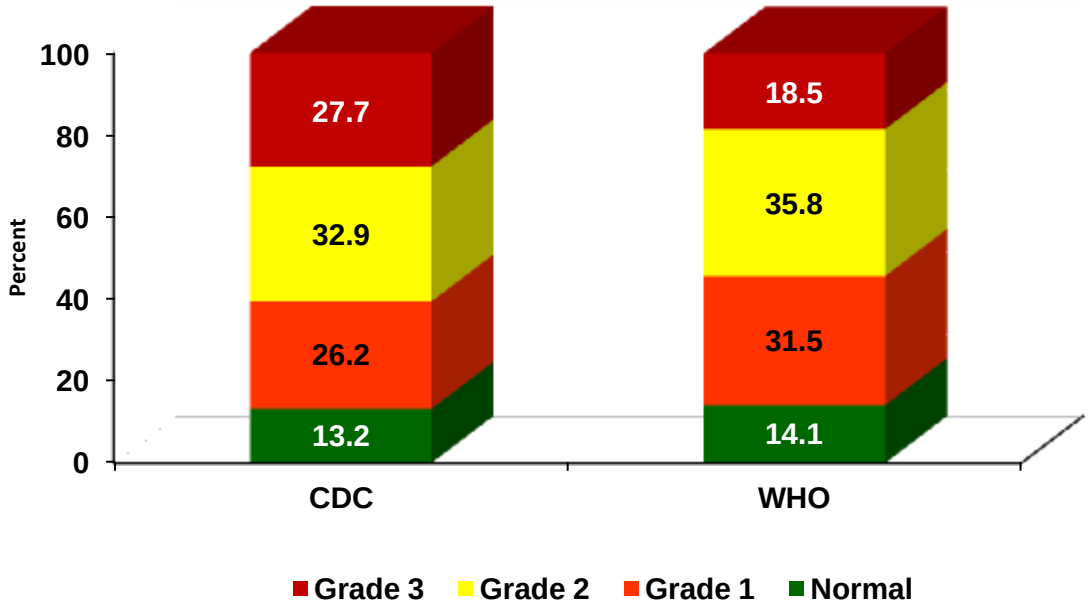


Figure 4.1.2: Prevalence of Stunting in Children by CDC & WHO

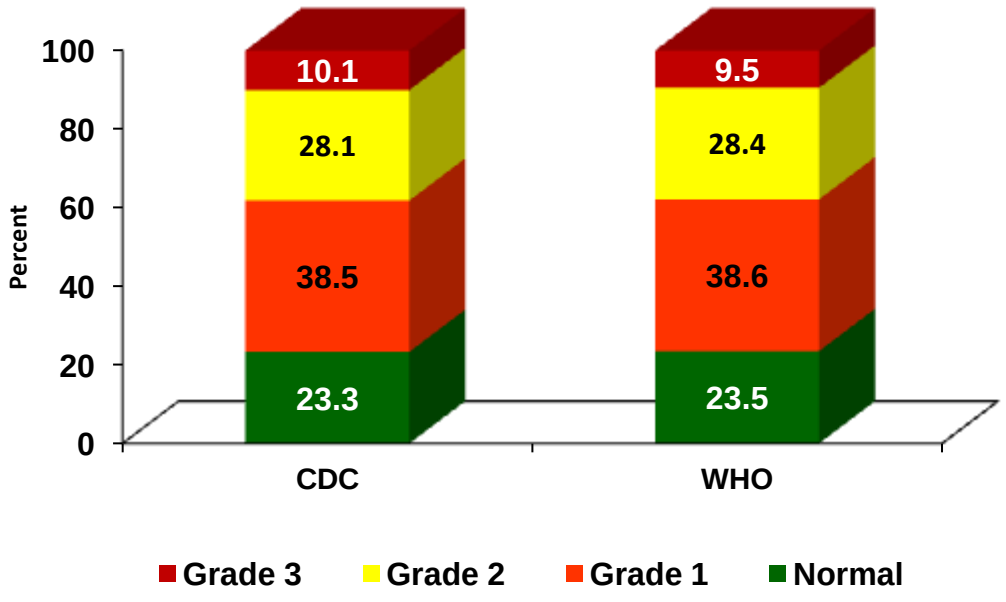


Figure 4.1.3: Prevalence of Thinness in Children by CDC & WHO

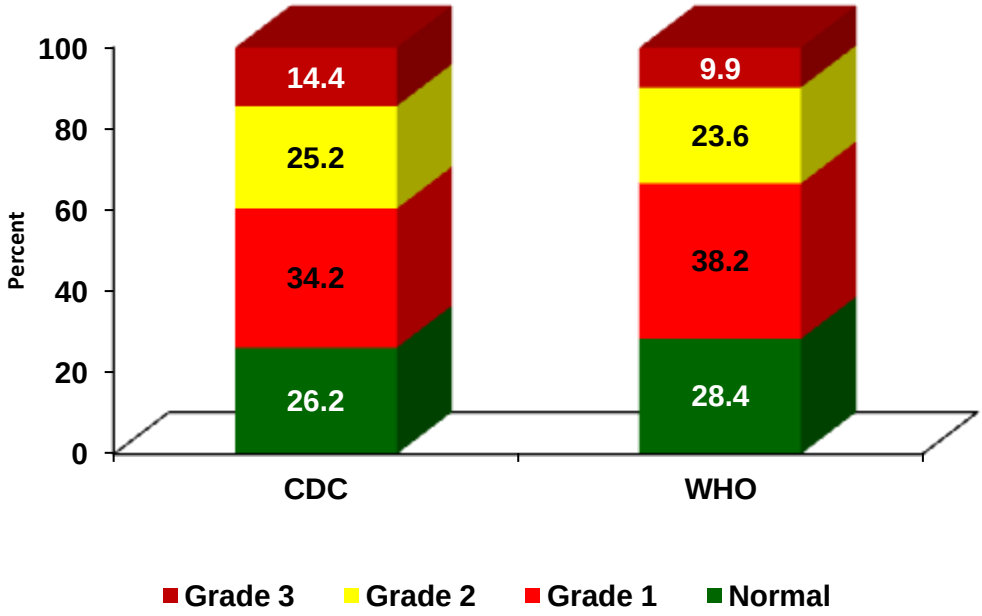


Figure 4.1.4: Prevalence of Undernutrition in Children by CDC & WHO

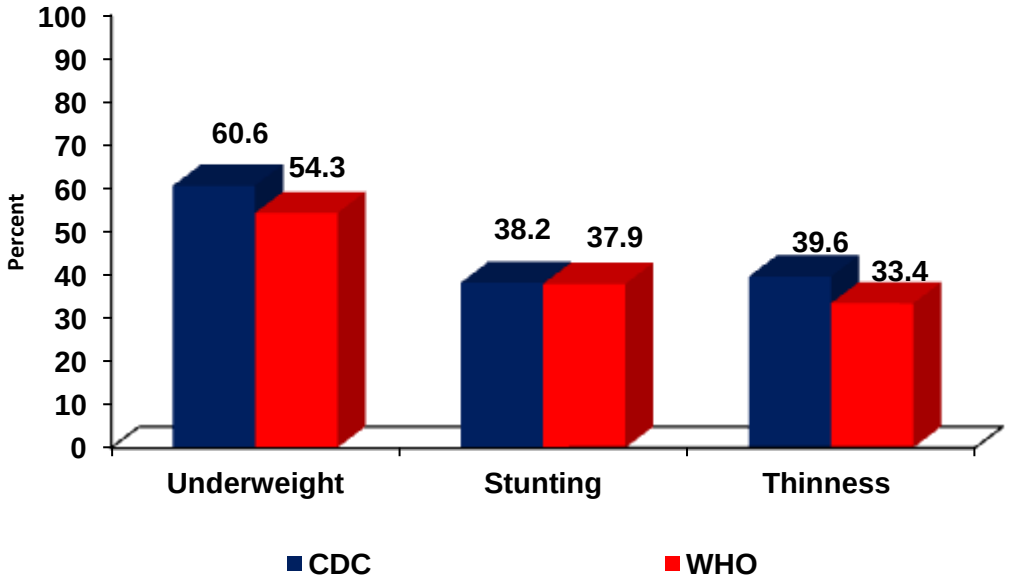


Table 4.1.21: % Prevalence of Undernutrition (Z score<-2SD) Cross Tabulated by Gender (N, %)

Variables	Boys	Girls	Chi Square (p-value)
WAZ			**23.96 (0.000) *****
N	1299	1511	
Normal	545 (42)	739 (49)	
Underweight	754 (58)	772 (51)	
HAZ			**1.80 (0.17)**
N	2365	2540	
Normal	1491 (63)	1554 (61.2)	
Stunting	874 (37)	986 (38.8)	
BMIZ			**64.17 (0.000)*****
N	2365	2540	
Normal	1443 (61)	1824 (71.8)	
Thinness	922 (39)	716 (28.2)	

* - denotes P<0.05 ** - denotes P<0.01 *** - denotes P<0.001
Value in parenthesis indicates percentage

Table 4.1.22: Severity of Malnutrition in Children by CDC and WHO Classification (%)

Category	CDC	WHO	CDC	WHO	CDC	WHO
	WAZ		HAZ		BMIZ	
Normal	13.2 (648)	14.1 (397)	23.3 (1141)	23.5 (1153)	26.2 (1287)	28.4 (1394)
Grade 1	26.2 (1286)	31.5 (887)	38.5 (1889)	38.6 (1892)	34.2 (1677)	38.2 (1873)
Grade 2	32.9 (1614)	35.8 (1006)	28.1 (1380)	28.4 (1395)	25.2 (1234)	23.6 (1155)
Grade 3	27.7 (1357)	18.5 (520)	10.1 (495)	9.5 (465)	14.4 (707)	9.9 (483)

Values in parenthesis indicate number

Gender wise severity of undernutrition was also looked into and is shown in **Table 4.1.23.** According to WHO standards, the prevalence of moderate and severe underweight and moderate and severe thinness was more among boys as compared to girls and the difference was statistically significant. The prevalence of stunting was almost similar in both the groups, except the prevalence of severe stunting which was more among the girls.

Prevalence of undernutrition among different age group of primary school children were distributed evenly. The age wise prevalence of undernutrition for both boys and girls reflected that at each age nearly 41% to 62% of the boys and 42% to 56% of the girls had poor nutritional status as indicated by WAZ Z scores **(Table 4.1.24).** Highest prevalence of underweight was seen at 9 years of age **(Figure 4.1.5)**. According to the Height for Age Z scores, undernutrition in the form of stunting was reflected in all the age groups in both boys and girls **(Table 4.1.25)**. It was seen that with increase in age the prevalence of stunting decreased until the age of 11 years among boys and until the age of 9 years among girls, after which the prevalence increased in case of both boys and girls. Highest prevalence of stunting was seen at 10 years of age **(Figure 4.1.6)**. The prevalence of stunting increased after the age of 15 years in case of both boys and girls, indicating a deficit in growth spurt during adolescence.

Prevalence of thinness when seen across the age revealed that nearly 25% to 100% of the boys and 11% to 50% of the girls were thin **(Table 4.1.25).** The prevalence of thinness was highest at 10-11 years of age **(Figure 4.1.7)**. The prevalence of all the three anthropometric indices increased with increase in age for all the children reflecting their poor nutritional status. The maximum prevalence of all the three anthropometric indices i.e. underweight, stunting and thinness was seen at 10 years of age **(Table 4.1.26)**.

Table 4.1.23: Gender wise Severity of Malnutrition in Children by CDC and WHO Classification (%)

	BOYS		GIRLS		TOTAL	
Category	**CDC**	**WHO**	**CDC**	**WHO**	**CDC**	**WHO**
WAZ						
Normal	11.2	11.6	15.1	16.3	13.2	14.1
Grade 1	24.9	30.3	27.5	32.6	26.2	31.5
Grade 2	32.7	36.3	33.1	35.4	32.9	35.8
Grade 3	31.3	21.7	24.3	15.8	27.7	18.5
HAZ						
Normal	23.4	24.3	23.2	22.7	23.3	23.5
Grade 1	39.0	38.7	38.0	38.5	38.5	38.6
Grade 2	28.3	28.1	28.0	28.7	28.1	28.4
Grade 3	9.3	8.8	10.8	10.1	10.1	9.5
BMIZ						
Normal	20.7	23.5	31.4	33.0	26.2	28.4
Grade 1	34.0	37.5	34.4	38.8	34.2	38.2
Grade 2	27.1	26	23.4	21.3	25.2	23.6
Grade 3	18.2	13	10.9	6.9	14.4	9.9

Table 4.1.24: Age Wise Prevalence of Underweight by WHO 2007 Standards (N, %)

Age Group (Yrs)	Weight For Age (<-2SD)			
	Boys		Girls	
	N	%	N	%
5-5.11	84	57.5	95	53.4
6-6.11	150	60.0	153	55.6
7-7.11	179	62.2	163	48.4
8-8.11	148	56.3	163	48.9
9-9.11	13	40.6	34	41.5
10-10.11	180	56.2	164	53.8
TOTAL	**754**	**58.0**	**772**	**51.1**

Figure 4.1.5: Age Wise Prevalence of Underweight (%)

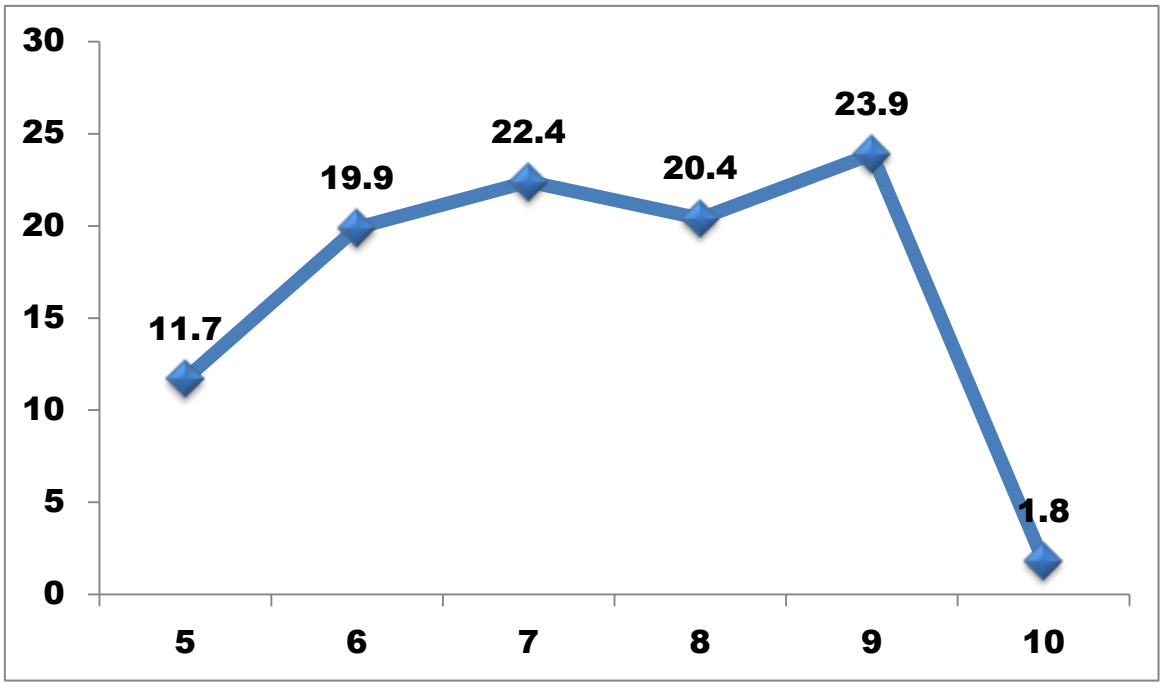


Table 4.1.25: Age Wise Prevalence of Stunting and Thinness by WHO 2007 Standards (N, %)

Age Group (Yrs)	Height For Age (<-2SD)				BMI For Age (<-2SD)			
	Boys		Girls		Boys		Girls	
	N	%	N	%	N	%	N	%
5-5.11	63	43.2	82	46.1	37	25.3	41	23.0
6-6.11	95	38.0	109	39.6	75	30.0	52	18.9
7-7.11	114	39.6	98	29.1	100	34.7	84	24.9
8-8.11	94	35.7	110	33.0	96	36.5	88	26.4
9-9.11	106	32.6	134	37.4	126	38.8	104	29.1
10-10.11	106	31.0	156	41.2	131	38.3	126	33.2
11-11.11	98	29.5	132	40.9	147	44.3	110	34.1
12-12.11	101	45.1	103	42.6	103	46.0	76	31.4
13-13.11	52	47.7	44	55.7	68	62.4	23	29.1
14-14.11	24	51.1	10	43.5	24	51.1	10	43.5
15-15.11	11	47.8	4	44.4	8	34.8	1	11.1
16-16.11	6	75.0	2	100.0	4	50.0	1	50.0
17-17.11	3	50.0	1	100.0	2	33.3	0	.0
18-18.11	1	100.0	0	.0	1	100.0	0	.0
TOTAL	**874**	**37.0**	**986**	**38.8**	**922**	**39.0**	**716**	**28.2**

Figure 4.1.6: Age wise Prevalence of Stunting (%)

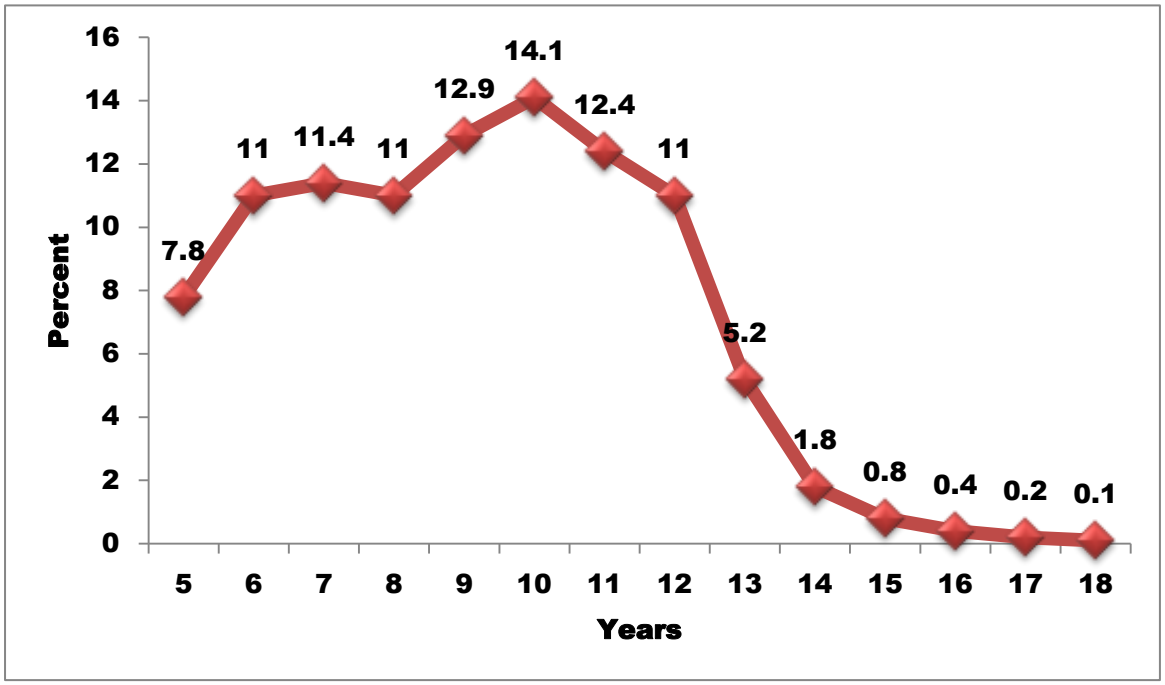


Figure 4.1.7: Age wise Prevalence of Thinness (%)

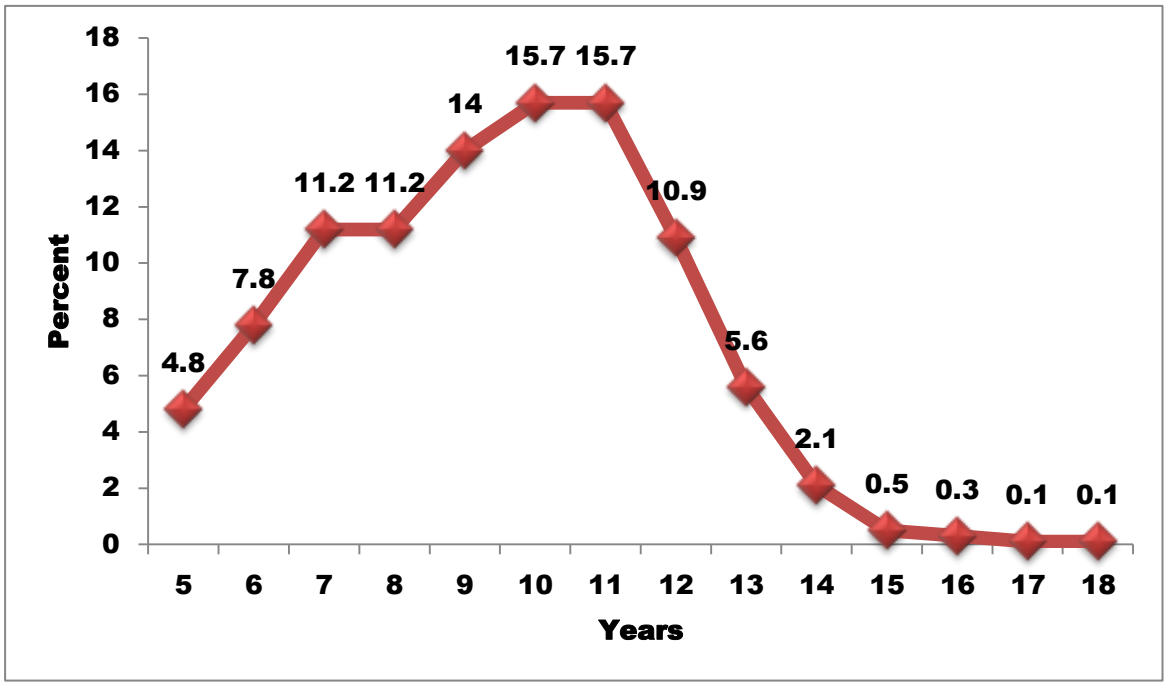


Table 4.1.26: Age wise % Prevalence of Undernutrition by WHO 2007 (Z score<-2SD) in Children

Age	WAZ	HAZ	BMIZ
5	55.2	44.8	24.1
6	57.7	38.9	24.2
7	54.7	33.9	29.4
8	52.2	34.2	30.8
9	48.2	35.1	33.7
10	54.3	36.3	35.6
11	-	35.1	39.2
12	-	43.8	38.4
13	-	51.1	48.4
14	-	48.6	48.6
15	-	46.9	28.1
16	-	80.0	50.0
17	-	57.1	28.6
18	-	100.0	100.0

Variations in the prevalence of undernutrition among all the schools were seen as depicted in **Table 4.1.27.** The highest prevalence of undernutrition (72%) was seen in Vinobha Bhave Prathmik Shala while the highest prevalence of stunting (49%) was seen in Dr. Hansa Mehta Prathmik Shala. Both the schools belonged to the same zone of Vadodara city. The highest prevalence of thinness (49%) was seen in Dr. Rajendra Prasad Prathmik Shala.

Very few studies have been reported from India which has dealt with Composite Index of Anthropometric Failure (CIAF) especially in school going children. In view of this, the present study was undertaken to evaluate the overall prevalence of CIAF among school children aged 5-18 years in urban municipal schools of Vadodara. **Table 4.1.28** shows that only about 1/3rd (39.1%) of the children had a normal anthropometric status while almost 2/3rd (60.9%) of the children were in a state of anthropometric failure (CIAF) with 10.9% stunted only, 4.6% underweight only, 10.6% thin only, 7.8% thin and underweight, 12.0% stunted and underweight and lastly 15.0% stunted, thin and underweight **(Figure 4.1.8)**. The prevalence of CIAF was higher as compared to other conventional indicator specifically underweight, stunting and thinness.

Subsequently the overall anthropometric failure was seen more in boys (63.1%) than girls (58.9%) and according to the classification, all the forms of undernutrition (except stunting alone and stunting and underweight) were more prevalent in boys than girls. In comparison to age, the prevalence of CIAF was higher among children less than 10 years of age than older children **(Table 4.1.28)**.

Determinants of Nutritional Status of the School Children

Multivariate analysis was done to assess the factors that were significantly associated with the nutritional status of the school children. For the analysis, the Z scores of weight for age, height for age and BMI for age were taken as the dependent variable and factors related to socio-economic status (gender,

Table 4.1.27: School Wise Prevalence of Undernutrition in Children using WHO 2007 Growth Standards (Z score<-2SD)

School Code	WAZ	HAZ	BMIZ
	%	%	%
1	55.3	33.2	31.1
2	45.5	30.5	34.6
3	39.2	24.8	33.6
4	56.8	37.7	27.4
5	51.1	37.1	35.0
6	61.5	33.3	38.8
7	60.6	49.0	40.6
8	72.2	42.0	36.1
9	55.4	38.6	38.6
10	55.1	45.5	33.3
11	50.3	40.3	30.6
12	50.0	34.2	27.3
13	67.2	43.9	49.1
14	44.8	34.4	22.4
15	66.4	40.5	41.4
16	52.8	36.9	32.5

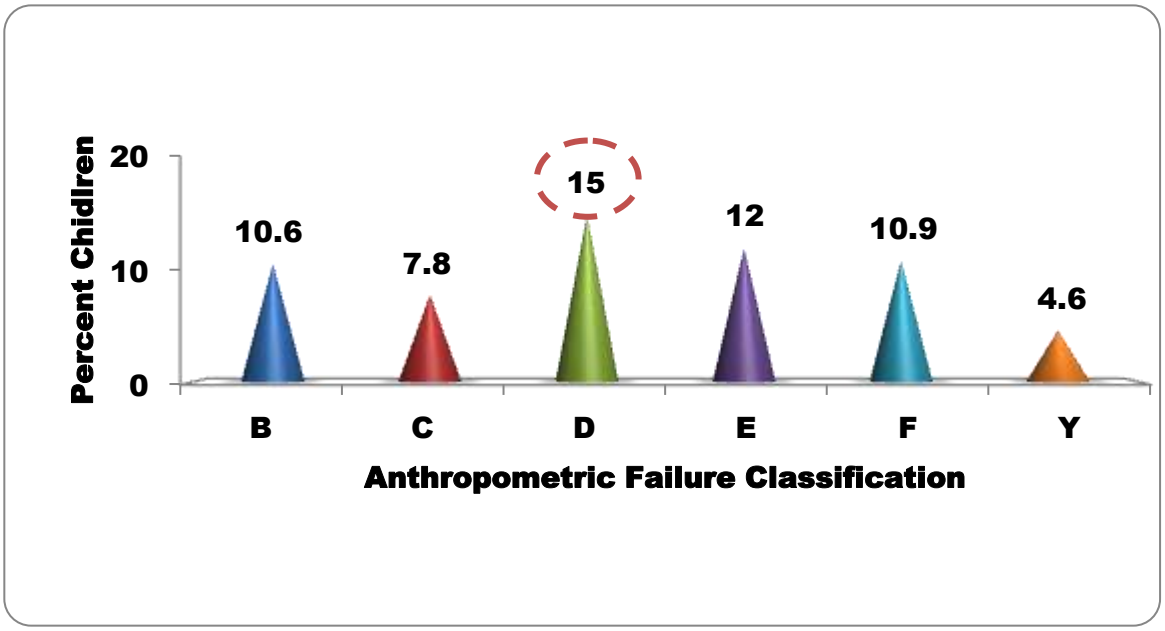
Table 4.1.28: CIAF Classification of Children with Anthropometric Failure Cross Tabulated By Gender And Age

	<10 years			≥10 years			Combined		
	Boys (1299)	**Girls (1511)**	**Total (2810)**	**Boys (1066)**	**Girls (1029)**	**Total (2095)**	**Boys (2365)**	**Girls (2540)**	**Total (4905)**
	N	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**
A	450 (34.6)	614 (40.6)	1064 (37.9)	422 (39.6)	430 (41.8)	852 (40.7)	872 (36.9)	1044 (41.1)	1916 (39.1)
B	56 (4.3)	53 (3.5)	109 (3.9)	253 (23.7)	157 (15.3)	410 (19.6)	309 (13.1)	210 (8.3)	519 (10.6)
C	213 (16.4)	169 (11.2)	382 (13.6)	-	-	-	213 (9.0)	169 (6.6)	382 (7.8)
D	175 (13.5)	154 (10.2)	329 (11.7)	225 (21.1)	183 (17.8)	408 (19.5)	400 (16.9)	337 (13.3)	737 (15.0)
E	269 (20.7)	318 (21.0)	587 (20.9)	-	-	-	269 (11.4)	318 (12.5)	587 (12.0)
F	39 (3.0)	72 (4.8)	111 (3.9)	166 (15.6)	259 (25.2)	425 (20.3)	205 (8.7)	331 (13.0)	536 (10.9)
Y	97 (7.5)	131 (8.7)	228 (8.1)	-	-	-	97 (4.1)	131 (5.2)	228 (4.6)
Total CIAF (B-F)	849 (65.4)	897 (59.4)	1746 (62.1)	644 (60.4)	599 (58.2)	1243 (59.3)	1493 (63.1)	1496 (58.9)	2989 (60.9)

Values in parenthesis indicate percentages

A- Normal, B- Wasting only, C- Wasting and underweight, D- Wasting, stunting & underweight, E- Stunting & underweight, F- Stunting only and Y- Underweight only

Figure 4.1.8: Classification of Children with Anthropometric Failure (%)



B- Wasting only, C- Wasting and underweight, D- Wasting, stunting & underweight, E- Stunting & underweight, F- Stunting only and Y- Underweight only

age, education of parents, occupation of parents, type of family, religion) of the children were taken as the independent variables.

Factors significantly associated with Weight for Age Z scores – Multiple Regression Analysis

Three factors were found to exert an independent effect on the dependent variable Weight for Age Z scores **(Table 4.1.29).** Gender was the first factor to enter the equation and explained 0.8% of the variation seen in the weight for age z scores of the children. Religion entered on the second step and accounted for 0.2% of the variation. Type of family was the third variable entered and again explained 0.2% of the variation. All the factors together explained 98.2% of the variability. Gender (r=0.09) had the strongest correlation followed by type of family (r=0.54) and religion (r=0.51).

Factors significantly associated with Height for Age Z scores – Multiple Regression Analysis

Three factors entered in the model when Height for Age Z scores was taken as dependent variable. Age was the first factor to enter the model explaining 0.3% of the variability. Second factor to enter the model was Education of father and accounted for 0.2% of the variation seen. Last factor to enter the model was Religion and explained 0.1% of the variation seen. All the factors together explained 0.6% of the variability **(Table 4.1.30)**.

Factors significantly associated with BMI for Age Z scores – Multiple Regression Analysis

On carrying multiple regression analysis taking BMI for Age Z scores as dependent variable, three factors were found to influence as independent factor. Gender was the first factor to enter the equation, explaining 1.8% of the variation observed. Age entered on the second step and accounted for 0.9% of the variation. Religion entered the third step accounting for 0.4% of the variation. Together 3.1% of the variation was seen with the three factors **(Table 4.1.31)**.

Table 4.1.29: Factors significantly associated with Weight for Age Z scores – Multiple Regression Analysis

Variable	Adjusted R2	SE	Variation Explained	"F" value	Pearson Correlation
Gender	0.008	1.03	0.8	19.725***	0.091***
Religion	0.010	1.03	0.2	13.001***	0.051**
Type of Family	0.012	1.03	0.2	10.660***	0.054**

Table 4.1.30: Factors significantly associated with Height for Age Z scores – Multiple Regression Analysis

Variable	Adjusted R2	SE	Variation Explained	"F" value	Pearson Correlation
Age (years)	0.003	1.03	0.3	12.604***	-0.055***
Education of Father	0.005	1.03	0.2	10.758***	-0.040**
Religion	0.006	1.02	0.1	9.789***	0.047**

Table 4.1.31: Factors significantly associated with BMI for Age Z scores – Multiple Regression Analysis

Variable	Adjusted R2	SE	Variation Explained	"F" value	Pearson Correlation
Gender	0.018	1.08	1.8	76.362***	0.134***
Age	0.027	1.07	0.9	59.329***	-0.107***
Religion	0.031	1.07	0.4	45.235***	0.067***

Thus, multiple regression analysis found that gender, age, religion, education of father and type of family acts as independent variables affecting the nutritional status of the children.

Haemoglobin Levels of Children

Haemoglobin estimations were carried out on 1220 children from standard 4th, 5th, and 6th. Overall the mean haemoglobin of children was 10.2g/dl. Gender wise comparison showed that the mean haemoglobin level for boys (10.4g/dl) was significantly higher than girls (10.1g/dl) **(Table 4.1.32).** When the mean haemoglobin level was analyzed across the age, it was found that the mean haemoglobin levels of the children were almost similar in all the age groups and was below normal, except at the age of 7 years, where the haemoglobin level was found to be normal (11.8g/dl). It was also observed that the mean haemoglobin levels of girls were lower than boys in the age group of 12 – 14 years and significantly lowest at 13 years of age.

Prevalence of Anaemia

According to the WHO classification which is age specific, 90% of the children were found to be anaemic **(Figure 4.1.9)**. Further categorization revealed that majority of the children (74.1%) suffered from moderate anaemia, followed by mild anaemia (12.9%). It was seen that only 3.0% of the children were severely anaemic **(Table 4.1.33)**.

Severity of Anaemia Based on Age and Gender

One way ANOVA revealed that less number of children were anaemic at seven years as compared to other age group and the mean difference was statistically significant. High percentage of moderate anaemia in the age group of 10 – 12 years was seen. The prevalence of moderate anaemia ranged from 73% to 77%

Table 4.1.32: Mean Hemoglobin Levels of the Children cross Tabulated by Age and Gender (Mean±SD, g/dl)

AGE GROUP (YEARS)	BOYS		GIRLS		TOTAL		
	N	Mean±SD	N	Mean±SD	N	Mean±SD	"t" value
7-7.11	1	11.5±0.0	3	11.9±1.2	4	11.8±1.0	0.326
8-8.11	58	10.4±0.8	89	10.0±0.8	143	10.1±0.9	3.259**
9-9.11	164	10.3±0.9	140	10.2±1.0	304	10.2±1.0	0.898
10-10.11	174	10.4±1.1	205	10.1±1.1	379	10.2±1.1	2.642**
11-11.11	122	10.4±1.0	104	10.1±1.0	226	10.2±1.0	1.954
12-12.11	47	10.3±1.0	56	9.9±1.5	103	10.1±1.3	1.781
13-13.11	21	10.9±0.8	15	9.2±1.8	36	10.2±1.5	3.611**[EVNA]
14-14.11	7	10.2±0.7	5	9.8±0.9	12	10.0±0.8	0.972
15-15.11	3	10.3±0.8	3	10.6±0.7	6	10.4±0.7	0.388
16-16.11	2	10.8±2.0	1	11.3±0.0	3	11.0±1.4	0.206
TOTAL	**599**	**10.4±1.0**	**621**	**10.1±1.1**	**1220**	**10.2±1.1**	**5.138*** **

*** - denotes P<0.001

't'value: Comparison between boys and girls

Figure 4.1.9: Prevalence of Anemia Among Children

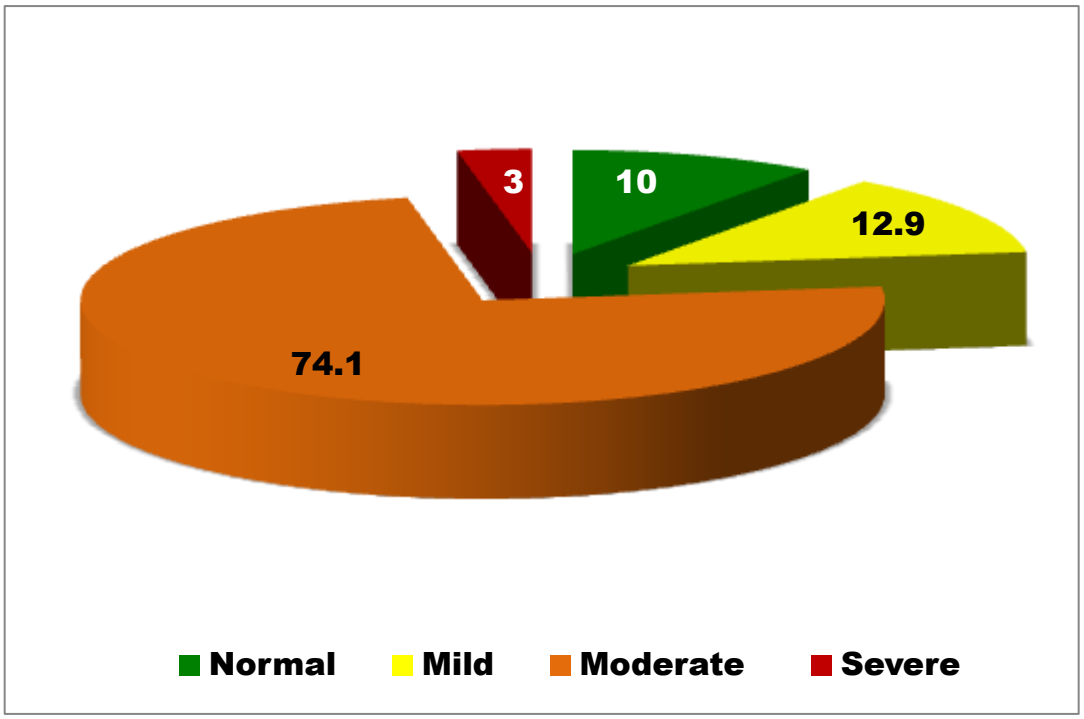


Table 4.1.33: Age wise % Prevalence of Anemia among Children

Anaemia Classification	Boys		Girls		Total	
	N (%)	CI	N (%)	CI	N (%)	CI
5-11 years	**(N=519)**		**(N=541)**		**(N=1060)**	
Normal	62 (11.9)	9.1-14.7	53 (9.8)	7.2-12.4	115 (10.8)	8.9-12.7
Mild	76 (14.6)	11.5-17.7	56 (10.3)	7.7-12.9	132 (12.4)	10.4-14.4
Moderate	370 (71.3)	67.3-75.3	416 (76.9)	73.3-80.5	786 (74.2)	71.5-76.9
Severe	11 (2.1)	0.8-3.4	16 (3.0)	1.5-4.5	27 (2.6)	1.6-3.6
12-16 years	**(N=80)**		**(N=80)**		**(N=160)**	
Normal	5 (6.2)	0.8-11.6	2 (2.5)	1.0-6.0	7 (4.4)	1.2-7.6
Mild	17 (21.3)	12.1-30.5	9 (11.3)	4.2-18.4	26 (16.2)	10.4-22.0
Moderate	58 (72.5)	62.5-82.5	60 (75)	65.3-84.7	118 (73.8)	66.8-80.8
Severe	0 (0)	0	9 (11.2)	4.1-18.3	9 (5.6)	2.0-9.2
Total	**(N=599)**		**(N=621)**		**(N=1220)**	
Normal	67 (11.2)	8.6-13.8	55 (8.9)	6.6-11.2	122 (10.0)	8.3-11.7
Mild	93 (15.5)	12.5-18.5	65 (10.5)	8.0-13.0	158 (12.9)	11.0-14.8
Moderate	428 (71.5)	67.8-75.2	476 (76.7)	73.3-80.1	904 (74.1)	71.6-76.6
Severe	11 (1.8)	0.7-2.9	25 (4.0)	2.4-5.6	36 (3.0)	2.0-4.0

Values in parenthesis indicate percentages

at 10 – 12 years. Thus at the age of 10 – 12 years both boys and girls had the maximum prevalence of moderate form of Iron Deficiency Anaemia **(Table 4.1.34) (Figure 4.1.10)**. While, Severe anaemia was more in children aged 12-16 yrs and all the severe anaemic were girls. Similar trends were seen in boys and girls. Girls were more anaemic than boys as shown in **Figure 4.1.11.**

The mean haemoglobin values and percent prevalence of anaemic are presented for all the children stratified into different degrees of nutritional status.

Using the three anthropometric indices, it was found that the mean haemoglobin levels were higher in children with Z score >-2 SD than in children with Z score ≤-2 SD indicating that the children belonging to the normal category had slightly higher mean haemoglobin levels as compared to the underweight and stunted children **(Table 4.1.35)**. Thus, with the severity of undernutrition the haemoglobin levels were compromised. The prevalence of anaemia was 92.4% in underweight children and 90.9% in stunted children, while it was 89.9% in thin children **(Table 4.1.36).** On comparing the nutritional status of the children with the prevalence of anaemia, no significant association was found between Underweight, Stunted and thin children with anaemia.

However, when gender wise comparison was done among anaemic children across their nutritional status, it was observed that the prevalence of anaemia was significantly higher among stunted girls as compared to the boys. While among boys, the prevalence of anaemia was significantly high with the prevalence of thinness **(Table 4.1.37).** Significant positive correlations were established between haemoglobin and weight, BMI, weight for age, height for age and BMI for age respectively. A significant negative correlation was seen between haemoglobin and gender **(Table 4.1.38).**

An attempt was also made to look into the prevalence of anaemia among children with anthropometric failure **(Table 4.1.39)**. It was seen that at any given severity of undernutrition, girls were more anaemic than boys especially

Table 4.1.34: Frequency Distribution of Haemoglobin among Children Cross Tabulated By Age (N,%)

AGE GROUP (YEARS)	N	≥11.5 g/dl	11-11.4 g/dl	8-10.9 g/dl	<8 g/dl
7-7.11	4	3 (2.4)	0 (0)	1 (0.1)	0 (0)
8-8.11	147	11 (9.0)	14 (8.9)	121 (13.4)	1 (2.8)
9-9.11	304	28(23.0)	35 (22.2)	234 (14.8)	7 (19.4)
10-10.11	379	45 (36.9)	57 (36.1)	264 (29.2)	13 (36.1)
11-11.11	226	28 (23.0)	26 (16.4)	166 (18.4)	6 (16.7)
	N	**≥12 g/dl**	**11-11.9 g/dl**	**8-10.9 g/dl**	**<8 g/dl**
12-12.11	103	4 (3.3)	13 (8.2)	80 (8.8)	6 (16.7)
13-13.11	36	2 (1.6)	9 (5.7)	22 (2.4)	3 (8.3)
14-14.11	12	0 (0)	1 (0.6)	11 (1.2)	0 (0)
15-15.11	6	0 (0)	2 (1.3)	4 (0.4)	0 (0)
16-16.11	3	1 (0.8)	1 (0.6)	1 (0.1)	0 (0)
Total	**1220**	**122**	**158**	**904**	**36**

Values in parenthesis indicate percentages

Figure 4.1.10:% Prevalence of Anemia among Children across the Age

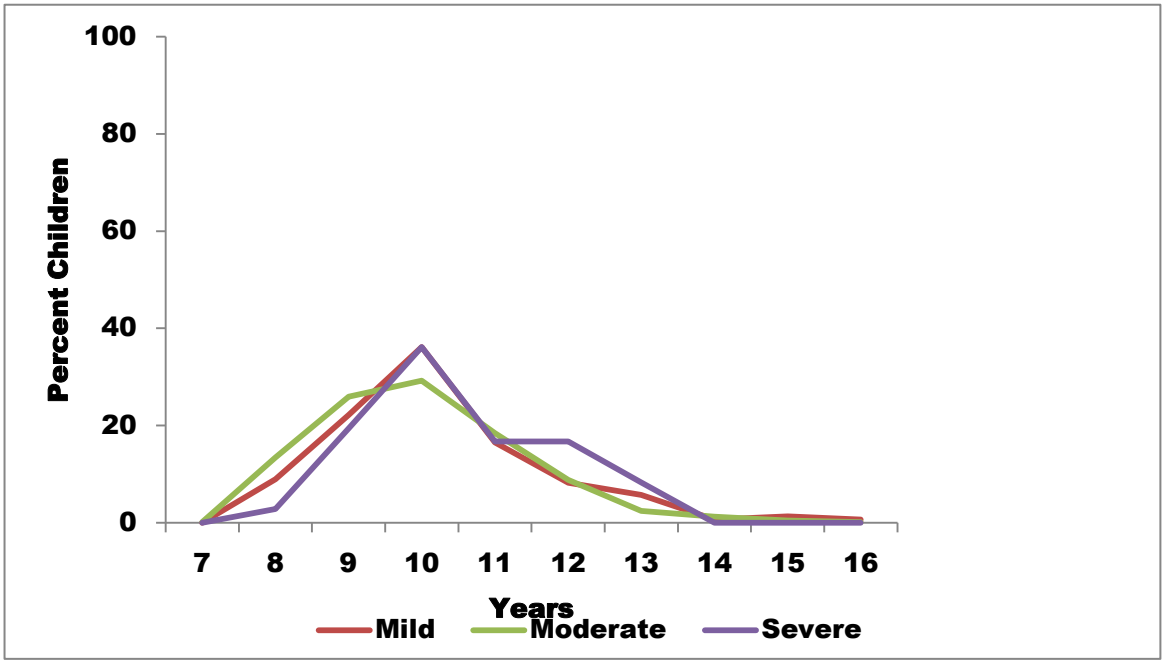
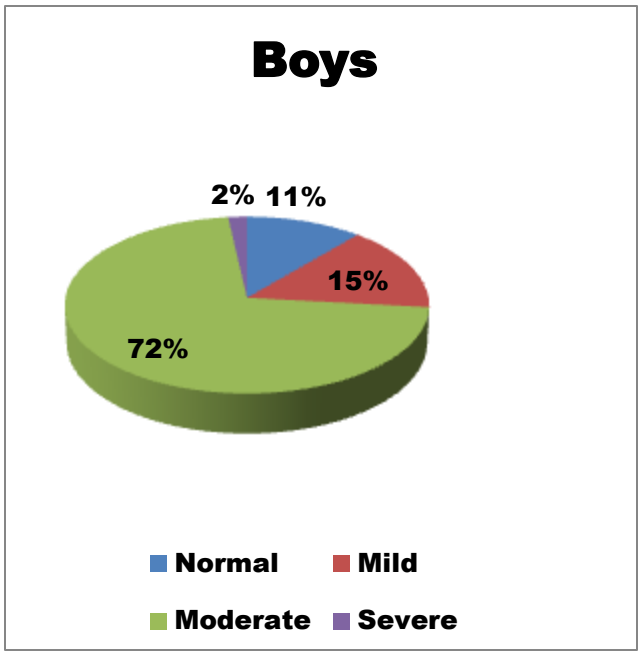


Figure 4.1.11:% Prevalence of Anaemia across the Gender



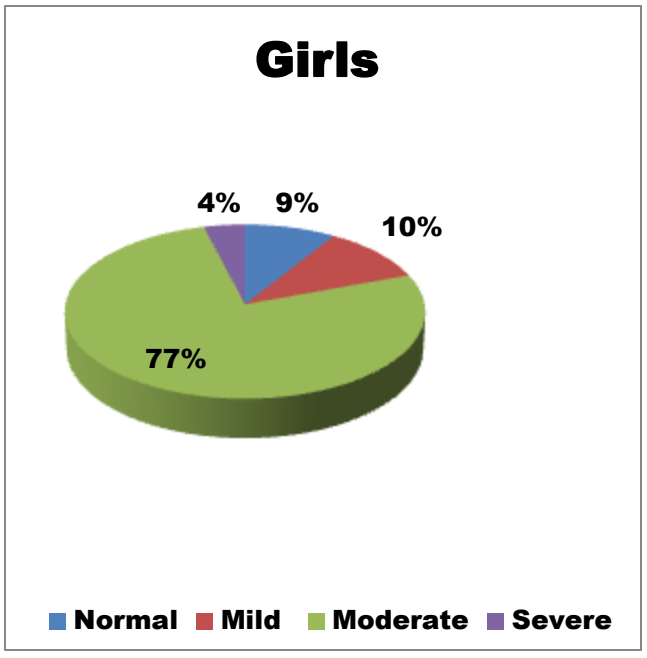


Table 4.1.35: Haemoglobin Levels Cross Tabulated with Nutritional Status of Children

Nutritional Status (Z Score)	N	Hemoglobin Levels (Mean ± SD)
WAZ		
Normal(≥-2SD)	1283	10.3±1.0
Underweight (<-2SD)	1006	10.1±0.9*[a]
Severe Underweight (<-3SD)	520	10.0±0.9* [b]
HAZ		
Normal(≥-2SD)	3044	10.2±1.1
Stunted (<-2SD)	1394	10.1±1.1
Severe Stunted (<-3SD)	465	10.1±1.2
BMIZ		
Normal(≥-2SD)	3265	10.2±1.1
Thinness (<-2SD)	1155	10.2±1.1
Severe Thinness (<-3SD)	483	10.1±1.0

The mean difference is significant between

- Normal Vs Underweight
- Normal Vs Severe Underweight

Table 4.1.36: Prevalence of Anaemia Cross Tabulated with Nutritional Status (N, %)

Nutritional Status	Normal	Anaemic	Total	Chi Square
Normal	29 (11.3)	228 (88.7)	257	1.82NS
Underweight	16 (7.6)	195 (92.4)	211	
Normal	85 (10.8)	703 (89.2)	788	0.80NS
Stunting	35 (9.1)	350 (90.9)	385	
Normal	75 (10.3)	653 (89.7)	728	0.01NS
Thinness	45 (10.1)	400 (89.9)	445	

Values in parenthesis indicates percentages

Table 4.1.37: Gender wise Prevalence of Anaemia across the Nutritional Status (%)

Nutritional Status	Boys	Girls	Total	Chi Square
WAZ				
N	207	216	423	
Normal	13.0 (27)	18.5 (40)	15.8 (67)	
Grade I	38.7 (80)	37.5 (81)	38.1 (161)	1.66NS
Grade II	34.3 (71)	28.7 (62)	31.4 (133)	3.03NS
Grade III	14.0 (29)	15.3 (33)	14.7 (62)	0.54NS
HAZ				
Normal	29.7 (151)	21.7 (118)	25.5 (269)	
Grade I	39.7 (202)	42.6 (232)	41.2 (434)	6.100*
Grade II	24.2 (123)	26.3 (143)	25.3 (266)	5.22*
Grade III	6.5 (33)	9.4 (51)	8.0 (84)	7.26**
BMIZ				
Normal	20.6 (105)	30.0 (163)	25.5 (268)	
Grade I	37.1 (189)	36.0 (196)	36.6 (385)	6.26*
Grade II	29.5 (150)	23.9 (130)	26.6 (280)	11.37***
Grade III	12.8 (65)	10.1 (55)	11.4 (120)	7.34**

Values in parenthesis indicates number

Chi square was calculated across Normal Vs Undernourished

Table 4.1.38: Correlation between Haemoglobin and different variables

Correlation between Hemoglobin and variables	Correlation Co-efficient
Age	-0.00
Gender	-0.13**
Weight (Kgs)	0.07*
Height (cms)	0.05
BMI (Kg/m^2)	0.07*
Weight for Age (WAZ)	0.15**
Height for Age (HAZ)	0.09**
BMI for Age (BMIZ)	0.07*

Table 4.1.39: Prevalence of Anaemia cross tabulated by CIAF and age wise for Total Number of Children

	<10 years				≥10 years				Combined			
	Normal	Mild	Moderate	Severe	Normal	Mild	Moderate	Severe	Normal	Mild	Moderate	Severe
A	19	30	154	3	32	49	189	8	51	79	343	11
B	6	3	19	1	21	23	116	8	27	26	135	9
C	6	5	62	1	-	-	-	-	6	5	62	1
D	0	4	41	2	12	16	95	4	12	20	136	6
E	9	3	44	1	-	-	-	-	9	3	44	1
F	4	0	17	1	10	14	102	6	14	14	119	7
Y	1	4	28	0	-	-	-	-	1	4	28	0
Total CIAF (B-F)	26 (5.6)	19 (4.1)	211 (45.1)	6 (1.3)	43 (6.1)	53 (7.5)	313 (44.4)	18 (2.5)	69 (5.9)	72 (6.1)	524 (44.7)	24 (2.0)

A- Normal, B- Wasting only, C- Wasting and underweight, D- Wasting, stunting & underweight, E- Stunting & underweight, F- Stunting only and Y- Underweight only

Values in parenthesis indicate percentages

moderate and severe anaemia. Age wise data revealed that children aged more than 10 years had higher prevalence of anaemia. Moderate and severe form of anaemia was higher in this age group.

Morbidity Profile

The data on morbidity profile showed that 27.8% of the children reported morbidities of various types in the last fifteen days of the interview **(Table 4.1.40)**.

The prevalence of morbidities was found to be higher in girls (31.9%) as compared to the boys (23.3%).

Fever was the most common morbidity found in 37.2% of the children followed by cough and cold (30.8%). About 8% of the children reported that they had stomach ache. Headache, toothache, vomiting, diarrhoea, and malaria were also prevalent but in a small number of children. About 4.7% of the children reported having other morbidities such as chickenpox, ear-pain, pain in limbs, measles, jaundice, chest pain etc.

Majority of the children (78.3%) reported that the period of illness was less than 5 days. Only around 12% of the children had morbidities for 6-10 days. A few children (2.6%) had longer period of illness (11-15 days) and 6.6% of the children did not remember the period of illness.

Morbidity pattern was seen among undernourished and anaemic children **(Table 4.1.41)** and it was found that the prevalence of morbidities was significantly associated with underweight children indicating that moderate and severe underweight children were having more morbidity as compared to healthy children. No significant association was found among stunted, thin and anaemic children.

Table 4.1.40: Morbidity Profile of the children

	Health Problem	Boys (N=1991)	Girls (N=2163)	Total (N=4154)
	Yes	464 (23.3)	689 (31.9)	1153 (27.8)
	No	1527 (76.7)	1474 (68.1)	3001 (72.2)
	Type of illness			
1	Cough & cold	166 (35.8)	189 (27.4)	355 (30.8)
2	Headache	32 (6.9)	59 (8.6)	91 (7.9)
3	Fever	159 (34.3)	270 (39.2)	429 (37.2)
4	Stomachache	39 (8.4)	58 (8.4)	97 (8.4)
5	Vomiting	23 (4.9)	39 (5.7)	62 (5.4)
6	Diarrhoea	14 (3.0)	25 (3.6)	39 (3.4)
7	Toothache	3 (0.6)	3 (0.4)	6 (0.5)
8	Malaria	6 (1.3)	6 (0.9)	12 (1.0)
9	Other illness	22 (0.9)	40 (5.8)	62 (5.4)
	Period of illness			
1	1-5 days	340 (73.3)	563 (81.7)	903 (78.3)
2	6-10 days	63 (13.6)	81 (11.8)	144 (12.5)
3	11-15 days	16 (3.4)	14 (2.0)	30 (2.6)
4	Don’t know	45 (9.7)	31 (4.5)	76 (6.6)

Values in parenthesis indicates percentage

Table 4.1.41: Morbidity Pattern among Undernourished and Anaemic Children (N,%)

Health Problem	Yes		No	
	N	%	N	%
Underweight				
Normal	118	15.8	221	13.6
Mild	213	28.5	556	34.2
Moderate	299	39.9	549	33.7
Severe	118	15.8	301	18.5
Chi-Square	54.348***			
Stunting				
Normal	267	23.2	717	23.9
Mild	457	39.6	1158	38.6
Moderate	325	28.2	854	28.5
Severe	104	9.0	272	9.1
Chi-Square	0.449			
Thinness				
Normal	336	29.1	851	28.4
Mild	437	37.9	1138	37.9
Moderate	269	23.3	714	23.8
Severe	111	9.6	298	9.9
Chi-Square	0.332			
Anaemic				
Normal	27	9.7	87	10.4
Mild	32	11.6	115	13.7
Moderate	209	75.5	611	73.0
Severe	9	3.2	24	2.9
Chi-Square	7.381			

Prevalence of Severe Acute Malnutrition

WHO defines Severe acute malnutrition (SAM), as severe wasting/thinness (weight for height < –3 z-scores or < 70% of the median National Center for Health Statistics/World Health Organization [NCHS/WHO] reference) and/or the presence of nutritional oedema. It is a life-threatening condition requiring urgent treatment. The prevalence of severe undernutrition is of growing concern (UNICEF).

In the present study, the prevalence of SAM was 9.9% (n=483) by WHO (2007) standards **(Figure 4.1.12)**. Out of 483 children, 308 were boys and 175 were girls. The mean weight, height and BMI of SAM children were 20.1kgs, 126.7cm and 12.3kg/m^2 respectively as shown in **Table 4.1.42**. The mean weight, height and BMI of both boys and girls showed an increasing trend with age. However, at 10 years of age, there was a drop seen in mean weight, height and BMI of boys. Overall, the mean weight and BMI of boys was significantly higher than girls. The mean height of boys and girls were comparable **(Table 4.1.43).** Thus, indicating that the prevalence of severe thinness was more in girls as compared to boys. Age wise data revealed that highest prevalence of severely thin children was seen among 10 – 12 year old children **(Figure 4.1.13)**

Prevalence of undernutrition of severely thin children is given in **Table 4.1.44**. The prevalence of undernutrition was assessed using the 2 indices WAZ and HAZ. The prevalence of severe underweight and stunting was 73.3%, 15.3% respectively.

Morbidity Profile

Morbidity profile for the reference period of 15 days of the school children is given in **Table 4.1.45.** The data showed that 27% of the children were suffering from morbidity, predominantly from fever (40.5%) and cough and cold (24.3%). The duration of morbidity in majority (78.3%) of the children ranged from 1-5 days.

Figure 4.1.12: Prevalence of Severe Acute Malnutrition in Boys & Girls

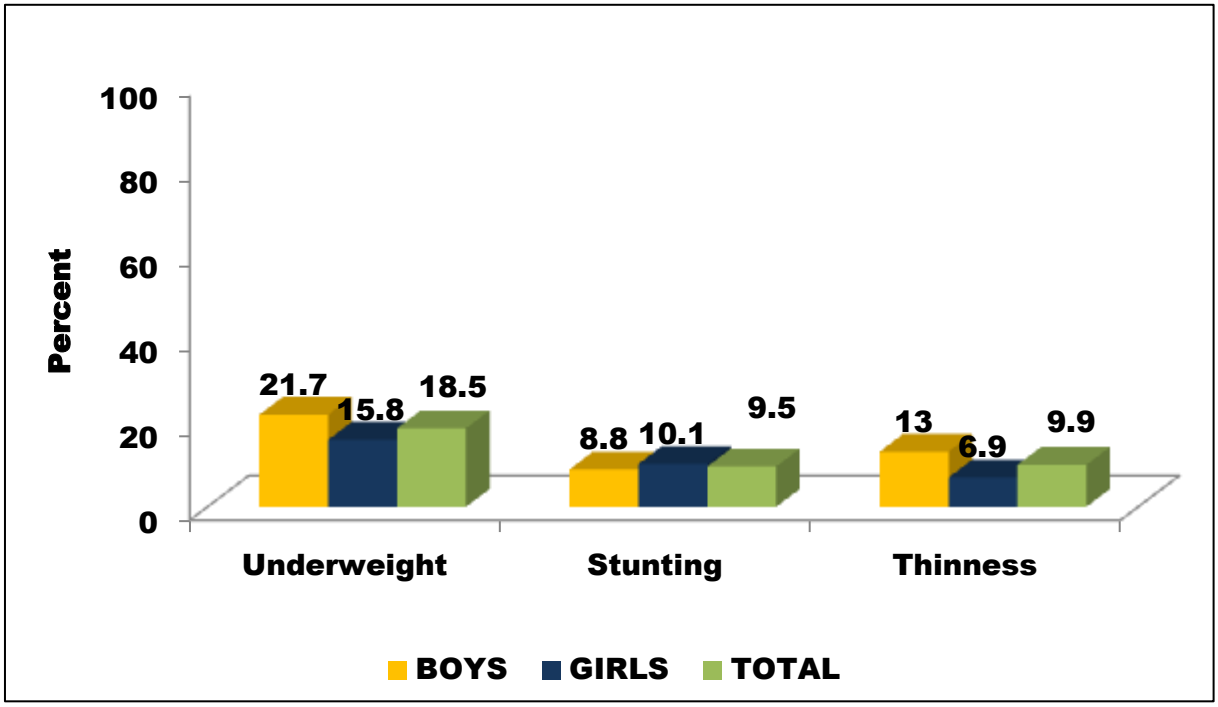


Figure 4.1.13: Age wise Prevalence of SAM (Severely Thin) Children

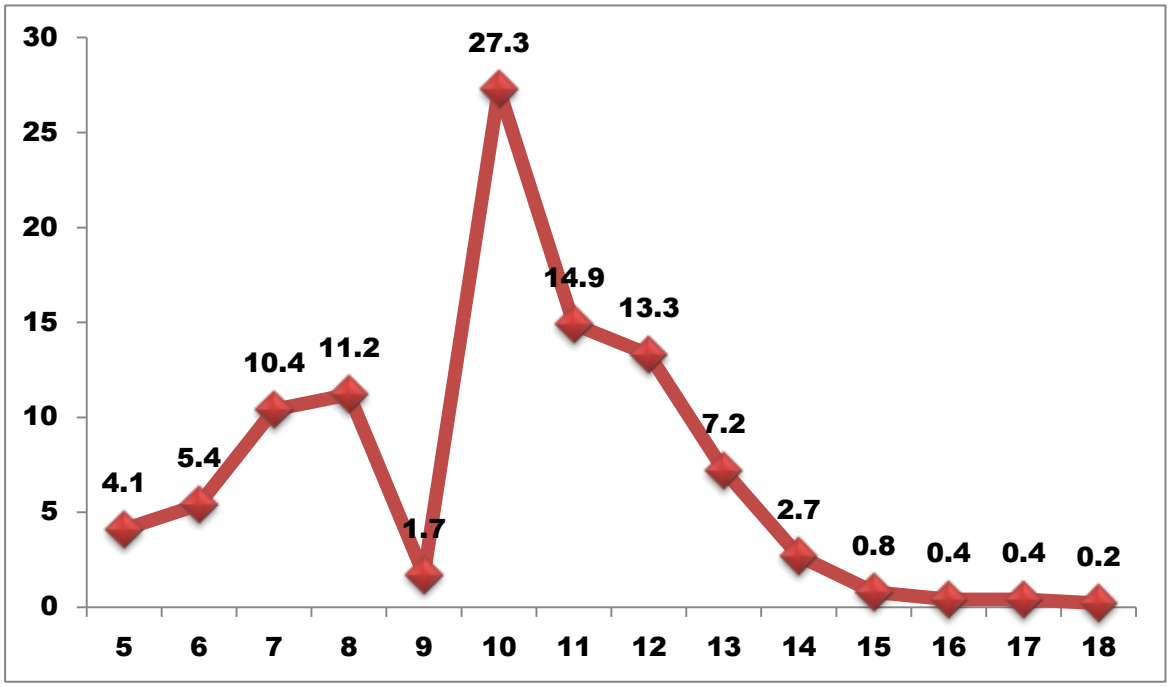


Table 4.1.42: Mean Weight, Height, BMI of SAM Children (Mean±SD)

Age (yrs)	Weight (Kg)	Height (cm)	BMI (Kg/m^2)
5	12.9±1.5	105.9±5.9	11.46±0.5
6	14.8±2.8	112.1±9.1	11.71±0.4
7	15.1±1.6	113.1±5.2	11.76±0.5
8	16.1±1.8	117.7±6.2	11.62±.6
9	19.7±3.4	127.3±8.8	12.04±0.7
10	19.3±2.3	126.4±6.7	12.05±0.5
11	22.2±2.6	132.5±7.2	12.57±.5
12	24.1±2.9	136.6±7.4	12.87±0.5
13	27.1±3.1	142.8±6.6	13.23±0.7
14	26.9±2.6	140.7±4.8	13.56±0.6
15	29.9±5.6	148.4±11.1	13.45±0.7
16	33.0±5.7	150.8±13.8	14.48±0.2
17	34.4±2.7	153.8±5.3	14.54±0.1
18	32.0±0.0	150.0±0.0	14.22±0.0
Total	**20.1±4.9**	**126.7±12.5**	**12.3±0.8**

Table 4.1.43: Mean Weight, Height, BMI of SAM Children Cross Tabulated By Age and gender (Mean±SD)

Age (Yr)	Boys			Girls		
	Weight (Kg)	Height (cm)	BMI (Kg/m^2)	Weight (Kg)	Height (cm)	BMI (Kg/m^2)
5-5.11	13.2±1.2	106±5	11.7±0.4**	12.4±1.7	106±7	11.1±0.6
6-6.11	15.5±2.7*	114±9*	11.9±0.3**	12.5±1.8	106±7	11.2±0.4
7-7.11	15.5±1.3**	114±5	11.9±0.4***	14.3±1.6	112±6	11.4±0.3
8-8.11	16.0±1.7	116±6	11.9±0.3***EVNA	16.2±1.9	119±6	11.4±0.6
9-9.11	21.0±2.6	130±7	12.4±0.4	17.4±3.7	122±11	11.5±0.8
10-10.11	19.6±2.2	126±6	12.2±0.5***	18.9±2.5	126±8	11.7±0.5
11-11.11	22.3±2.5	133±7	12.7±0.5*	21.8±2.6	132±8	12.4±0.5
12-12.11	24.3±2.8	137±7	12.9±0.5EVNA	23.8±3.2	136±8	12.8±0.3
13-13.11	27.2±3.0	142±7	13.4±0.5**EVNA	26.4±4.0	144±7	12.6±0.9
14-14.11	26.7±2.7	140±5	13.5±0.6	28.2±2.4	142±6	14.0±0.0
15-15.11	29.8±6.9	148±13	13.5±0.9	30.0±0	151±0	13.2±0.0
16-16.11	33.0±5.7	151±14	14.5±0.2	–	–	–
17-17.11	34.4±2.7	154±5	14.5±0.1	–	–	–
18-18.11	32.0±0.0	150±0	14.2±0	–	–	–
Total	**20.7±5.0*** **	**128±12**	**12.5±0.7*** **	**19.1±4.7**	**125**	**11.9±0.8**

* - denotes P<0.05 ** - denotes P<0.01 *** - denotes P<0.001

EVNA –Equal Variance Not Assumed
't' test between boys and girls

Table 4.1.44: Prevalence of Under Nutrition (Z-score) in Severely Thin Children (N,%)

CATEGORY	BOYS		GIRLS		TOTAL		CI at 95%
	N	%	N	%	N	%	
WAZ	**(N=130)**		**(N=91)**		**(N=221)**		
NORMAL	5	3.8	6	6.6	11	5.0	2.1-7.9
UNDER-WEIGHT	32	24.6	16	17.6	48	21.7	16.2-27.2
SEVERE	93	71.5	69	75.8	162	73.3	67.3-79.3
HAZ	**(N=308)**		**(N=175)**		**(N=483)**		
NORMAL	165	53.6	79	45.1	244	50.5	46.0-55.0
STUNTED	102	33.1	63	36.0	165	34.2	29.9-38.5
SEVERE	41	13.3	33	18.9	74	15.3	12.0-18.6

Table 4.1.45: Morbidity Profile of the SAM children

	Health Problem	Boys (N=254)	Girls (N=153)	Total (N=407)
	Yes	56 (22.0)	55 (35.9)	111 (27.3)
	No	198 (78.0)	98 (64.1)	296 (72.7)
	Type of illness			
1	Cough & cold	16 (28.6)	11 (6.320.0)	27 (24.3)
2	Headache	3 (5.4)	7 (12.7)	10 (9.0)
3	Fever	23 (41.1)	22 (40.0)	45 (40.5)
4	Stomachache	5 (8.9)	6 (10.9)	11 (9.9)
5	Vomiting	3 (5.4)	2 (3.6)	5 (4.5)
6	Diarrhoea	1 (1.8)	3 (5.5)	4 (3.6)
7	Toothache	2 (3.6)	0 (0.0)	2 (1.8)
8	Malaria	1 (1.8)	1 (1.8)	2 (1.8)
9	Other illness	2 (3.6)	3 (5.5)	5 (4.5)
	Period of illness			
1	1-5 days	42 (75.0)	45 (81.8)	87 (78.3)
2	6-10 days	7 (12.5)	6 (10.9)	13 (11.7)
3	11-15 days	4 (7.1)	0 (0.0)	4 (3.6)
4	Don't know	3 (5.4)	4 (7.3)	7 (6.3)

Values in parenthesis indicates percentage

The prevalence of morbidity was more among girls as compared to their counterparts.

Prevalence Of Anaemia

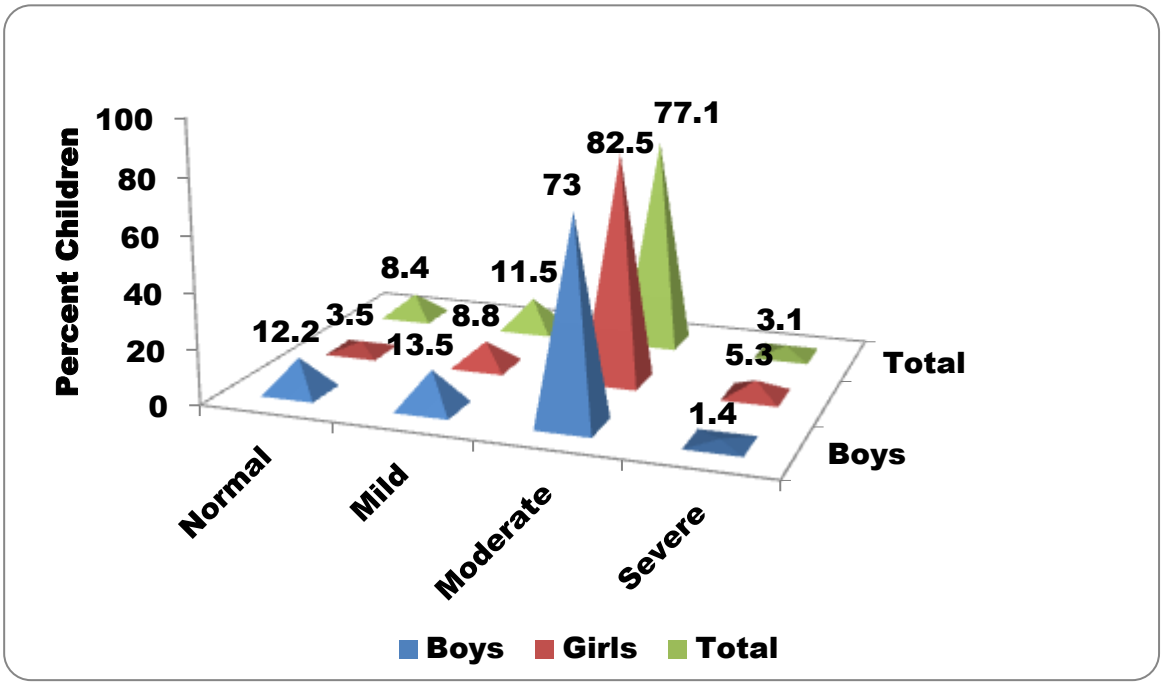
The mean haemoglobin level among SAM children was 10.1g/dl as shown in **Table 4.1.46.** The mean haemoglobin level of boys (10.3g/dl) was significantly higher than girls (9.9g/dl). Age wise data revealed that the mean haemoglobin level was lowest at 12 years of age. **Figure 4.1.14.** shows the prevalence of anaemia among severely thin children. The prevalence of anaemia has been calculated using WHO cut-off according to age group. Majority (77.7%) of the children were moderately anaemic and 11.5% were mildly anaemic. Only around 8.4% of children were normal while 3.1% were severely anaemic. The prevalence of moderate and severe anaemia was more among girls as compared to the boys.

Table 4.1.46: Mean Hemoglobin levels among SAM Children cross tabulated by Age

Age (yr)	BOYS		GIRLS		Total	
	N	Mean±SD	N	Mean±SD	N	Mean±SD
8	2	09.8±0.2	9	10.0±0.6	11	09.9±0.5
9	3	10.4±1.2	1	10.2±0.0	4	10.4±1.0
10	40	10.3±1.0	27	09.9±0.8	67	10.1±1.0
11	12	10.5±1.0	9	10.3±1.1	21	10.4±1.0
12	11	09.8±0.7	9	09.7±1.2	20	09.8±0.9
13	3	11.1±0.3*	1	07.8±0.0	4	10.2±1.7
14	1	11.1±0.0	-	-	1	11.1±0.0
15	1	09.5±0.0	1	11.0±0.0	2	10.2±1.1
16	1	12.2±0.0	-	-	1	12.2±0.0
TOTAL	74	10.3±1.0*	57	09.9±0.9	131	10.1±1.0

* - denotes P<0.05 ** - denotes P<0.01 *** - denotes P<0.001
't' test between boys and girls

Figure 4.1.14: Prevalence of Anemia among SAM Children



HIGHLIGHTS

- **Majority of the children were Hindus and equal distribution of boys (48%) and girls (52%) was seen in the study population.**
- **The majority of the fathers were occupied in service and mothers were housewives.**
- **Approximately 50% of the children consumed MDM food daily. The most food item liked was Dal and Rice while the most disliked item was Dudhi Chana and Masala Roti.**
- **The mean weight and height of boys was higher than that of girls. Mean BMI of girls was higher than that of boys.**
- **All the three anthropometric indices showed the prevalence of undernutrition to be very high. The prevalence of underweight was around 61%, stunting was 38% and thinness was 40% by CDC standards. According to WHO standards, the prevalence of underweight was 54%, stunting 38% and thinness was 33%.**
- **The CDC standards reported higher percentage of children in Grade 3 for underweight and thinness as compared to WHO standards.**
- **The overall prevalence of undernutrition by CIAF was found to be 60.9%.**
- **The prevalence of SAM was 9.9% with higher prevalence seen among girls as well as among 10-12 year old children.**
- **Almost universal population i.e. 90% of the children was anaemic. The prevalence was predominantly of moderate anaemia.**
- **The mean hemoglobin levels were almost similar in all the age groups. The mean hemoglobin levels were higher in children with Z-score >-2 SD than in children in ≤-2 SD. Thus with the severity of undernutrition the hemoglobin levels were compromised.**
- **About 27.8% of the children reported morbidities.**

Discussion:

Globally, malnutrition, especially that affecting young children, is one of the foremost public health problem in developing countries. Growing children in particular are most vulnerable to its consequences. Hunger and undernutrition ruin children's health, undermine their learning abilities and impair their lives in many other ways (MDM Primer). Micronutrient malnutrition is also one of the burning problems in developing countries, out of which those of major public health significance are deficiency of one or more of the three micronutrients iron, iodine and vitamin A (Singh, Marwal, & Lakshminarayana, 2010). India is still suffering from a heavy burden of many micronutrient deficiencies and child undernutrition.

The frequency of malnutrition cannot be easily estimated from the prevalence of commonly recognized clinical syndromes, such as Kwashiorkor and Marasmus because these constitute syndromes only, the proverbial tip of iceberg. Cases with mild to moderate malnutrition are likely to remain unrecognized because clinical criteria for their diagnosis are imprecise and are difficult to interpret accurately (Hasan, 2010; Joseph, Rebello, Kullu, & Raj, 2002).

Anthropometry is the single most universally applicable, inexpensive, and non-invasive method available to assess the size, proportion and composition of human body (WHO, 1995); (Medhi, Barua, & Mahanta, 2006). Growth monitoring is universally used to assess nutritional status, health and development of individual children, and also to estimate overall nutritional status and health of populations (Srivastava et al., 2012). School health surveys give excellent chance to screen a huge number of paediatric populations with minimum resources (Bhandari & Shrestha, 2012). In the present study, the nutritional status of the children was assessed using CDC 2000 and WHO 2007 growth standards.

The results of the study showed that height, weight and BMI increase with age among both the boys and girls and followed a normal distribution in all the age groups except at 16-18 years where the sample size was very small. Boys were taller than girls across all age except for 12 years, where girls were significantly taller than boys. Girls become heavier than boys from 11 years; however, there is a crossing over (no difference) in weight at 15 years and from 16 years of age, the boys become heavier. There was no difference in mean BMI between boys and girls until 9 years of age and from 10 years onward, the mean BMI of girls at each age was higher compared with that of boys. Thus, the BMI curve of girls rises more steadily as compared with that of boys. These findings are similar to a study carried out in South – Western Nigeria and among urban school children in Guatemala (Groeneveld, Solomons, & Doak, 2007; Omigbodun et al., 2010) to assess the nutritional status of in-school adolescents.

A cross sectional study conducted to explore the nutritional status of school-age slum children 5 to 15 years in 3 urban slums of Bareilly district in UP, also showed that the mean height of girls was lower than that of the boys in all age groups except the 13-14 years old age group in which girls were taller than boys (Srivastava et al., 2012).

In the present study, the mean weight, height and BMI of school children were found to be significantly lower than WHO 2007 and CDC 2000 reference standards. Similar findings were also observed by Shariff et al in a study conducted among school children aged 6-10 years in Kuala Lumpur (Shariff, Bond, & Johson, 2000), Thekdi among school students of 11-15 years age group in Surendranagar district, Gujarat (Thekdi, Kartha, & Nagar, 2011), and Pakistani School Children aged 5-12 years (Mushtaq et al., 2012).

The major strength of this study is the large sample size covering a wide range of age group of 5-18 years among both genders, such that the height, weight and BMI followed a normal distribution curve at all ages except at 16-

18 years where the sample size was small. The limitation of this study is that it does not take into account the sexual maturity among adolescents.

Analysis of the nutritional status (weight-for-age, height-for-age, and BMI-for-age) shows significant differences among few age groups in both the gender. Adolescents (> 13 years of age) show the most severe form of undernutrition and formed the highest percentage of undernourished children. Boys present lower Z-scores than girls and there are higher percentages of undernutrition (thinness and underweight) among the boys which is also been documented by other studies carried out in various parts of the world (Goon et al., 2011); (Fetuga et al., 2011; Haboubi & Shaikh, 2009; Venkaiah et al., 2002). Linear growth retardation, or stunting, which is a manifestation of chronic malnutrition, was highly prevalent among girls. Conversely, girls tended to be more stunted (56.8%) compared to boys (48.4%) (Goon et al., 2011).

The fact that girls seemed to be more stunted and anaemic may be due to early pubertal maturation in girls than boys (Aboussaleh & Ahami, 2009). Sex differentials in the prevalence of stunting were also very marginal in other studies in India (Anand, Kant, & Kapoor, 1999; Medhi, Hazarika, & Mahanta, 2007; Venkaiah et al., 2002).

In the present study, the prevalence of underweight, stunting and thinness and especially to find the overall magnitude of undernutrition using the CIAF among 5-18 year old school children was studied in Municipal Schools of Vadodara city. It was observed that underweight (60.6%, 54.3%) was the most prevalent form of undernutrition in the study population followed by stunting (38.2%, 37.9%) and thinness (39.6%, 33.4%) using both CDC 2000 and WHO 2007 growth standards.

CDC standards overestimate the prevalence of underweight and thinness when compared to WHO growth standards among all ages and gender. When

looked in detail higher variation was seen in prevalence of severe degree of underweight and thinness.

Similar results were shown in a study conducted on Nutritional status of primary school children (6-10 years) from low income households in Kuala Lumpur by Shariff et al in the year 2000. Prevalence of underweight, stunting and wasting was 52%, 50% and 30% respectively (Shariff et al., 2000).

Overall, the prevalence of the mild category of thinness was higher with the WHO standard than with the CDC standard (38.2% vs. 34.2%), slight difference was observed for the moderate category of thinness with CDC standard (23.6% vs. 25.2%) and the prevalence of the severe category of thinness was lower with the WHO cut-offs than with the CDC standard (9.9% vs. 14.4%).

The advantages of the z-score system are that besides being sex specific and able to measure all the three indices, it allows comparison across indicators and countries. Since these indices do overlap, none of them is able to provide a comprehensive estimate of the number of undernourished children in a population. Therefore for a comprehensive measurement of overall prevalence of under nutrition there is a need of a single aggregate indicator which would incorporate all undernourished children be they stunted and/ or wasted and/or underweight. Such an aggregate indicator was proposed by development economist Peter Svedberg and was named CIAF i,e Composite Index of Anthropometric Failure. He suggested that children with wasting , stunting or who are underweight are all considered undernourished and are said to be in a state of anthropometric failure and thus proposed the new index i,e. CIAF. To these subgroups one more subgroup Y has been added by Nandy et al which represents children who are only underweight (Anjum, Pandit, Mir, & Bhat, 2012).

The overall prevalence of undernutrition by CIAF was found to be 60.9%. Thus, indicating that almost 2/3rd of the children were in a state of anthropometric failure i.e. stunted only, underweight only, wasted only,

wasted and underweight, stunted and underweight or stunted, wasted and underweight. The present study is the first of its kind to extend the use of CIAF to child groups aged 5 years to 18 years. The findings are similar to a study conducted by Jaydip Sen et al among Bengalee children aged 5-11 years, showing a high incidence of undernutrition (57.6%) among these children using the CIAF (Sen, Dey, & Mondal, 2011). Underweight (47%) was the most common form of undernutrition followed by Stunting (38.5%) and wasting (17.6%). However, the higher prevalence of all forms of undernutrition in boys observed in the present study was also in accordance with that observed by Jaydip Sen et al. Another study by Anjum et al observed a prevalence of 25.58% of CIAF in school going children (5-9 years aged) in Kashmir which is less that of the current study (Anjum et al., 2012).

Using the CIAF, a very high prevalence of undernutrition has been reported among children from different parts of the country. Mandal & Bose, (2009) (73.1%) in Hooghly District of West Bengal, Mukhopadhyay & Biswas, (2010) (69.1%) and Shit et al., (2012) (80.3%) in Bankura district of West Bengal, Das & Bose, (2009) (66.3%) in Purulia District of West Bengal, Sen & Mondal, (2012) (63.6%) in Darjeeling district of West Bengal, Anwar, Gupta, Prabha, & Srivastava, (2013) (62.5%) in rural Varanasi, Brahmbhatt et al., (2012) (98.2%) in Dakshina Kannada region of Karnataka, Deshmukh, Dongre, Sinha, & Garg, (2009) (59.6%) in rural Wardha, Seetharaman et al., (2007) (68.6%) in Tamilnadu and 32.7% in rural areas of West Bengal (Dasgupta et al., 2014). However, all these studies have been conducted among children aged up to 6 years.

Nutritional anaemia is a recognized public health problem throughout the world. In the present study high prevalence of anaemia (90%) was seen among school children. The anaemia was graded according to WHO standards. It showed that 12.9% were mildly anaemic, 74.1% were moderately anaemic and 3.0% were diagnosed as severely anaemic children.

Relatively few studies are published on the prevalence of anaemia among school children. Studies on prevalence of anaemia from different parts of

India, reported a prevalence of anaemia ranging from 16-96% among school children (Basu et al., 2005; Gawarika, Gawarika, & Mishra, 2006; Jain & Jain, 2012; Sabale, Kowli, & Chowdary, 2013). A multi-centric study carried out by Indian Council of Medical Research in 16 districts of 11 states, found the prevalence of anaemia among adolescent girls as high as 90.1% (Toteja et al., 2006). Another study conducted in 4 government schools in Ujjain city also reported high prevalence of anaemia as high as 96.5% (Gawarika et al., 2006).

The prevalence of anaemia was very much higher in girls (91.1%) when compared to boys (88.8%) as the mean haemoglobin between girls and boys was different and statistically significant. More than 50% of the school children were anaemic in each age group. Percent prevalence of severe anaemia was highest (11.2%) among girls aged 12-13 years of age.

Similar results were also reported by Gomber et al., (2003); Hettiarachchi et al., (2005); Gawarika, Gawarika, & Mishra, (2006); Sudhagandhi et al., (2011); Jain & Jain, (2012); Sabale, Kowli, & Chowdary, (2013); Bhise, Wadekar, & Tarpe, (2013).

In view of the findings, it is evident that occurrence of anaemia in undernourished children was more compared to nourished children, but a significant proportion of the apparently healthy children also suffered from iron deficiency anaemia suggesting that iron deficiency is widely prevalent in the community. A significant positive correlation exists between haemoglobin levels and weight, BMI, weight/age, height/age and BMI/age respectively.

Many Studies have reported that children living in lower socio-economic status are more likely to have lower haemoglobin status (Basu et al., 2005; Gawarika et al., 2006; Hashizume et al., 2003), which is in agreement with the present study.

Since the onset of the obesity epidemic, prevalence rates of thinness decreased. However, we found a small but persistent group of extremely thin

children. Thinness in school children and adolescents is largely under studied, contrasting with the vast amount of literature on infant malnutrition and a current focus on overweight in children and adolescents (Bovet et al., 2011; Schonbeck et al., 2014). The prevalence of severe thinness also known as Severe Acute Malnutrition (SAM) in the present study was nearly 10%. The prevalence of SAM cannot be ignored as it too has its implications not only on the child's nutritional status but also on their cognitive development. The study also focused on gender and age differentials among the SAM children. It was found that the prevalence of severe thinness was more in girls as compared to boys. Age wise highest prevalence was seen among 10 – 12 year old children.

Goon et al., (2011) found that high prevalence of both chronic and acute malnutrition was observed in 9 to 12 years old children attending public primary schools in Makurdi, which are unexpected from an urban region. However, the fact is that most of the children attending primary school in this region are from relatively low socio- economic background. Therefore, the low socio-economic background of these children suggests that factors such as education, occupation and economic status of parents may also account for the high prevalence of under nutrition among our study (Musa, Ali, Musa, & Khan, 2013).

A high prevalence of malnutrition both chronic and recent in nature coupled with high prevalence of anaemia among school children of Vadodara indicates that school health is an important aspect of essential public health program but has received little attention, as most of the focus is on under-five children. Though intervention among under-five is important, equally important is the nutrition program for school children. Only nutrition program catering to this age group is Mid Day Meal Programme which needs to be strengthened. As high prevalence rates of anaemia was seen among both boys and girls, it implies that along with girls, boys should also be targeted for control of anaemia. For Anaemia control program, regular IFA supplementation along with de-worming tablets should be given to primary school children.

Another area of concern is out of school children such as street children, school drop outs or migratory population as not much information is available about their nutritional status. UNESCO 2012 data reveals that about 1.4 million children out of 58 million out of school children belong to India and are girls.

PHASE II: PROCESS EVALUATION

Phase II represents process evaluation of Mid Day Meal Programme in urban municipal schools of Vadodara covered by the The Akshaya Patra Foundation (TAPF) and has been divided into two sections:

a) Evaluation of The Akshaya Patra kitchen
b) Spot observations in the Schools

EVALUATION OF THE AKSHAYA PATRA KITCHEN

The Mid-Day meal Programme has been strengthened with the interventions of Private and corporate Partnerships. One such example is TAPF mid-day meal programme which is unique in its approach, because technology is extensively used to minimize cost, time and labour and also to deliver most nutritious and hygienic food. The food is cooked in a centralized kitchen, and distributed through custom-built vehicles to schools. The centralized kitchen facilities have been designed and built by TAPF management, which reduce the human handling and also ensure very high standards of hygiene and cleanliness. The systems of mechanized steam- heated cauldrons also expedite the large scale cooking process. The cooked food is packed into stainless steel containers and loaded into insulated vehicles. The food is transported to the schools located within a radius of 50 km from the kitchen.

In order to improve the nutritional status of municipal school children of Vadodara, (TAPF) has set up a centralized kitchen which is operational since 5th November'2009.

In the present study, for the evaluation of the centralized kitchen, observations were done once every month. A structured observation checklist was used in order to record the detailed process of procurement, meal preparation, manpower, storage, kitchen, delivery system, infrastructure, sanitation and hygiene, cooking process, packing and delivery.

The kitchen evaluation is discussed under the following heads:

1. Infrastructure facilities
2. Machinery and equipments
3. Storage facilities
4. Manpower
5. Sanitation and Hygiene
6. Food Handling
7. Menu
8. Cooking process
9. Transportation
10. Quality Analysis

1) Infrastructure facilities

As TAPF caters to a large population of children at one point of time, for which the centralized kitchen has been well developed. The centralized kitchen of Akshay Patra has eight rooms, comprising of the cooking area, storage area, cleaning, and washing area **(Table 4.2.1)**. Basic supplies in kitchen such as running water, drinking water and good ventilation facilities were available.

2) **Machinery and equipments**

A number of machineries are available in the Akshay Patra kitchen like Rice cauldrons/cookers, Dal cauldrons/cookers, Vegetable cutters, High speed vegetable peeler, Vegetable washing machine, Rice cleaning machine (aspirator), Masala grinder, Dough maker, Roti making machine, Sukhadi making machine, Vegetable crates, steam boilers, Digital weighing machines, Rice silo for storage of cleaned rice and SS – 304 insulated vessels for serving **(Table 4.2.2; Figure 4.2.1 – 4.2.9).**

Table 4.2.1: Infrastructure facilities in the kitchen

Infrastructure Facilities	Number of Rooms
Cooking area	2
Store area	5
Cleaning area	1
Dispatch area	Open area
Total Rooms	**8**

Table 4.2.2: Machines available at centralized kitchen

Machines	Quantity
Rice Cookers/Cauldrons	5
Dal Cookers/Cauldrons	3
Dough Maker	4
Roti Making Machine	2
Vegetable Cutter	1
Vegetable Washer	1
Steam Boiler	2
Sukhadi Making Machine	1
Rice Cleaning Machine	1
Grains Silo	2

Figure 4.2.2: Dough Maker

Figure 4.2.2: Sukhadi Maker

Figure 4.2.3: Vegetable Cutter

Figure 4.2.4: Dal Couldron

Figure 4.2.5: Rice Cleaning Machine

Figure 4.2.6: Rice Couldron

Figure 4.2.7: Roti Making Machine

Figure 4.2.8: Masala Grinder

Figure 4.2.9: Vegetable Washer

Basically the large number of machinery was available in order to:

- Facilitate cooking process
- Prepare food in bulk
- Minimize cooking time
- To provide similar end products to children

The kitchen is well-equipped with Reverse Osmosis (RO) Plant. The RO purified water is used for cooking the food. Water softeners are also used. The other important facilities found in the Akshay Patra Kitchen were boilers generating steam which not only ensures that the cooking is safe, retains the nutrition of the ingredients used, but also makes the process totally hygienic. Secondly the steam jet sanitizer is used for cleaning of utensils, and plastic curtains. These would help in preventing contamination and are very important from food safety point of view. The kitchen also had provision of exhaust fans in each room. In order to store the cooked food, insulated vessels of 3 different capacities (big, medium, small) were available. This would help to keep the food warm during the process of transportation by sophisticated mobile vans.

3) Storage facilities

Wheat and rice are provided free of cost to all schools by Government of India and were kept in a well labeled room. The bags were kept according to the date of the receipt of the food-grain in the store. The older food grains were utilized first to ensure that the quality of food grains was not deteriorated. A variety of materials were used for storage of foods. None of the food items were kept open. Vegetable crates were used for storing of vegetables. Sacs were used for storing rice, wheat and dals and were placed on raised platforms in order to avoid contamination. The sacs were arranged neatly in bulk **(Figure 4.2.10)**. Rice was cleaned with the help of rice cleaning machine (aspirator) and cleaned rice was stored in rice silo. Dal was cleaned manually and stored in dal silo.

Figure 4.2.10: Storage Facilities

Masalas

Wheat Flour

Jaggery

Vegetables

Jaggery was stored properly by wrapping it with plastic material. To prevent from adulteration, all the masalas such as red chili, turmeric were grinded in the grinders and were kept in airtight plastic containers. Thus, good storage practices were followed. During none of the visits, insects and pests were visible in the store room.

4) Manpower

Manpower in Akshay Patra comprised of hierarchy of personnel, including the managers monitoring the kitchen administration, quality control personnel for

ensuring quality of meal preparation, supervisors to ensure smooth functioning of the kitchen, Cooks for meal preparation, helpers and cleaners for maintaining sanitation and hygiene, and route staff for loading/unloading of vessels and transportation of food to different schools.
At the time of study, 200 people were working at the Vadodara Akshaya Patra kitchen.

5) Sanitation and Hygiene

The personnel hygiene practices practiced by Akshay Patra staff are as follows:

- Clean clothes
- Trimmed nails
- Removal of footwear
- Wearing headgear
- Washing hands before and after food handling.

The Akshay Patra employees strictly follow all the basic sanitation and hygiene practices **(Figure 4.2.11 – 4.2.15)**.

Figure 4.2.11: Wearing of headgear & hand gloves

Figure 4.2.12: Cleaning and Washing of Utensils

Figure 4.2.13: Good ventilation facilities

Figure 4.2.14: Cleaning of kitchen after cooking

Figure 4.2.15: Cleaning of grains, spices and vegetables

Pest Control Treatment

Pest Control Treatment was done on a daily basis in association with Pestcone Pest Control Services by using various disinfectants as given in **Table 4.2.3.**

6) Food Handling

The good food handling practices followed in the Akshay Patra kitchen were:

- Use of hand gloves and head gears, removal of footwear
- Cleaning of grains, pulses
- Washing vegetables before cutting
- Soaking of pulses
- Cutting vegetables in medium or big pieces
- Using clean water for cooking
- Cooking rice in sufficient water
- Cooking meals at appropriate temperatures
- Covering of food after preparation and maintenance of adequate temperature

7) Menu and cost

The TAPF and non-TAPF kitchen showed variation in offering MDM which is depicted in **Table 4.2.4**. and **Figure 4.16 - 4.20**. The non-TAPF menu mainly provides either a cereal–pulse or a cereal–vegetable combination, whereas the TAPF has a three item menu and ensured a cereal–pulse–vegetable combination. In both the kitchens rice, wheat flour and pulses are obtained from Food Corporation of India (FCI). The reason for offering a great variety attractive meal to the children could be attributed to the fact that TAPF invests extra cost per meal than the usual cost of Rs 2.50 which is incurred by the Government. This extra cost helps in making the meal more nutritious and delicious. Cost of the various cooked food menus ranged from Rs. 4.50 to Rs. 5.50; with the vegetable being the costliest food item, followed by various types of Dal's [depending upon the type of dal used] and the items of rice like: Vegetable Pulav, Khichdi, Jeera Rice, Plain Rice.

Table 4.2.3: Pest control services done at the Akshay Patra Kitchen

TREATMENT	CHEMICAL AGENT	CONCENTRATION
General Disinfestations	Chlorophriphos	50ml./1L water
General Disinfestations	Remover	10-20ml./1L water
Rodent Control	Bromodiolone	RTU
Prophylactic Treatment	Bilflex	10ml./1L water
Prophylactic Treatment	K-othrin	5-10ml./1L water

(As per records of Akshaypatra)

Table 4.2.4: MDM Menu provided by the Akshay Patra Kitchen

Days	Changed – TAPF	Non TAPF
Monday	Mutter Pulao, Thepla, Dal	Lapsi/Sukhadi
Tuesday	Rice, Roti, Alu & Kabuli Chana Sabji	Vegetable Khichadi
Wednesday	Mix Dal, Veg Pulao	Dal Dhokali
Thursday	Jeera ice, Chana Dal, Thepla	Dal, Rice
Friday	Khichdi, Roti, Mix Sabji	Muthiya/Handvo
Saturday	Veg Pulao, Dal Dhokli	Vegetable Pulao

Figure 4.2.16: Menu for Monday and Thursday

Thepla, Mutter Pulao, Dal / Dudhi Chana Subji

Figure 4.2.17: Menu for Tuesday

Roti, Mix Aloo Sabji, Rice

Figure 4.2.18: Menu for Wednesday

Kabuli Chana Rice, Dal Dhokli, Sukhadi

Figure 4.2.19: Menu for Friday

Roti, Khichdi, Mix Sabji

Figure 4.2.20: Menu for Saturday

Veg Pulao, Dal,

8) Cooking Process

The cooking in the kitchen begins in the morning and follows a scheduled menu. The Akshay Patra Kitchen has norms for preparation of standardized meal which involves weighing of the raw materials according to standardized portion. Procurement of food item is done by issue slip and there is strict maintenance of records. The standardized recipe of each menu is derived from recipes developed at the Gandhinagar Kitchen of Akshay Patra. The main source of fuel in Akshay Patra kitchen is steam and LPG. Hence, food is usually prepared by steaming and flaming in the Akshay Patra Kitchen. Practice of soaking of pulses prior to meal preparation was done. To increase nutritional as well as cooking quality vegetables were cut into big pieces to retain the nutritional loss.

Fortified Wheat Flour is procured every month from Bhagwati Flour Mill, Ahmedabad; (150 sacks of 20kg each making the total amount of 3000kg). The Shelf life of the flour is 45 days. Nutritional content of 50 grams of flour with nine micronutrient and fortification level was adopted by Gujarat**.** The cooking process of Rice, Dal and Sabji and Sukhadi making is shown in **Figure 4.21- 4.23**. While the rice cauldrons are designed to cook 100 kg of raw rice for 1,000 children in 20 minutes, in the boilers 2000 litres of Dal is cooked at a time and the roti making machines roll out 40,000 rotis to the hour **(TAPF Annual report 09-10).** All the vessels are of stainless steel 304 food grade material.

9) Transportation

There are 39 vans of which 20 are insulated mobile units/vans and 19 ordinary vans for transporting foods to various schools. These vans are designed to fit in different sized insulated vessels in them to facilitate easy and safe transportation of foods **(Figure 4.2.24)**.

Figure 4.21: Rice Making Process

Figure 4.2.22: Dal and Sabji Making Process

Figure 4.2.23: Sukhadi Making Process





Figure 4.2.24: Transportation of Food






10) Quality Analysis

The Nutrient Content evaluation of various nutrients present in the cooked food item is done at Food and Drug Laboratory by Public Health Analyst. The food samples are randomly collected from the kitchen and taken to the lab for estimations [As per records of Akshaypatra. The quality inspection of the cooked food is done by Food Inspector of Vadodara Mahanagar Sevasadan on daily basis by tasting it. [**Observed during Kitchen visits**]

Waste Management

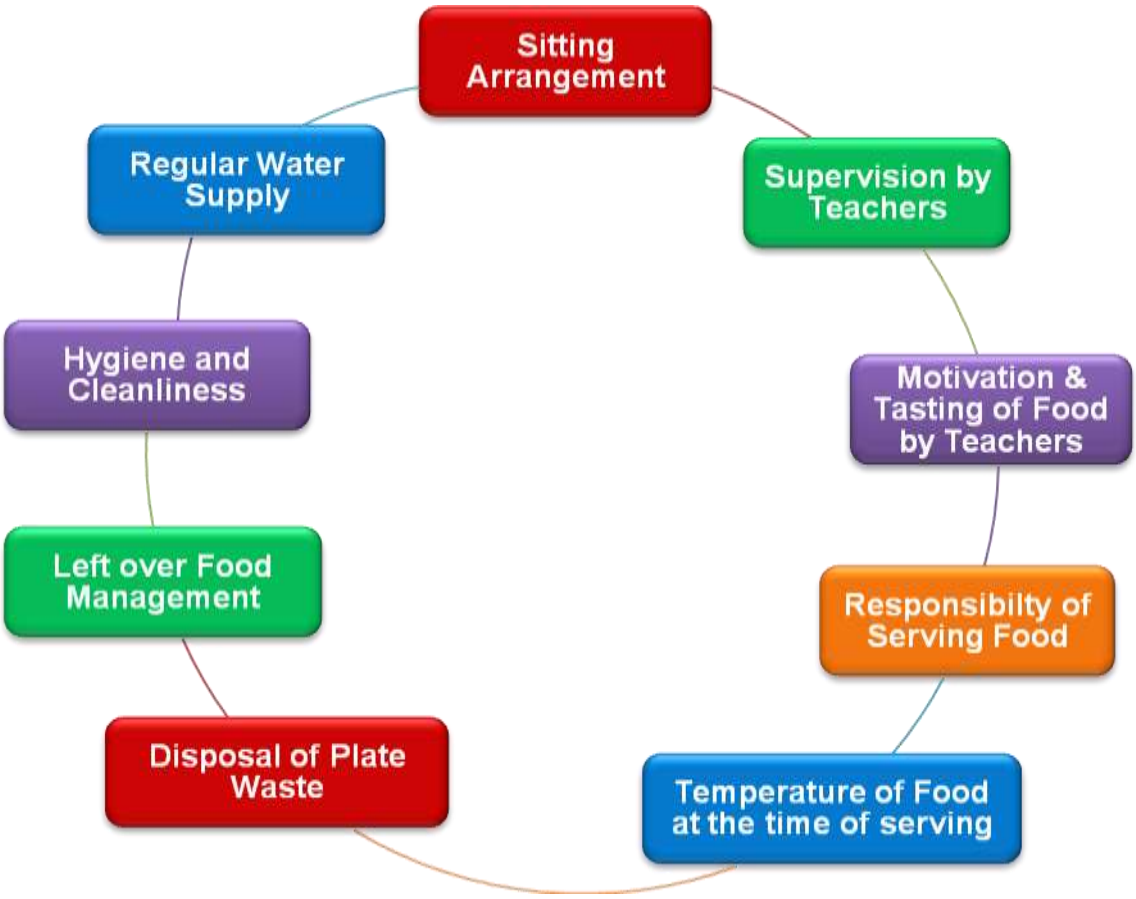
The leftover food, which is sent back by the schools to the Akshay Patra kitchen, is distributed to registered local shepherds for their animals to eat and daily record for the same is maintained [As per records of Akshay patra].

SPOT OBSERVATIONS IN SCHOOLS

Direct observation is an underused and valuable method for collecting evaluation information. Spot observations were carried out once in a month to observe the execution of the MDM programme at the school level. Observations were made in all the schools over a period of one and a half year. During the study period a total of 229 spot observations in schools were done. The results have been presented based on the direct observations made during the school visits, which are as shown in **Figure 4.2.25.** All these information was elicited through a structured observation check list.

Also, quantity of MDM consumed by children was measured on a sub sample. Every month one girl and one boy were selected from each standard in each school. The amount of food served to them and the amount of plate waste, which is defined as the quantity of food served but not eaten was measured using standard cups and spoons. Also, extra servings served to them were noted. Total 1404 children were observed during the spot observations. The data was used to arrive at the nutrient intake by the children.

Figure 4.2.25: Components of spot observations



Sitting arrangement

- In majority of the observations (67.7%) children sat in the corridors to have food and in around 25.8% of the observations it was seen that children sat in the playground to have food. Thus corridors and playground of the school were the major venues for having food **(Figure 4.2.26)**.

Role of teachers – Supervision

- In 28% of the observation, all class teachers were present for supervision when children were consuming MDM. As per the norms, only in 29% of the observations two teachers were present for supervision when children were consuming MDM. In 17.5 % of the observation no teacher was present for supervision.

- Motivation by the teachers to children to consume food was found to be inadequate (66.4%) and needs to be addressed. Motivation by the teachers increased after the workshop that was conducted for the Municipal School Teachers of urban Vadodara where they were sensitized regarding the importance of MDM Programme in the management of undernutrition.

- The practice of tasting food by the teachers (2%) before serving to the children was not seen. The food was tasted either along with the children or after they finished eating **(Table 4.2.5)**.

- The school should play a proactive role in the management of MDM and in motivating the school children to consume the same.

Akshayapatra Service

- In majority of the observations (97.8%) food was hot or warm at the time of serving.

Figure 4.2.26: Sitting Arrangement during MDM Consumption

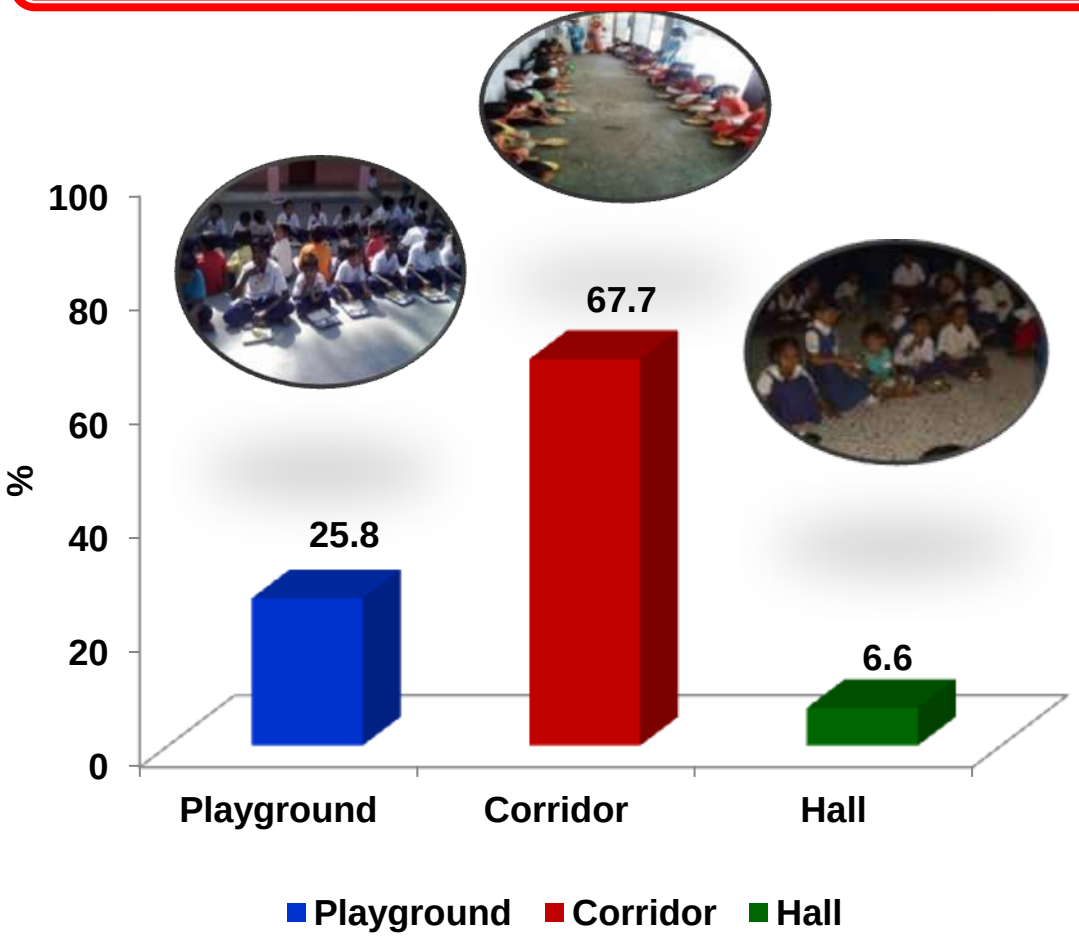


Table 4.2.5: Role of Teachers in Supervision

Presence of Teachers	**N**	**%**
• All Class Teachers	65	28.4
• 2 Teachers	67	29.2
• More than 2 Teachers	13	5.7
• 1 Teacher	44	19.2
• No One	40	17.5
Motivation of Teachers		
• Yes	77	33.6
• No	152	66.4
Tasting of food by Teachers		
• Yes	4	1.7
• No	225	98.3

- In 73% of the observations the Akshay Patra helpers distributed the food to the children. In 16% of the observations, senior school children, school peons and school teachers were also found to be serving the food along with the Akshay Patra helpers. In 11% of the observation, school children, peon or teachers were serving the food. This was mainly seen when the Akshay Patra helpers were not allotted for all the schools **(Figure 4.2.27)**.

Plates

- In December 2010, big plates were provided to almost all the schools for children by Nagar Prathmik Shikshan Samiti in which all the food items could be served properly. Earlier it was found that (85.7%) the plates did not have sufficient space to serve all the items properly. The quantity of food served depended on the size of the tiffin boxes or plates carried by the children from home. Thus distribution of plates to children by Nagar Prathmik Shikshan Samiti is highly appreciated.

Plate waste disposal

- In 95% of the observations it was found that children used dustbins to dispose the plate waste. However in 27% of the observations, children were found to be disposing the plate waste in open space where animals were eating which lead to unhygienic conditions in the school premises, and in 40% of the observation, the plate waste was given to shephards for feeding the cattle. Thus, waste management is an issue that needs to be taken care of especially in such an environment **(Figure 4.2.28)**.

Leftover food management

- In 21% of the observations the leftover food was distributed to the children which they took it home or consumed it during recess. In 21% of the observation, the food was distributed to children and then sent back to

Figure 4.2.27: Responsibility of Serving

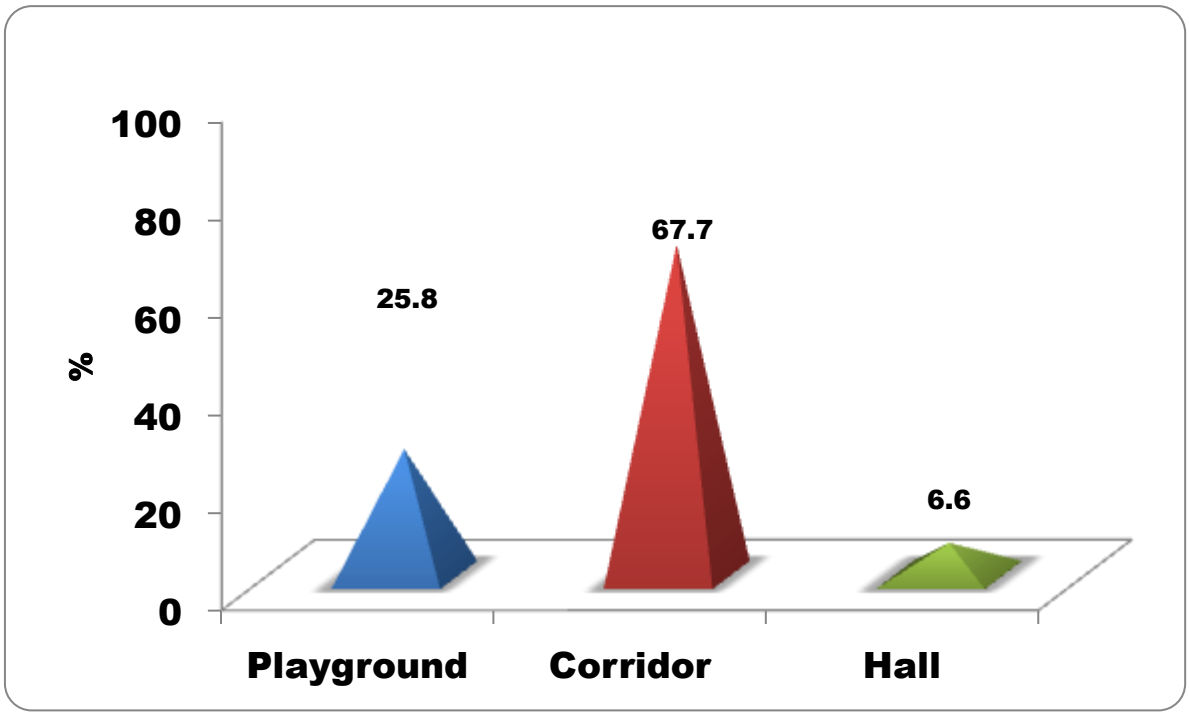


Figure 4.2.28: Disposal of Plate Waste

Disposal in Open Space- 27%

Use of Dustbin- 95%

Given to Animals- 40%

*** Multiple responses**

- Akshay Patra. In 6% of the observations, food was given to cows after distributing to children, while in 10% observations it was given to shephards for feeding the cattle. In 33% of the observations it was seen that the leftover food was sent back to Akshay Patra. Only in 8% of the observation, it was seen that there was no leftover food **(Figure 4.2.29)**.

Water facility

In majority of the observations (89%), water supply was seen to be sufficient **(Figure 4.2.30)**. In 31.4% of the observations, it was seen that there was separate space for drinking water and for washing hands and plates. In some observations children were found to be washing their plates and also drinking water from the same place. This led to unhygienic conditions as water used to get clogged in the sink. **Such unhealthy practice needs to be discouraged.**

Cleanliness and hygiene

- Predominately, in 65.1% of the observations it was found that the vessels used for serving was clean. While in 34.9% of the observations it was found that the serving vessels were not cleaned. If school vessels are used then it should be cleaned properly before use **(Figure 4.2.31)**.

- In 93% of the observation it was seen that the dining area was cleaned after the children had their meal **(Figure 4.2.32)**. In very few observations (1.3%), the dining area was not cleaned even after serving MDM. Only in 5.7% of the observation it was seen that the serving area was cleaned both before and after the children had their meals.

- In 94.3% of the observations, children washed their hands after eating with only water. Washing of hands before and after eating was seen in only 4.8% of the observation and needs to be strengthened. **(Figure 4.2.33 and Figure 4.2.34)**.

Figure 4.2.29: Leftover Food Management

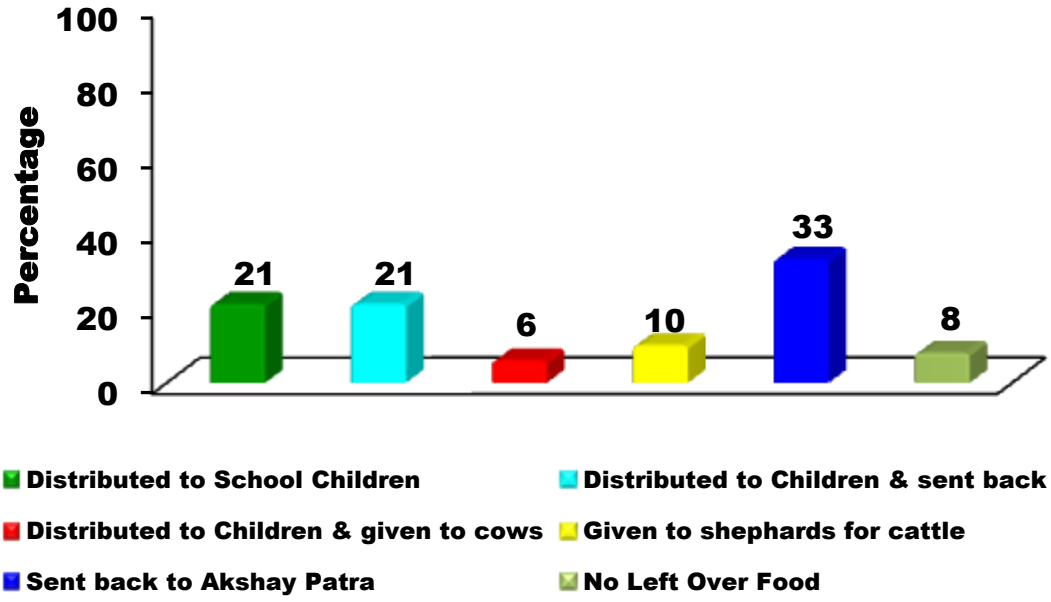


Figure 4.2.30: Regular Water Supply in School

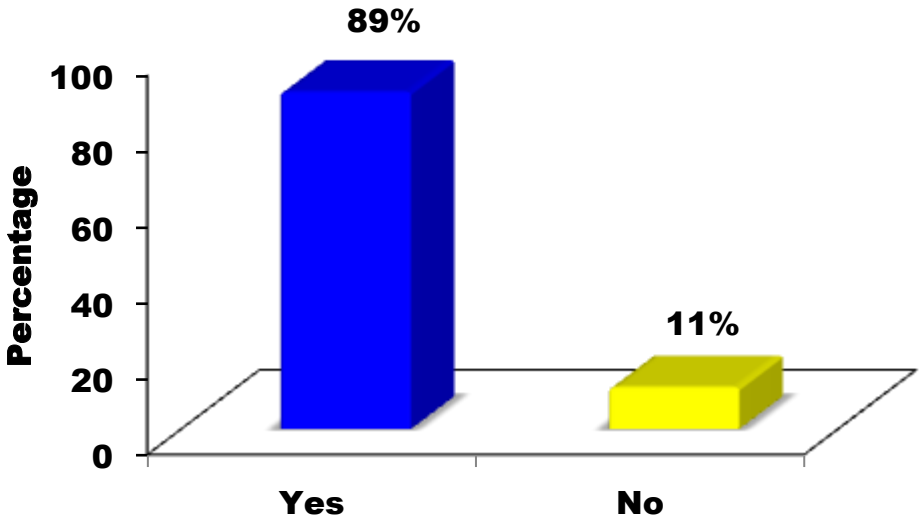


Figure 4.2.31: Cleanliness of Serving Vessels & Spoon

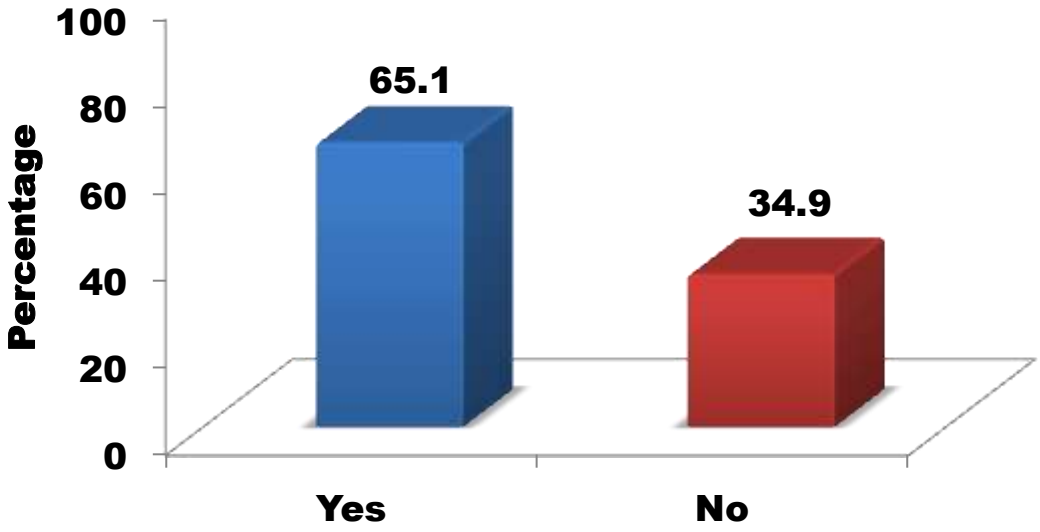


Figure 4.2.32: Cleanliness of Dining Area

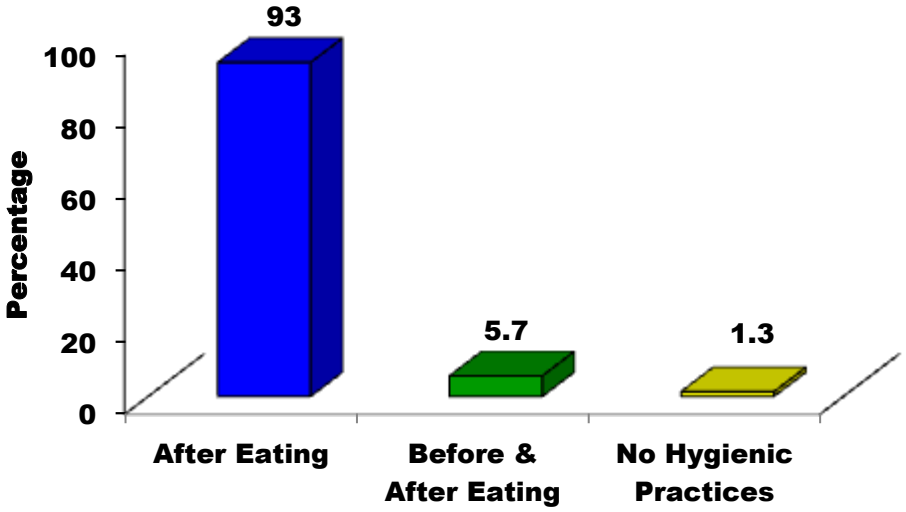


Figure 4.2.33: Hand Washing by Children

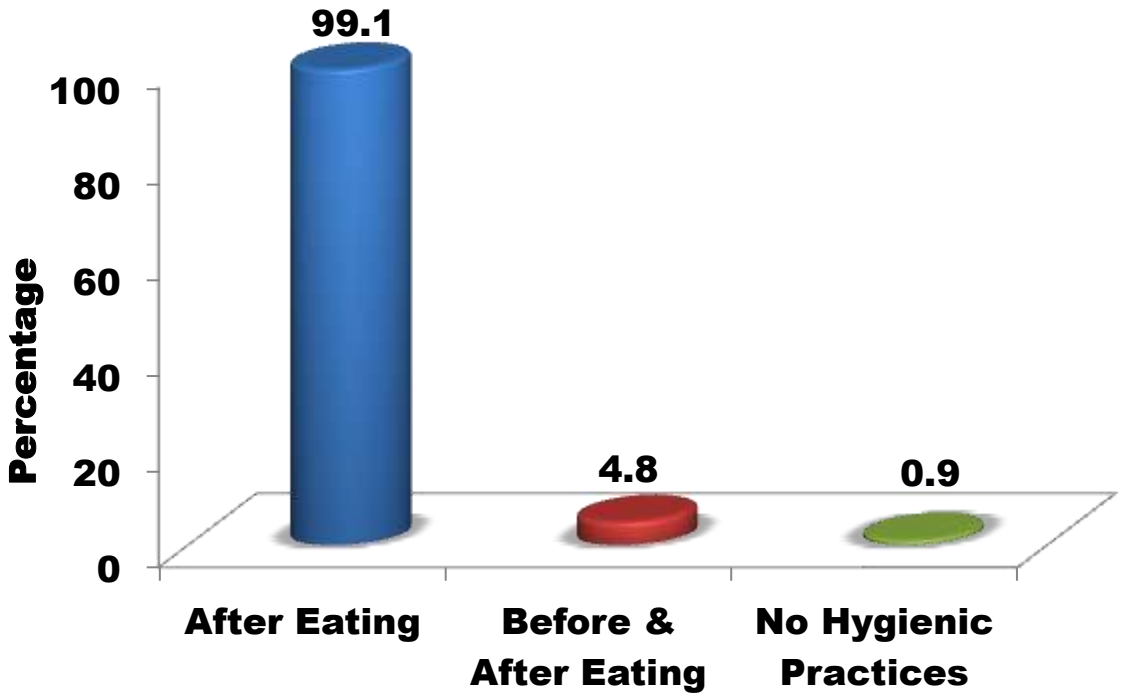
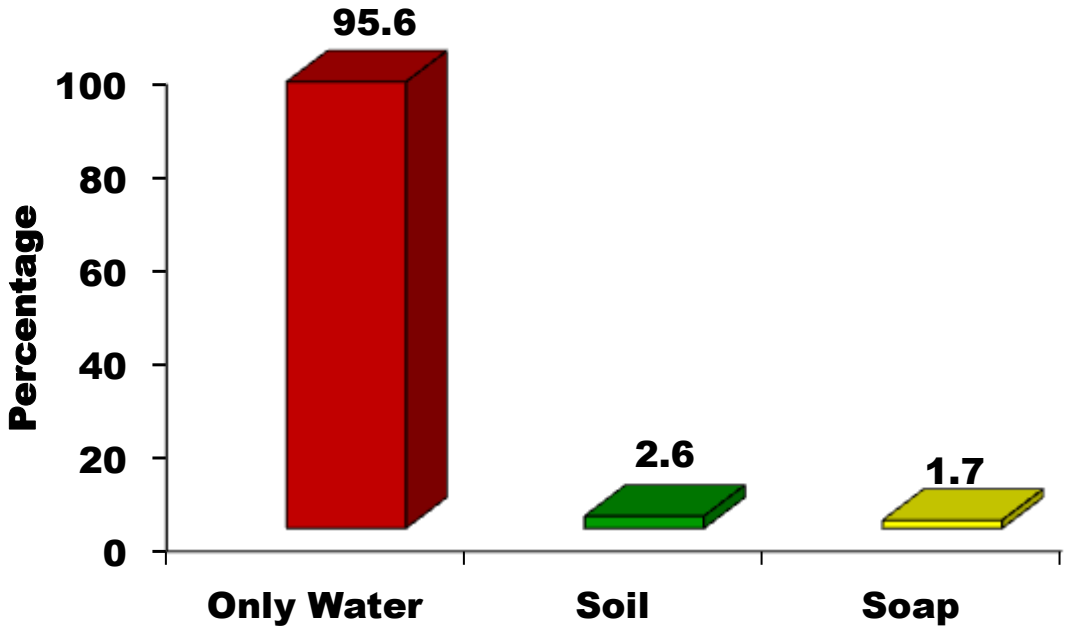


Figure 4.2.34: Material Used for Hand Washing



Nutrient Intake Based on MDM Consumption

The information on the dietary intake of school children was collected from a sub sample of **1404** children from 16 municipal schools of urban Vadodara covering almost equal number of boys (n=699) and girls (n=705) through actual measurements of dietary intake. Consumption of food provided under MDM was quantified and mean nutrient intake was calculated and dietary intake was converted into percent RDA and was compared with $1/3^{rd}$ of the Recommended Dietary Allowances (RDA). The nutritive value of the recipes based on wheat, rice and dal prepared by the Akshay Patra Kitchen were shown in **Table 4.1.6**, **Table 4.1.7** and **Table 4.1.8** respectively.

The energy and protein content from the wheat based products ranged from 97 – 219 kcal and 2.4 – 3.1 g respectively. The energy and protein content from the rice based products ranged from 52 – 76 kcal and 1.0 – 1.9 g respectively. And the energy and protein content from the dal based products ranged from 73 – 118 kcal and 2.5 – 7.1 g respectively.

On an average, 100 gm (1 cup) of cooked dal, 100 gm (1 cup) of cooked rice and I serving of wheat gives 298 Kcal and 8.2 gms of protein. Thus, indicating that a primary school child (1^{st}-5^{th} std) should at least have 1 cup of cooked rice, 1 cup of cooked dal and 1 serving of wheat (gives 453 kcal and 13.5 g of protein) to meet the nutritional requirement prescribed as per MDM norms. For upper primary school children (6^{th}-7^{th} std), a child should at least consume $2^{1/2}$ cup of cooked rice, $2^{1/2}$ cup of cooked dal and 2 serving of wheat which provides 751 kcal and 21.7 gms of protein to achieve the norms of MDM.

The mean nutrient intake and %RDA met by the children for different nutrients is shown in **Table 4.2.9.** The mean nutrient intake was found to be grossly inadequate for macro and micro nutrients except for protein, fat and Vitamin - C . The mean calorie intake of the children through the school meal was 335 kcal and provided approximately 12g of proteins. The mean calorie and protein intake was significantly higher in case of boys as compared to girls **(Table 4.2.10)**. Similarly, the mean intake of micronutrients such as Calcium,

Table 4.2.6: Nutritive Value of Wheat Based Products provided by the Akshay Patra Kitchen (per 1 piece)

Recipes	Energy (Kcal)	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)	Carotene (µg)	Vitamin – C (mg)
Thepla	114	2.9	3.9	24	1.30	33	0
Roti	97	2.4	3.5	10	0.98	12	0
Sukhadi	219	3.1	28.71	26	1.50	349	0
Avg	**143**	**2.8**	**12.0**	**20**	**1.26**	**131**	**0**



Table 4.2.7: Nutritive Value of Rice based Recipes provided by the Akshay Patra Kitchen (Per 100 gm)

Recipe	Energy (Kcal)	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)	Carotene (µg)	Vitamin C (mg)
Plain rice	52	1.0	0.08	2	0.1	0	-
Mutter Pulao	65	1.0	2.0	3	0.15	81	1
Veg Pulao	76	1.2	2.8	7	0.2	161	3
Pulao	72	1.1	2.8	4	0.15	159	2.3
Khichdi	70	1.9	2.1	7	0.27	9	-
Kabuli chana rice	76	1.3	2.2	5	0.18	7	0.05
Avg	**69**	**1.3**	**2.0**	**5**	**0.18**	**69**	**11**




Table 4.2.8: Nutritive Value of Dal based Recipes provided by the Akshay Patra Kitchen (Per 100 gm)

Recipes	Energy (kcal)	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)	Carotene (µg)	Vitamin C (mg)
Dal	118	7.1	1.6	27	1.4	236	2
Chana Dal	103	4.8	2.2	23	1.32	220	4
Dal Dhokli	85	6.9	1.6	24	1.4	36	-
Aloo Chana	82	2.7	1.6	34	0.81	1068	24
Aloo Mung dal	80	3.4	1.2	26	0.79	1063	21
Aloo Rajma dal	80	3.2	1.2	40	0.86	1062	21
Aloo Subji	73	2.5	1.3	31	0.72	1071	22
Aloo Vaal dal	81	3.5	0.2	20	0.31	1062	21
Mix Veg Subji	75	2.9	0.7	45	0.9	1672	29
Avg	**86**	**4.1**	**1.3**	**30**	**0.95**	**832**	**16**

Table 4.2.9: Nutrient Intake of MDM (Mean and as Percent RDA) for the Children

Nutrients	Boys		Girls		Total	
	Nutrient Intake*	% RDA	Nutrient Intake	% RDA	Nutrient Intake	% RDA
Energy	370±169	59±25	301±139	51±22	335±159	55±24
Proteins	13.0±6.9	120±62	10.5±5.5	97±50	11.7±6.4	108±57
Fats	9.0±6.4	134±96	7.2±5.4	107±81	8.1±6.0	121±90
Calcium	66±35	32±17	53±28	25±13	60±32	29±15
Iron	3.06±1.65	52±27	2.45±1.34	39±22	2.75±1.54	46±25
Fibre	2.2±1.7	17±13	1.8±1.4	14±11	2.0±1.6	15±12
β-Carotene	1009±1098	67±71	831±854	55±56	920±987	61±64
Vitamin-C	17±21	125±151	14±16	94±110	15±19	109±133
CHO	65.5±30.5	19±8	52.6±23.0	16±7	59.0±27.8	18±8

***1/3 rd RDA as per NIN-ICMR 2009**

Table 4.2.10: Mean Nutrient Intake of Children for Macro Nutrients (MEAN±SD)

Age (Yrs)		Energy (Kcal)	Protein (g)	Fat (g)	CHO (g)
5-5.11	BOYS	273±114	9.9±4.9	7.5±6.6	47.2±19.5
	GIRLS	244±97	8.5±3.9	6.1±2.9	41.4±14.5
6-6.11	BOYS	259±104	9.0±4.2	6.2±4.3	45.0±18.1
	GIRLS	231±91	8.1±3.5	5.8±5.1	40.5±14.2
7-7.11	BOYS	313±138	10.4±5.5	8.4±7.5	54.7±25.4
	GIRLS	247±124	8.6±4.8	5.7±4.8	43.0±20.3
8-8.11	BOYS	353±155	12.6±6.9	8.9±6.3	61.9±27.9
	GIRLS	298±118	10.1±4.5	7.8±6.2	50.5±18.3
9-9.11	BOYS	397±157	14.2±6.9	9.4±5.1	70.5±28.8
	GIRLS	314±122	10.9±4.5	7.2±5.0	55.5±20.3
10-10.11	BOYS	418±163	14.6±6.8	9.8±6.1	74.0±29.2
	GIRLS	336±152	11.9±6.8	8.1±5.9	58.2±25.0
11-11.11	BOYS	427±187	14.8±7.4	10.7±8.0	76.2±32.0
	GIRLS	323±159	11.1±5.8	7.4±5.9	57.5±26.2
12-12.11	BOYS	412±170	15.2±7.6	9.7±6.2	73.5±28.4
	GIRLS	369±152	13.6±6.6	8.5±5.2	65.9±24.5
13-13.11	BOYS	461±198	15.9±7.7	10.4±5.4	82.8±38.6
	GIRLS	347±164	10.9±6.0	8.5±5.3	60.9±29.2
14-14.11	BOYS	455±224	15.2±9.0	9.9±7.1	85.2±46.3
	GIRLS	350±100	12.0±4.9	8.1±4.1	61.0±16.6
15-15.11	BOYS	477±204	12.4±5.4	11.3±0.0	83.8±48.9
	GIRLS	0	0	0	0
TOTAL	BOYS	**370±169**	**13.0±6.9**	**9.0±6.4**	**65.5±30.5**
	GIRLS	**301±139**	**10.5±5.5**	**7.2±5.4**	**52.6±23.0**
"t"value		**8.41*** **	**7.59*** **	**5.73*** **	**9.00*** **

Iron, β-Carotene and Vitamin – C was also significantly higher for boys than girls **(Table 4.2.11).**

The mean nutrient intake increased as the age increased. However, in the age group of 5-6 years, a decrease in the intake of all the macronutrients **(Table 4.2.12)** and the two micronutrients i.e. Calcium and Iron (**Table 4.2.13),** was seen as compared to other age group.

Mean Nutrient Intake According to MDM Norms:

When the nutrient intake was analyzed based on standards, it was observed that quantity of MDM to be consumed as per MDM norms was not satisfactory for all the boys and girls. It was observed that the upper primary school children (Standard 6^{th}-7^{th}) had higher nutrient intake as compared to the primary school children (Standard 1^{st}-5^{th}). The mean caloric intake of the primary school children was 311 kcal which was found to be lower as compared to the nutritional norms of MDM scheme, i.e. 450 kcal **(Figure 4.2.35).** Similar trend was seen for upper primary school children also. As per the nutritional norms of MDM they should consume 700 kcal against which they consumed only 57% of the requirement i.e. 397Kcal **(Figure 4.2.35).** With regards to protein, the intake was much better as compared to calories. Primary school boys were able to meet the requirement of 12 g of protein as compared to girls. However, older children were not able to meet the protein requirement **(Figure 4.2.36)**.

Mean Nutrient Intake Comparison According to Gender:

When the data was compared gender wise, it was seen that the mean nutrient of boys was higher than that of girls in both primary and upper primary standards. Energy consumption was 344 kcal for boys from standard 1^{st}–5^{th} and 437 kcal for boys from 6^{th}–7^{th} standard, while for girls it ranged from 279 kcal in 1^{st}–5^{th} standard and 356 kcal among higher standards **(Table 4.2.12).**

Table 4.2.11: Mean Nutrient Intake of Children for Micro Nutrients (MEAN±SD)

Age (Yrs)		Calcium (mg)	Iron (mg)	β Carotene (µg)	Vitamin C (mg)
5-5.11	BOYS	48±21	2.34±1.21	608±554	9±11
	GIRLS	43±16	2.09±0.90	609±553	10±10
6-6.11	BOYS	44±21	2.11±1.00	663±710	11±14
	GIRLS	41±18	1.90±0.90	596±628	10±12
7-7.11	BOYS	56±24	2.53±1.20	915±893	15±17
	GIRLS	45±24	2.03±1.16	724±749	12±14
8-8.11	BOYS	61±30	2.83±1.47	866±900	14±17
	GIRLS	52±26	2.46±1.23	770±778	13±16
9-9.11	BOYS	71±38	3.32±1.71	962±1148	16±21
	GIRLS	57±28	2.49±1.16	953±996	16±19
10-10.11	BOYS	77±36	3.46±1.58	1224±1328	21±26
	GIRLS	59±29	2.83±1.57	863±787	14±15
11-11.11	BOYS	76±36	3.50±1.88	1262±1117	22±22
	GIRLS	56±31	2.49±1.38	959±1054	16±19
12-12.11	BOYS	73±33	3.54±1.73	940±943	15±18
	GIRLS	68±31	3.13±1.69	899±866	15±17
13-13.11	BOYS	88±49	3.94±1.91	1552±1773	26±33
	GIRLS	60±32	2.55±1.38	1158±1002	21±20
14-14.11	BOYS	90±53	3.59±2.32	1761±1491	33±31
	GIRLS	64±25	2.83±1.36	1087±988	18±19
15-15.11	BOYS	77±61	3.46±1.44	1638±2259	32±46
	GIRLS	0	0	0	0
TOTAL	**BOYS**	**66±35**	**3.06±1.65**	**1009±1098**	**17±21**
	GIRLS	**53±28**	**2.45±1.34**	**831±854**	**14±16**
"t"value		**7.53*** **	**7.63*** **	**3.38*** **	**3.12*** **

't'value between boys and girls

Table 4.2.12: Nutrient Intake of Children consuming MDM Cross Tabulated by Gender and Standard

Total	Energy (Kcal)	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)	Carotene (µg)	Vitamin-C (mg)
Boys	370± 169	13.0± 6.9	9.0± 6.4	66± 35	3.06± 1.65	1009± 1098	17± 21
Girls	301± 139	10.5± 5.5	7.2± 5.4	53± 28	2.45± 1.34	831± 854	14± 16
Total	335± 159	11.7± 6.4	8.1± 6.0	60± 32	2.75± 1.54	920± 987	15± 19
Standard wise							
1to 5th std.	311± 143	10.8± 5.7	7.6± 5.7	55± 29	2.55± 1.37	834± 901	14± 17
6 to 7th std.	397± 179	14.0± 7.4	9.4± 6.5	72± 36	3.28± 1.79	1137± 1150	19± 22
Boys							
1to 5th std.	344± 155	12.0± 6.3	8.4± 6.1	61± 32	2.82± 1.50	912± 1011	15± 19
6 to 7th std.	437± 186	15.5± 7.7	10.5± 6.9	80± 39	3.67± 1.86	1251± 1261	21± 24
Girls							
1to 5th std.	279± 122	9.7± 4.7	6.8± 5.2	49± 24	2.28± 1.18	757± 770	13± 15
6 to 7th std.	356± 162	12.5± 6.7	8.3± 6.0	64± 32	2.88± 1.62	1022± 1016	17± 19

Table 4.2.13: Distribution of Children Based on Gradations of % RDA of Nutrients

Percent RDA	Energy (Kcal)	Protein (g)	Fat (g)	Iron (mg)	β Carotene (µg)	Calcium (mg)
Boys (N=699)						
≤25%	6.4 (45)	1.1 (8)	7.0 (49)	15.3 (167)	30.2 (211)	39.9 (279)
25.1-50%	35.2 (246)	8.9 (62)	7.3 (51)	37.5 (262)	27.0 (189)	47.4 (331)
50.1-75%	33.0 (231)	15.5 (108)	14.6 (102)	27.8 (194)	14.3 (100)	11.0 (77)
75.1-100%	19.0 (133)	19.6 (137)	14.0 (98)	14.7 (103)	4.3 (30)	1.3 (9)
>100%	6.3 (44)	54.9 (384)	57.1 (399)	4.7 (33)	24.2 (169)	0.4 (3)
Girls (N=705)						
≤25%	9.6 (68)	3.5 (25)	10.6 (75)	30.1 (212)	36.9 (260)	57.9 (408)
25.1-50%	44.3 (312)	15.3 (108)	10.8 (76)	41.6 (293)	27.2 (192)	38.0 (268)
50.1-75%	32.1 (226)	20.0 (141)	17.6 (124)	22.0 (155)	13.2 (93)	3.8 (27)
75.1-100%	11.8 (83)	18.4 (130)	13.9 (98)	5.1 (36)	2.1 (15)	0.3 (2)
>100%	2.3 (16)	42.7 (301)	47.1 (332)	1.3 (9)	20.6 (145)	0.0 (0)
Total (N=1405)						
≤25%	8.0 (113)	2.4 (33)	8.8 (124)	22.7 (319)	33.5 (471)	48.9 (687)
25.1-50%	39.7 (558)	12.1 (170)	9.0 (127)	39.5 (555)	27.1 (381)	42.7 (599)
50.1-75%	32.5 (457)	17.7 (249)	16.1 (226)	24.9 (349)	13.7 (193)	7.4 (104)
75.1-100%	15.4 (216)	19.0 (267)	14.0 (196)	9.9 (139)	3.2 (45)	0.8 (11)
>100%	4.3 (60)	48.8 (685)	52.1 (731)	3.0 (42)	22.4 (314)	0.2 (3)

Values in parenthesis indicate number

Figure 4.2.35: Energy Intake of the Children

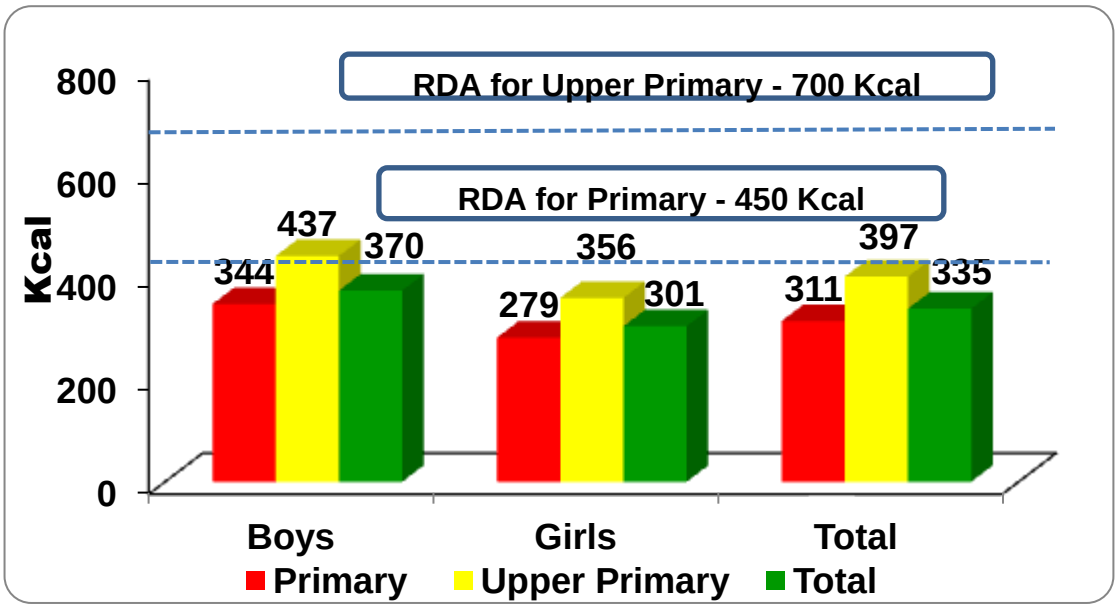
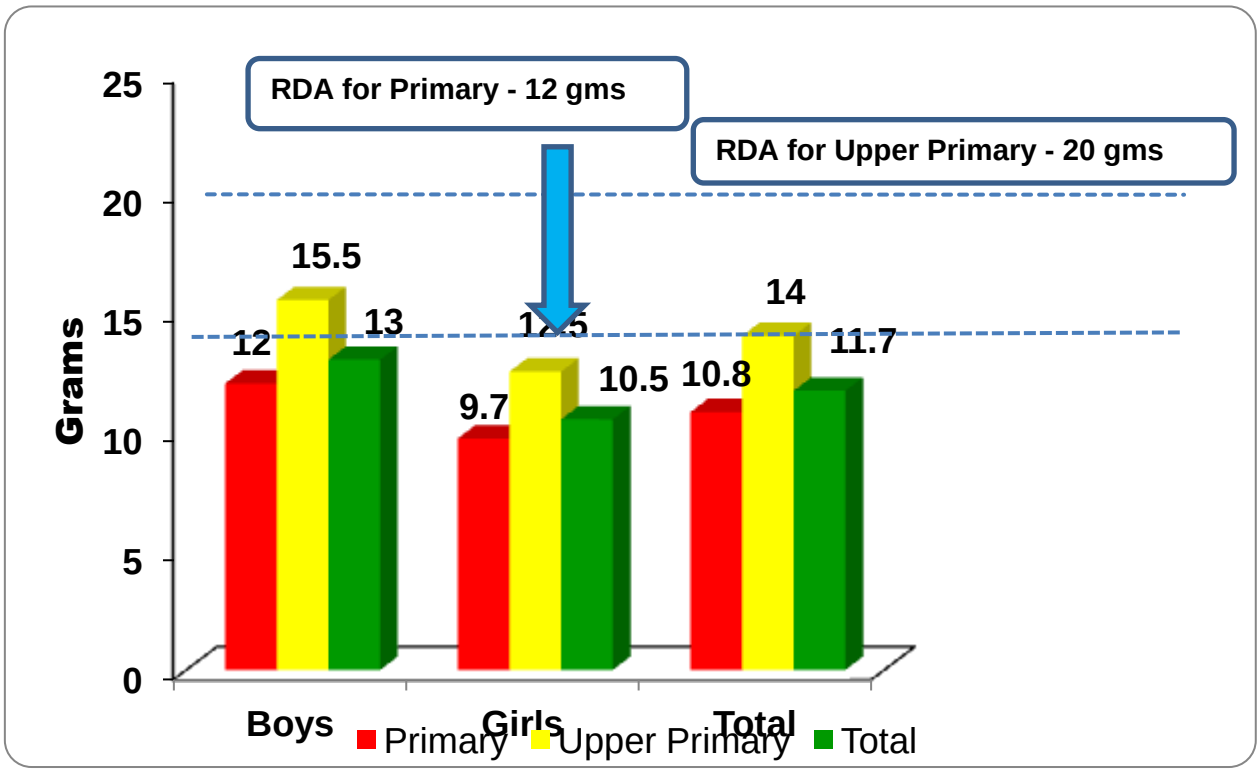


Figure 4.2.36: Protein Intake of the Children



With regard to proteins, the intake according to nutritional norms was much better as compared to calories. Overall the protein intake for children from 1st-5th standard was 11g and for children from 6th-7th standard was 14g as compared to the nutritional norms of 12g and 20g respectively. Only younger boys from 1st-5th standard were able to meet the protein requirement.

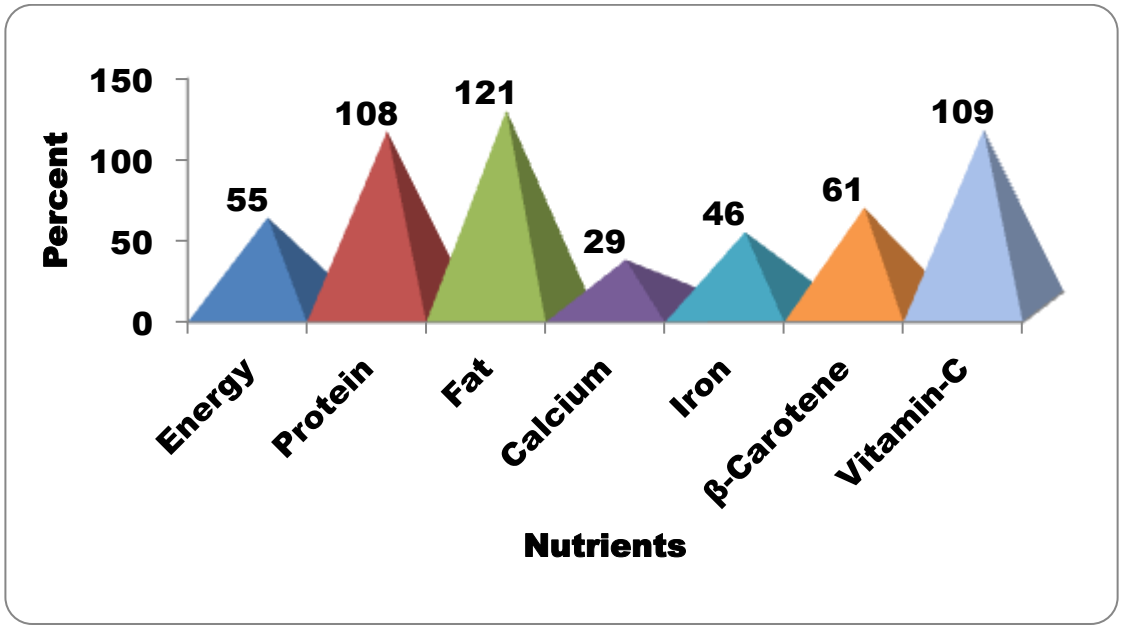
The mean iron intake of boys from 1st–5th Standard and those from 6th–7th Standard was 2.82mg and 3.67mg respectively while for girls from 1st–5th Standard and those from 6th–7th Standard, it was 2.28mg and 2.88mg respectively **(Table 4.2.12).** Primarily the iron came from Fortified Flour recipes.

Mean Nutrient Intake at various levels of RDA

The contribution of nutrients from MDM as compared to % RDA is shown in **Table 4.2.9.** The % RDA has been derived by calculating 1/3rd of the RDA given by NIN – ICMR (2009) which are age and gender specific. The meal provided 55% of energy, 108% protein and 121% fats. Requirements for all micronutrients except Vitamin–C were not adequately met. The meal provided 29% Calcium, 46% Iron and 61%, Carotene, whereas it provided 109% of Vitamin-C **(Figure 4.2.37).**

When the data was segregated based on gradation of % RDA consumption (**Table 4.2.13**), it was observed that majority of the children met <75% of RDA for energy, while 49% and 52% of the children met >100% of RDA for protein and fat respectively. In case of micronutrients, it was observed that majority of the children (40%) met 25.1-50% of the RDA for Iron, 33% met only <25% of the RDA for Carotene and 92% of the children met <50% of the RDA for Calcium. This indicates a deficit in the consumption of micronutrients which could possibly lead to micronutrient deficiencies.

Figure 4.2.37: Summary of MDM Intake by Children as Compared to % RDA



Mean Nutrient Intake according to Week Days

The mean nutrient intake was significantly higher on Monday as compared to other days of the week as Dal and Rice given on Monday was the most liked food item by the children **(Table 4.2.14)**. The mean nutrient intake was least on Friday as children did not like the mixed vegetable sabji given on that day. **Thus, the analysis indicates that the preferences for food item influenced the consumption of MDM among children.**

Mean Nutrient Intake according to the Nutritional Status

The nutrient intake of the children according to Weight for age Z scores is shown in **Table 4.2.15.** All the mean nutrient intake of the underweight children was significantly lower than the normal children.

When comparison was done among stunted and normal children, only carbohydrate (CHO) was significantly lower among stunted than normal children **(Table 4.2.16).** However, no significant difference was seen among the mean nutrient intake of normal and thin children **(Table 4.2.17). Thus, it can be concluded that the mean nutrient intake do affect the nutritional status of children.**

Attendance and Consumption Pattern of MDM:

The data on the MDM consumption was compared with the total number of registered children as well as the total number of children present on the day of data collection. **Table 4.2.18** shows the consumption pattern of MDM of all the 16 schools. %MDM consumption was calculated based on number of children present. It was found that less than 50% of the children registered were present in the school and the mean % children present were 48.1%. MDM Consumption was 46.9% in one school which was lowest while the maximum percent was 87.6%. Overall % MDM consumption was 72.6%.

Table 4.3.14: Mean Nutrient Intake According to Weekly Menu

	Energy (Kcal)	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)	Carotene (µg)
Day	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Mon	392±153	15.1±6.3	9.8±4.6	71±34	3.65±1.76	461±269
Tues	330±145	9.0±4.2	5.6±3.5	62±32	2.30±1.18	1679±844
Wed	319±157	13.9±7.1	8.0±5.8	52±27	2.66±1.40	304±280
Thurs	347±170	11.2±5.8	8.7±5.5	63±35	3.01±1.67	922±1161
Fri	302±153	9.4±5.3	6.9±4.6	59±35	2.53±1.53	1254±1281
Satur	337±159	12.6±7.0	10.3±9.4	54±27	2.55±1.31	786±660
'F"value	**7.988*** **	**37.210*** **	**20.773*** **	**9.964*** **	**21.861*** **	**79.908*** **

Table 4.2.15: Mean Nutrient Intake According to Weight for Age Z scores

Nutrients	Normal			Underweight			't'value
	Boys	Girls	Total	Boys	Girls	Total	
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	
Energy (kcal)	338±153	274±119	304±139	330±147	276±117	303±136	8.411***EVNA
Protein (gm)	11.9±6.5	9.7±4.5	10.7±5.6	11.6±6.1	9.3±4.5	10.5±5.5	7.591***EVNA
Fat (gm)	8.1±5.7	6.7±5.4	7.4±5.6	8.4±6.0	6.7±4.8	7.6±5.5	5.729***EVNA
Calcium (mg)	60±29	51±26	55±28	58±33	47±23	53±29	7.531***EVNA
Iron (mg)	2.75±1.42	2.28±1.14	2.49±1.30	2.76±1.51	2.23±1.16	2.50±1.37	7.630***EVNA
Carotene (µg)	938±973	784±862	855±917	775±914	724±721	750±824	3.377**EVNA
Vitamin-C (mg)	16±19	13±16	14±18	12±17	12±14	12±15	3.126**EVNA
CHO (gm)	60.2±28.6	47.8±19.8	53.5±25.0	57.1±25.5	47.3±18.6	52.3±22.8	8.993***EVNA

Table 4.2.16: Mean Nutrient Intake According to Height for Age Z scores

	Normal			Stunting			
	Boys	Girls	Total	Boys	Girls	Total	't'value
	Mean± SD	Mean± SD	Mean± SD	Mean± SD	Mean± SD	Mean± SD	
Energy (kcal)	379±170	310±142	344±160	376±171	294±135	335±159	1.034
Protein (gm)	13.3±7.2	10.9±5.5	12.1±6.5	13.2±6.7	10.0±5.6	11.6±6.3	1.453
Fat (gm)	9.1±6.4	7.5±5.7	8.3±6.1	9.4±6.5	7.0±5.0	8.2±5.9	0.279
Calcium (mg)	68±6	55±28	61±33	67±35	52±27	60±32	0.880
Iron (mg)	3.12± 1.64	2.54± 1.37	2.82± 1.54	3.17± 1.73	2.36± 1.32	2.76± 1.59	0.755
Carotene (µg)	1059± 1160	816± 833	937± 1015	953± 1023	862± 869	907± 948	0.527
Vitamin-C (mg)	18±22	14±16	16±19	16±19	15±17	15±18	0.594
CHO (gm)	67.8± 31.7	54.2± 23.6	61.0± 28.7	65.3± 28.7	50.7± 21.6	57.9± 26.3	1.978*[EVNA]

Table 4.2.17: Mean Nutrient Intake According to BMI for Age Z scores

	Normal			Thinness			
	Boys	Girls	Total	Boys	Girls	Total	't'value
	Mean± SD	Mean± SD	Mean± SD	Mean± SD	Mean± SD	Mean± SD	
Energy (kcal)	379±162	302±139	338±155	374±172	305±134	345±161	0.706
Protein (gm)	13.5±7.1	10.5±5.6	11.9±6.5	13.2±6.9	10.5±5.2	12.1±6.4	0.374
Fat (gm)	9.2±5.8	7.5±6.1	8.3±6.1	9.4±7.2	7.4±4.9	8.6±6.4	0.644
Calcium (mg)	67±35	54±27	60±31	67±37	51±25	61±33	0.144
Iron (mg)	3.13± 1.62	2.47± 1.32	2.78± 1.51	3.14± 1.76	2.45± 1.34	2.85± 1.63	0.738
Carotene (µg)	994± 1059	874± 883	930± 970	988± 1118	734± 729	881± 981	0.776
Vitamin-C (mg)	17±20	15±17	16±19	16±21	12±13	15±18	0.783
CHO (gm)	67.2± 29.3	52.9± 23.4	59.6± 27.2	65.9± 30.2	52.5± 20.2	60.3± 27.3	0.388

Table 4.2.18: Attendance and Consumption Pattern of Children

School No.	Registered	Present	% Present	Consumed	% of MDM consumers
SSG	253	122±46	48.2	80±39	65.6
PSRA	422	180±63	42.7	127±51	70.6
MVB	142	82±29	57.7	63±25	77.2
PSDM	648	303±134	46.8	207±139	63.9
JCB	315	148±53	46.9	94±46	62.6
CSA	141	94±13	66.9	74±17	77.8
DHM	333	209±68	62.9	185±67	87.6
VB	175	99±24	56.3	86±23	86.5
DBSA	307	156±59	50.7	109±45	70.7
RV	549	167±57	30.4	107±44	63.6
SV	622	215±112	34.6	135±50	67.4
ZCM	256	101±29	39.4	48±18	46.9
DRP	289	151±59	52.2	120±50	80.5
DHG	504	137±30	27.2	93±26	67.8
RRMR	268	151±47	56.4	121±32	81.3
DSPM	1350	342±103	50.8	288±100	84.5
Total		**174±102**	**48.1**	**129±89**	**72.6**

The monthly consumption pattern of mid day meal was also derived and the data revealed that the consumption ranged from 65% to 85% **(Table 4.2.19)**.

The number of children present (43%) as well as the consumption of Mid Day Meal (65%) was lowest in the month of August due to rainy season and various festivals like Roza and Shravan mahina as can be seen in **(Figure 4.2.38).**

Table 4.2.20 shows the weekly MDM consumption pattern of school children. The consumption trend was more or less similar varying in narrow range from 69% to 76%. Wednesday consumption of MDM was the highest at 75.7%. This variation could be because of personal likes and dislikes of the children and the recipe cooked on that particular day i.e. Sukhadi (a sweet made of wheat flour and jaggery) as well as could be due to the highest attendance seen on Wednesday. On Saturdays, the attendance as well as the consumption of MDM was low **(Figure 4.2.39)**. This could possibly be due to morning shift on Saturdays, as a result of which few children came to school and also the meals were served after school got over, so children were in a hurry to go home.

Table 4.2.19: Month wise Consumption Pattern of MDM by School Children

Month	No of children present	% of children present	No of children consuming MDM	% of children consuming out of present
Jan	172±82	46.1	128±71	74.1
Feb	179±78	51.0	134±67	75.3
Mar	150±45	44.4	115±41	76.4
Apr	144±41	59.7	95±32	66.7
Jun	101±1	45.8	86±23	85.0
Jul	230±144	55.2	171±119	74.1
Aug	159±124	43.4	109±114	64.6
Sep	174±106	46.6	137±94	77.5
Oct	162±81	47.5	112±73	66.6
Dec	169±116	56.0	114±76	67.5

Table 4.2.20: Weekly Consumption pattern for Mid Day Meal by School Children

Days	Registered	Present	% Present	Consumed	% Consumed
Monday	397±192	166±100	43.9	125±92	71.8
Tuesday	414±185	201±104	52.8	152±98	74.1
Wednesday	392±195	208±125	54.7	161±110	75.7
Thursday	392±172	158±59	44.4	118±53	74.1
Friday	353±182	165±107	49.2	114±79	71.0
Saturday	365±166	143±90	41.5	101±81	68.6

Figure 4.2.38: Monthly MDM Consumption Pattern by Children

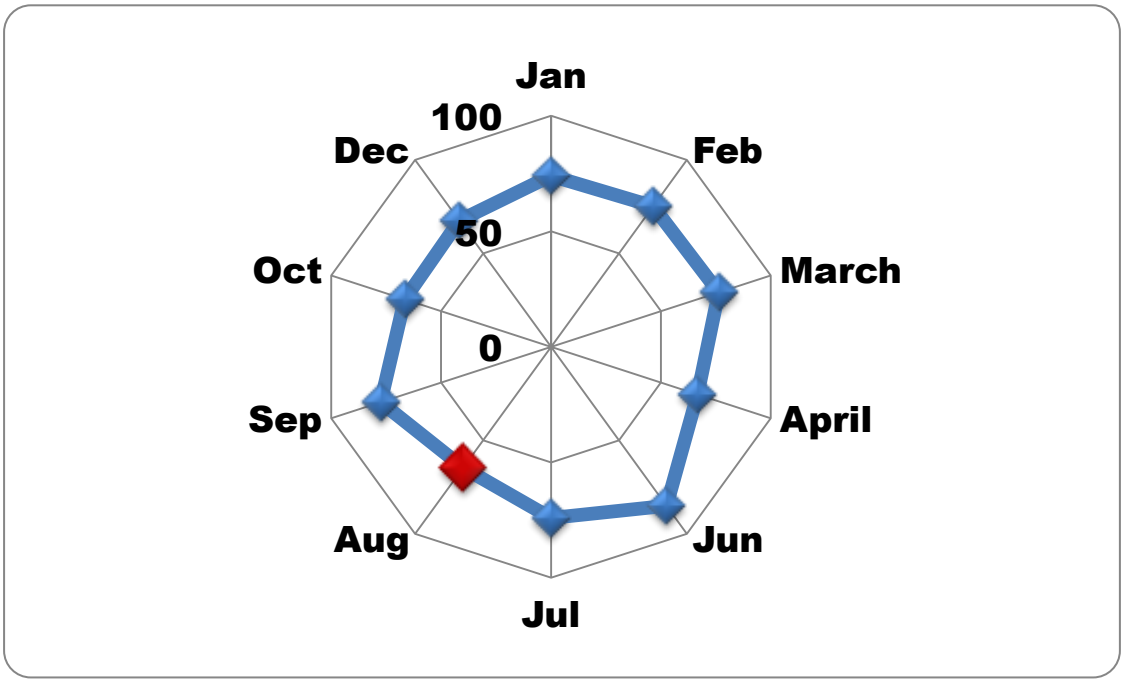
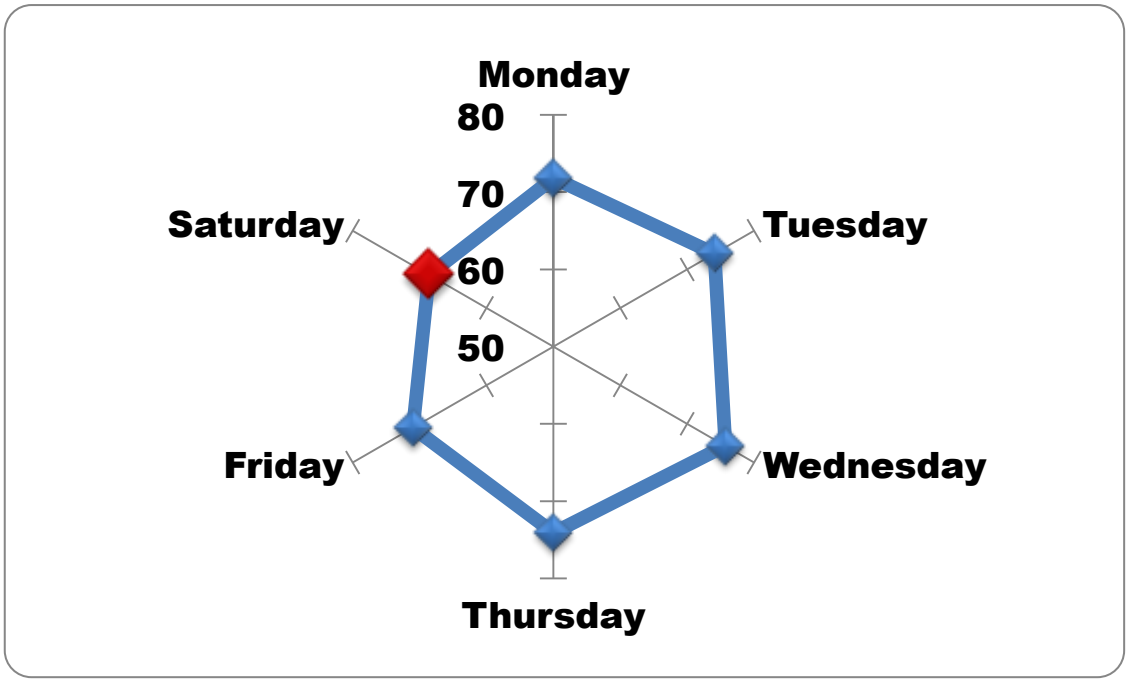


Figure 4.2.39: Weekly MDM Consumption Pattern by Children



HIGHLIGHTS

KITCHEN EVALUATION

- **The Centralized kitchen had good infrastructure to cater to the needs of the MDM programme.**
- **Good storage practices, food handling practices were followed at Akshay Patra. Akshay Patra employees followed all the basic sanitation and hygiene practices.**
- **Cost of various cooked food menu ranged from Rs.4.50 – Rs. 5.50.**
- **The Government of Gujarat provided raw food ingredients such as Fortified Wheat Flour and Rice.**
- **Insulated mobile vans are used for transporting foods to various schools.**
- **Quality analysis was done by Public Health Analyst.**
- **Leftover food received was distributed to registered local shepherds.**

SCHOOL OBSERVATIONS

- **Motivation by the teachers to consume MDM was insufficient.**
- **Akshay Patra helpers (73%) were mainly responsible for distribution of MDM.**
- **Disposal of plate waste led to unhygienic conditions in the school campus.**
- **The mean nutrient intake of the children was less than 1/3rd of the RDA as well as less than the nutritional norms prescribed in MDM.**
- **The mean nutrient intake was higher among boys as compared to girls.**
- **The mean nutrient intake was significantly lower among underweight children as compared to the normals.**
- **MDM consumption was 72.6% amongst the children present.**
- **MDM consumption was highest on Wednesday and least on Saturday.**

KEY MESSAGES

- **An attempt should be made to improve the sanitation and hygienic practices among the school children.**
- **Teachers can play a pivotal role in motivating children for achieving 100% compliance and improving the hygienic practices among the children.**

DISCUSSION

Many of the children come from homes where food availability is limited and, consequently, it is essential that they receive optimal nutrition at school in order to learn, grow, and develop appropriately (Bergman, Buergel, & Timothy, 2004).

Kitchen Evaluation

The Mid day Meal Program is the popular name for the school meal program, is a flagship programme of Government of India. It involves provision of meals free of cost to school children on all working days of the school to enhance school enrolment, retention, attendance and concurrently improving nutritional status of school children.

Within the PPP model of implementation of the MDMS, the system of providing Mid Day Meals by NGOs in a large scale is a relatively newer concept than the traditional way of preparation of MDM in the school itself especially in the urban areas where space is an issue. There are many NGO's like The Akshay Patra Foundation, Stri Shakti, Naandi, AMMS (Annapurna Mahila Sahkari Samiti), ISKON Food Relief Foundation which are providing MDM in various parts of India. The NGO's providing MDM are known for their advanced technology, efficient management and quality workforce as they have to outreach a greater number of children as compared to that of a single kitchen in a school setup. On the other hand the kitchen sheds at the school premises had minimal infrastructure and supplies to meet the basic need for meal preparation (Iyer and Dhaudiyal, 2010).

The system of centralized kitchen in Vadodara was introduced in 2009 by engaging The Akshay Patra Foundation (TAPF) to provide cooked nutritious food. The largest partner of the Government is the Akshaya Patra Foundation, a not-for-profit trust of ISKCON (International Society for Krishna Consciousness), Bangalore. Akshaya Patra started in the year 2000, and today reaches in 9 states across India. It serves cooked lunches from 19 kitchens to 1.3 million children daily, forming the largest NGO-run mid-day meal programme in the world (Governance Knowledge Centre, 2012).

A well planned kitchen ISO 2000:2005 certified was observed at The Akshay Patra Foundation which comprised of cooking area, cleaning area, washing area, stores and dispatch area. The kitchen also had sophisticated machinery like rice cauldrons, dal cauldrons, grains silo for storage of grains, aspirator for cleaning of rice, dough maker, roti making machine, sukhadi making machine, oil sprinklers, vegetable crates and steam boilers. There were some other facilities also available for reinsuring quality to food as well as work environment. These included re-sanitizer for utensils, hand sanitizers, plastic curtains, aqua guard and water/air coolers.

Similar kitchen is run by Naandi Foundation wherein a highly sophisticated centralized kitchen delivers food to nearly 6000 schools in Rajasthan (Savita Kaushal, 2009) and it has established a central kitchen at Hyderabad from which mid day meal is supplied to 1,01,394 children in 891 schools in the twin cities of Hyderabad and Secunderabad. Similarly the centralized kitchen established in Vishakhapatnam city by the same NGO covers 35,734 children in 111 schools (Josephine & Raju, 2008).

Another organization Stri Shakti, is providing mid day meals to 6063 schools covering 13, 19,325 children in different parts of Delhi, Gujarat, Bihar and Punjab. In Gujarat, they have 4 kitchens in Ahmedabad, Valsad, Umargaaon and Pardi (www.strishakti.in/accessed on 4/11/2014).

There was a systematic procedure for meal preparation. All the cooking equipment was sterilized using steam before the cooking process began. Six sigma methodology is used for cooking in the kitchen to improve the efficiency of various processes inside the kitchen with an aim at overall improvement in quality and optimization of costs. The vehicles are steam sterilised before the loading process. These vehicles use a puffed body to reduce the temperature loss and a honeycomb structure to hold the vessels upright and keep the freshness of the cooked meal intact till it is served to the children (Akshay Patra Foundation, 2014).

Sanitation and hygiene which forms one of the most important part of meal preparation were well ensured and the basic norms of food handling were well implemented in the Kitchen. The employees followed a code of personal as well as general hygiene practices during meal preparation. Pest Control Treatment was done on a daily basis in association with Pestcone Pest Control Services.

The menu provided by TAPF was attractive and comprised of a combination of wheat, rice and dal/vegetable based menu. An additional cost was incurred by TAPF for meal preparation than the usual Government entitlement of cost per meal per child. The most lacking factor in the menu was in terms of green leafy vegetables. As per MDMS guidelines green leafy vegetables should be added in the MDMS meal so that the children get the nutritional benefits (*National Programme of Nutritional Support to Primary Education [Mid-Day Meal Scheme] GUIDELINES*, 2006)

Deodhar in similar study reported that NGO, Stri Shakti which provides MDM to 277 schools under Ahmedabad Municipal Corporation (AMC) had a variety of meal to offer to children such as Rice and Dal, Puri and Chana, Khichdi and Sabji, Puri and Alu sabji, Sheera and Desi Chana, and Khichdi and Dal Baingan (Deodhar et al., 2007).

Thus, the centralized kitchen is a new dimension to the MDM Programme in the country. With better kitchen facilities and maintaining sanitation and

hygiene the system is able to cater to the reach of large number of children in limited time.

Hence, we can say that Akshaya Patra is a unique & successful example of a Public Private Partnership (PPP) in the Mid Day Meal sector which is more efficient and effective in providing hot nutritious MDM to school children.

Spot Observations at School

Since school lunch is designed to provide children with one-third of their nutrient requirements for the day, it is essential that the school environment be designed to promote optimum consumption of a well-balanced diet (Bergman et al., 2004). Mid Day Meal Programme is the popular name for school meals in India and is one of the largest school meal programme in the world. Since MDMP started in 1995 there have been lots of changes in the programme to suit to the situation and meet the nutritional demands of the beneficiaries i.e. the children. In order to improve upon the MDMP the Government of India joined hands with various NGOs like the Akshay Patra Foundation.

Several dietary assessment methods have been developed for assessing the dietary intake among primary school children. However, they pose challenges because they are dependent on child's literacy and cognitive recall abilities. Direct observation is a method which is not dependent on the child's memory and can provide unbiased information about the child's actual intake. Hence, this method was used in our study and it's the strength of our study as no studies in India are available reporting the mean nutrient intake obtained from MDM consumption.

Spot observations revealed that corridors and playground of the school were the major venues for having school meals. Similar findings were also seen in a study conducted in Rajasthan, where in almost all the schools, children were made to sit on the mats spread in front of the corridor of the class rooms (Savita Kaushal, 2009). Another study carried out to evaluate the MDM scheme of urban Vadodara using Health research system strategy also found that in 81% schools, students had their food sitting in the corridors. (Nambiar

& Gandhi, 2008). Gangadharan (2006) in a study of Mid Day Meal Scheme (MDMS) (termed as noon-meal scheme in Kerala) running in Kerala also reported that school verandah was the main venue for serving food.

The success of the mid day meal programme revolves around the manner in which it is implemented at the school. Safety and hygiene standards must be set and practiced with rigor. Teachers play a crucial role in ensuring that good quality food is served, by tasting the food before it is served to children and secondly monitoring the actual serving and encouraging children to eat in a spirit of togetherness and in hygienic conditions. Cooking and serving utensils should be properly cleaned and dried every day after use (*National Programme of Nutritional Support to Primary Education [Mid-Day Meal Scheme] GUIDELINES*, 2006).

Motivation by the teachers to children to consume food was found to be inadequate (66.4%) and the practice of tasting food before serving to the children (2%) was also not seen which needs to be addressed.

A study conducted on impact of cooked mid day meal in West Bengal also showed that the teachers were found to be hostile and appeared to be indifferent towards to the programme (Rana, 2005). Another study conducted in MCD schools of Delhi, also reported that in schools where teachers supervised the distribution of meals, the efficiency of the system was enhanced but tasting of food was either not done or done in a nominal way (Samson, Noronha, & De, 2007). In a descriptive survey conducted among 50 school teachers of 20 primary schools of Jagadhary block of District Yamunanagar also reported that the quality of the meals was not checked nor tested (Bhargav & Bhargav, 2011). Gupta (2009) studied teachers and students perceptions towards Mid Day Meal Scheme in district Mandi of Himachal Pradesh and concluded that the lack of interest was noticed on the part of primary school teachers regarding implementation of Mid Day Meal Scheme [cross ref by (Kumar & Sharma, 2011)].

Contrary to our findings Kumari, Devi & Rani (2009) in their study "Impact of Mid day Meal Programme in Tribal Areas of East Godwari district of Andhra Pradesh" found that all the principals of the schools taste the food before it was served to the children.

School authorities should participate to keep a strict watch on the MDM being served and make a significant contribution to encouraging and facilitating healthier eating patterns among schoolchildren (Gould, Russell, & Barker, 2006).

Earlier it was found that (85.7%) the plates did not have sufficient space to serve all the items properly. The quantity of food served depended on the size of the tiffin boxes or plates got by the children from home. In December 2010, big plates were provided to almost all the schools for children by Nagar Prathmik Shikshan Samiti in which all the food items could be served properly which was highly appreciated.

According to a study conducted in four districts of Madhya Pradesh, similar findings was found that many of the schools did not have utensils, hence children had to bring lunch boxes or plates from home (Robinson, 2007)
As per the norms, helpers should serve the MDM but due to the shortage of helpers it was seen that teachers, peons and senior school children were helping the Akshay Patra helpers in serving the meals. Another study conducted in Dharwad, Karnataka reported that maximum number of teachers viz., 33.33 per cent reported that the attenders and children served the food to children followed by 26.67 per cent who reported, teachers alone served and equal per cent who reported that children along with teachers served. About 13.33 per cent reported that along with teachers, children and attenders served the food (Bellary, Karkannavar, & Ashalatha, 2013).

Apart from hygienic processing of ingredients and cooking of meal, it is important that children themselves are trained to eat their meal hygienically. Looking at their sanitation and the hygiene practices, majority of the schools had the provision of regular supply of water and separate drinking water

facility. But lack of hygiene was a serious issue as no one insisted children to wash their hands before the meal. The importance of washing one's hands with soap before and after eating was completely overlooked. Hand washing is a relatively simple, inexpensive and important public health measure. Teaching primary school children to wash their hands properly and encouraging regular hand washing may not only reduce infection related absenteeism but also help to habitualise this behaviour (Chittleborough et al., 2013)

Inadequate sanitary conditions and poor hygiene practices play major roles in the increased burden of -communicable disease within these developing countries. Lack of resources, namely soap and water, as well as inadequate sanitation facilities may be two of the main reasons why children do not wash their hands (Vivas et al., 2010).

In none of the schools, cleaning of the area was not done where the food would be served or where the children would eat. Thus, dust, dirt and flies could find its way into the food. In most of the schools, the utensils were cleaned and had waste disposable bin. In 95% of the observations it was found that children used dustbins to dispose the plate waste. However in 27% of the observations, children were found to be disposing the plate waste either in dustbin or in open space where animals were eating which lead to unhygienic conditions in the school premises, and in 40% of the observation, the plate waste was given to shephards for feeding the cattle or thrown in dustbin or in open space. All the schools distributed the left over among children. In majority of schools the left over was eaten by cows of the village **Thus, increased attention should be directed towards the school environment where children consume MDM as it is an important contribution towards their daily diet.**

A study conducted by Anup Kumar (2011), observed the implementation of MDM in Himachal Pradesh and found that school verandah was the main venue for serving MDM and was kept clean by the school peons before and

after MDM distribution. Here, the role of school teachers to keep the school campus clean and avoiding scattering of left over meal was praiseworthy.

As per the nutrition and quantity parameters of the MDMS, the standards are specific in the range of foods, which should be offered to meet nutritional requirements. The standards stipulate that each day for a primary school children a meal should have 100 gm of grains (rice/wheat), 20 gm pulses, 50 gm vegetables, and 5 gm oil, and 150 gm grains (rice/wheat), 30 gm pulses, 75 gm vegetables, and 7.5 gm oil for upper primary school children (Shukla, 2014).

From the present study it was found that primary school children should at least consume 1 cup of cooked rice, 1 cup of cooked dal and 1 serving of wheat to meet the nutritional requirement prescribed as per MDM norms and upper primary school children should consume minimum $2^{1/2}$ cup of cooked rice, $2^{1/2}$ cup of cooked dal and 2 serving of wheat to achieve the norms of MDM.

A study conducted in Ludhiana by Mehta et al (2013), reported that the mean energy content of the menu prepared under MDM programme at schools varied from 350-386 kcal and 10.9-11.9 g of protein per day which is far below the recommended norms of 450 kcal and 12 g of protein for primary school children and 700 kcal and 20 g of protein for upper primary school children.

It was found that despite implementation of the mid day meal programme which provides $1/3^{rd}$ of the RDA, the consumption of MDM and hence, the consumption of most of the essential nutrients by school children was less than $1/3^{rd}$ of the RDA. **Dietary deficiency may be an important contributing factor to the undernutrition and anemia observed in the present study.** A deficient nutrient intake and substandard growth in children from socio-economically backward families have been observed by other researchers (Ananthakrishnan, Pani, & Nalini, 2001)

The mean nutrient intake of the primary school children (aged 7-9 years) in urban areas of Ludhiana was 369 kcal and 11.9 g of protein which was higher than the present study. In another study carried out by Bellary (2009), the

mean nutrient intake was 272 kcal and 6.14 g of protein for primary school children and 420 kcal and 11.3 g of protein for upper primary school children obtained from MDM provided by non-religious institution and the mean nutrient intake was 253 kcal and 6.09 g of protein for primary school children and 401 kcal and 9.6 g of protein for upper primary school children obtained from MDM provided by religious institution. The mean nutrient intake of the children provided by both the institutions was less than the present study.

The mean dietary intake was statistically different across the gender and standards wherein the mean nutrient intake of boys was more than girls and children studying in upper primary standards had higher intake as compared to children studying in primary standards.

Children's food preferences were an important determinant for the nutrient intake obtained from the food provided by the schools. Similar findings were reported by Gould et al., (2006) were 74 children aged 11-12 years of secondary schools in Shaffield, UK were assessed to examine the influence of children's food choices on nutrient intake at lunch time.

The limitation of the study was that total dietary intake of school children was not assessed to see whether the school meal provided additional calories and nutrients or was replaced by a home meal. Similar limitation was observed in other research study. (Jomaa, McDonnell, & Probart, 2011)

The Public Private Partnership (PPP) model like The Akshay Patra Foundation should be encouraged as it would resolve the issues related to MDM programme such as regular supply of meals, involvement of teachers and children in cooking process thereby cutting the cost of teaching and learning time, workload of teachers in maintaining the records, procurement of ingredients etc. Also prevent the children from unhealthy atmosphere in the school created during food preparation in the school premises. The added advantage of this model is that children are getting now well cooked nutritious meal prepared under hygienic conditions.

As school environment affects the growth and development of a child, increased attention needs to be intended towards the sanitation and hygienic at school which includes cleanliness of the school premises, cleanliness of the serving area, serving utensils and plates for consuming MDM along with drinking water and toilet facility.

Good sanitation and hygiene practices should be inculcated among school children such as washing hands with soap before and after eating as they are the most persuasive advocates of good sanitation practices in the community.

Teachers play a pivotal role in creating awareness among children regarding the health benefits of MDM. Children should also be motivated with simple messages like regular consumption of MDM at school in addition to home meals like breakfast, lunch and dinner.

PHASE 3: IMPACT EVALUATION

The Government has successfully implemented many schemes to have better educational standards and to reduce the dropout rate in schools. However, all of them have diverse results. The present study focuses on the performance of one such scheme – the Mid Day Meal Programme run through public private partnership by an NGO The Akshay Patra Foundation (TAPF). The aim of the study was to observe the impact on nutritional status and growth of primary school children of Vadodara. Hence, in this phase of the study, impact data were analyzed for only those whose data were available in the initial round and after one year of intervention.

Number of children enrolled for the phase

Overall 3524 school children were covered for the impact phase. Of these, 1649 (46.8%) were boys and 1875 (53.2%) were girls. The age-wise distribution of number of children is shown in **Table 4.3.1**. About 82% of the children were upto the age of 10 years. Less than 5% of the children were >12 years of age. Around 10% of the children were 11 years old. Thus, it was observed that predominantly children were in the age range of 6-10 years.

Socio-Economic Status

The details regarding the socio-economic status are presented in **Table 4.3.2**. It can be seen that majority of the children were Hindus (81.6%) followed by Muslims (18.0%). Amongst the children majority belonged to OBC category (36.5%) followed by the general category (31.3%), Scheduled Caste (16.3%) and Scheduled Tribe (15.9%). Majority of the children lived in nuclear families (62.6%) and the difference was statistically significant across the gender where in higher number of boys belonged to nuclear families.

Table 4.3.21: Distribution of Children According To Age (N, %)

Age Group (Years)	Boys		Girls		Total	
	N	%	N	%	N	%
5	104	6.3	134	7.1	238	6.8
6	199	12.1	237	12.6	436	12.4
7	229	13.9	283	15.1	512	14.5
8	214	13.0	293	15.6	507	14.4
9	275	16.7	310	16.5	585	16.6
10	278	16.9	322	17.2	600	17.0
11	196	11.9	171	9.1	367	10.4
12	83	5.0	82	4.4	165	4.7
13	38	2.3	32	1.7	70	2.0
14	23	1.4	7	0.4	30	0.9
15	5	0.3	3	0.2	8	0.2
16	5	0.3	1	0.1	6	0.2
Total	**1649**	**46.8**	**1875**	**53.2**	**3524**	**100**

Table 4.3.22: Socio Economic Profile of the Children (N, %)

	Boys (N=1649)		Girls (N=1875)		Total (N=3524)		Chi Square Value
	N	%	N	%	N	%	
Caste							
SC	279	16.9	296	15.8	575	16.3	4.837
ST	278	16.9	282	15.0	560	15.9	
OBC	575	34.9	712	38.0	1287	36.5	
GEN	517	31.4	585	31.2	1102	31.3	
	Boys (N=1463)		**Girls (N=1684)**		**Total (N=3147)**		
Religion							
Hindu	1200	82.0	1367	81.2	2567	81.6	6.738
Muslim	253	17.3	313	18.6	566	18.0	
Sikh	1	0.1	0	0.0	1	0.0	
Christian	9	0.6	3	0.2	12	0.4	
Other	0	0.0	1	0.1	1	0.0	
Type of family							
Nuclear	935	63.9	1035	61.5	1970	62.6	7.760*
Extended Nuclear	320	21.9	348	20.7	668	21.2	
Joint	208	14.2	301	17.9	509	16.2	

* **Significant at P<0.05**

Education and Occupation of Parents

With regards to the education of the parents of the children, it was observed that 8.3% of the fathers as compared to 18.3% of the mothers were illiterate as shown in **Table 4.3.3.** Majority of the children (34%) were not aware about the educational status of their parents. The data also revealed that the educational status of the mothers of the girls was better compared to the mothers of the boys and the difference was statistically significant.

Occupation data of the parents depicted in **Table 4.3.4** revealed that majority of the fathers were self employed (driver, tailor, painter) (29.3%) followed by 28.7% of the fathers who had service and 24.3% who worked as labourers. In case of the mothers, 45.9% of them were housewives whereas 36.0% of the mothers worked as housemaid. Higher number of mothers of boys were employed as housemaid as compared to mothers of girls and the difference was statistically significant.

Information related to MDM is shown in **Table 4.3.5.** Around 85% of the children consumed MDM and liked the food very much. Among the children who consumed MDM in school, around 50% of children consumed the food all the days in a week.

Impact of Intervention on Growth and Iron Deficiency Anemia

To assess the impact of Mid Day Meal intervention on the growth and haemoglobin levels, the change in weight, height, BMI and their haemoglobin were analyzed. The analysis was cross tabulated by various variables like age and gender. **Table 4.3.6** present the impact of mid day meal programme on the nutritional status of the children across the gender.

Impact of Intervention on Weight:

The mean anthropometric measurements of children i.e. weight, height, and BMI according to age and gender are shown in **Table 4.3.7, Table 4.3.8** and **Table 4.3.9** respectively.

Table 4.3.23: Education of Parents among the Study Population (N,%)

	Boys (N=1463)		Girls (N=1684)		Total (N=3147)	
	N	%	N	%	N	%
Education of Father						
Illiterate	139	9.5	123	7.3	262	8.3
Primary (1-7)	389	26.6	468	27.8	857	27.2
Secondary (8-10)	307	21.0	368	21.9	675	21.4
Higher Secondary (11-12)	102	7.0	132	7.8	234	7.4
Graduate & above	6	0.4	10	0.6	16	0.5
Don't Know	514	35.1	573	34.0	1087	34.5
Not Applicable	6	0.4	10	0.6	16	0.5
Chi Square Value: 7.33						
Education of Mother						
Illiterate	289	19.8	286	17.0	575	18.3
Primary (1-7)	409	28.0	518	30.8	927	29.5
Secondary (8-10)	168	11.5	267	15.9	435	13.8
Higher Secondary (11-12)	44	3.0	49	2.9	93	3.0
Graduate & above	1	0.1	6	0.4	7	0.2
Don't Know	545	37.3	553	32.8	1098	34.9
Not Applicable	7	0.5	5	0.3	12	0.4
Chi Square Value: 24.19* **						

***** Significant at P< 0.001**

Table 4.3.24: Occupation of the Parents of Children (N, %)

	Boys (N=1463)		Girls (N=1684)		Total (N=3147)	
	N	%	N	%	N	%
Occupation of Father						
Laborer	355	24.3	410	24.3	765	24.3
Industrial worker	73	5.0	70	4.2	143	4.5
Agricultural Worker	37	2.5	38	2.3	75	2.4
Self Employed	436	29.8	487	28.9	923	29.3
Service	407	27.8	497	29.5	904	28.7
Vegetable/Food Vendor	48	3.3	51	3.0	99	3.1
Others	2	0.1	4	0.2	6	0.2
Unemployed	9	0.6	21	1.2	30	1.0
Don't know	55	3.8	56	3.3	111	3.5
Not Applicable	41	2.8	50	3.0	91	2.9
Chi Square Value: 6.77						
Occupation of Mother						
House wife	614	42.0	832	49.4	1446	45.9
House maid	550	37.6	582	34.6	1132	36.0
Laborer	59	4.0	52	3.1	111	3.5
Industrial worker	12	0.8	9	0.5	21	0.7
Agricultural worker	18	1.2	21	1.2	39	1.2
Self-Employed	97	6.6	93	5.5	190	6.0
Service	68	4.6	54	3.2	122	3.9
Don't know	24	1.6	29	1.7	53	1.7
Not Applicable	21	1.4	12	0.7	33	1.0
Chi Square Value: 24.08**						

**** Significant at P<0.01**

TABLE 4.3.25: Information about Children Consuming Mid Day Meal Food

Sr. No.	Variable	Boys (N=1463)	Girls (N=1684)	Total (N=3147)
	Consume MDM Food			
1	Yes	88.2 (1290)	82.8 (1395)	85.3 (2685)
2	No	11.8 (173)	17.2 (289)	14.7 (462)
	Chi Square Value: 17.800* **			
	Frequency of consumption of MDM food/week			
1	≤ 3 Days	10.5 (154)	11.3 (190)	10.9 (344)
2	4-5 Days	26.7 (391)	23.4 (394)	24.9 (785)
3	All Days	50.9 (745)	48.2 (811)	49.4 (1556)
4	Don't Consume	11.8 (173)	17.2 (289)	14.7 (462)
	Chi Square Value: 20.284* **			
	Like the food?			
1	Yes	88.2 (1290)	82.8 (1395)	85.3 (2685)
2	No	11.8 (173)	17.2 (289)	14.7 (462)
	If No, (Reason)			
1	Eat from their home	46.8 (81)	39.1 (113)	42.0 (194)
2	Don't bring plate	12.7 (22)	12.1 (35)	12.3 (57)
3	Don't like the food given	33.5 (58)	34.3 (99)	33.9 (157)
4	Don't allow by parents	5.2 (9)	11.8 (34)	9.3 (43)
5	Coming late from home	1.7 (3)	1.4 (4)	1.5 (7)
6	Rickshaw coming early/late	0.0 (0)	1.4 (4)	0.8 (4)

Values in parenthesis indicates number

***** Significant at P< 0.001**

Table 4.3.26: Impact of Mid Day Meal Programme on the Nutritional Status of the Children

Variables	BOYS (N=1649)	GIRLS (N=1875)	TOTAL (N=3524)	't' VALUE
	WEIGHT (Kg)			
INITIAL	21.8±5.7	21.4±5.8	21.6±5.8	1.838
FINAL	24.8±6.9	24.8±6.9	24.8±7.1	0.351^{EVNA}
DIFFERENCE	3.0±2.0	3.4±2.4	3.2±2.3	5.893***^{EVNA}
PAIRED "t" VALUE	59.616***	61.975***	85.223***	
	HEIGHT (cms)			
INITIAL	123.5±12.2	122.0±12.1	122.7±12.1	3.587***
FINAL	129.1±12.3	127.9±12.2	128.5±12.2	2.778**
DIFFERENCE	5.6±1.7	5.9±1.8	5.8±1.8	5.346***
PAIRED "t" VALUE	129.547***	140.761***	190.548***	
	BMI (Kg/m^2)			
INITIAL	14.0±1.4	14.1±1.6	14.1±1.5	1.587^{EVNA}
FINAL	14.6±1.7	14.9±2.1	14.7±2.0	4.140***^{EVNA}
DIFFERENCE	0.5±1.0	0.7±1.2	0.6±1.1	5.138***^{EVNA}
PAIRED "t" VALUE	22.345***	28.866***	34.808***	

**** Significant at P<0.01 *** Significant at P< 0.001**

EVNA – Equal Variance Not Assumed

The mean weight of boys (24.8 kgs) and girls were (24.9 kgs) comparable and no significant gender difference was seen in the mean values of weight. However, there was significant increase in the weight in case of both boys and girls as compared to their baseline values and the difference was statistically significant.

The mean increase in the weight of girls was 3.4 kgs and for boys was 3.0 kgs. The mean increase in the weight of girls was significantly higher than boys and the difference was statistically significant. **Thus, the impact of MDM was better among girls as compared to the boys.**

After one year of intervention, the weight of both boys and girls across all the ages was higher than their initial weights. When the data was analyzed as per the age, it was observed that mean weights for both boys and girls increased with the increase in age **(Table 4.3.7)**. The maximum increase in weight was seen at 12 years of age. The peak weight velocity of the children is depicted in **Figure 4.3.1**. Across the gender, the maximum weight gain among boys occurred at 15 years (6.4 kgs) and minimum was 1.9 kgs at 5 years. Among girls, the maximum weight gain occurred at 16 years (6.3 kgs) and minimum at 5 years (1.7 kgs).

Impact of Intervention on Height:

In case of height, it was seen that the mean height of boys was 129 cms and of girls was 128 cms post one year of intervention **(Table 4.3.8)**. Though, significant gender difference was seen in the overall mean values of height. Only in the age group of 5-6 years, boys were significantly taller than girls. From 7 years onwards, no significant difference was seen in mean height of boys and girls.

The overall increase in the mean height of boys was 5.6 cms while for girls it was 5.9 cms. Thus, the mean increase in the height of girls was significantly higher than boys and the difference was statistically significant indicating that the catch up growth in terms of height gain was more evident in the girls than in the boys. Age wise analysis **(Figure 4.3.2)** of data revealed that the

Table 4.3.27: Mean Weight of the Children Cross Tabulated by Age and Gender (Mean±SD, kg)

Age (yr)	Boys	Girls	Total	"t" value
5 – 5.11 Years				
INITIAL	15.1±1.9	14.6±1.7	14.8±1.8	2.062*
FINAL	17.0±2.4	16.3±2.0	16.6±2.2	2.508*
DIFFERENCE	1.9±1.3	1.7±1.2	1.8±1.3	1.45
PAIRED "t" VALUE	15.605***	16.087***	22.349***	
6-6.11 Years				
INITIAL	16.7±2.2	16.0±2.2	16.3±2.2	3.350**
FINAL	18.9±2.7	18.2±2.8	18.5±2.8	2.887**
DIFFERENCE	2.2±1.4	2.2±1.5	2.2±1.4	0.392
PAIRED "t" VALUE	21.973***	23.086***	31.892***	
7-7.11 Years				
INITIAL	18.0±2.4	18.0±2.8	18.0±2.6	0.042^{EVNA}
FINAL	20.5±3.0	20.5±3.5	20.5±3.3	0.036^{EVNA}
DIFFERENCE	2.5±1.4	2.5±1.4	2.5±1.4	0.006
PAIRED "t" VALUE	26.892***	29.385***	39.866***	
8-8.11 Years				
INITIAL	19.9±2.8	20.2±3.3	20.0±3.1	
FINAL	22.5±3.6	23.2±4.4	22.9±4.1	1.168^{EVNA}
DIFFERENCE	2.7±1.7	3.1±1.8	2.9±1.8	2.019^{*EVNA}
PAIRED "t" VALUE	23.533***	28.364***	36.641***	-2.479*
9-9.11 Years				
INITIAL	22.1±3.5	22.4±4.0	22.3±3.8	0.865
FINAL	25.1±4.4	26.2±5.3	25.7±4.9	2.889^{**EVNA}

DIFFERENCE	2.9±1.6	3.8±2.2	3.4±1.9	5.755***EVNA
PAIRED "t" VALUE	31.066***	31.161***	42.148***	
10-10.11 Years				
INITIAL	24.4±4.1	24.7±4.6	24.6±4.4	0.992 EVNA
FINAL	27.6±5.4	29.3±6.1	28.5±5.8	3.597*** EVNA
DIFFERENCE	3.2±2.1	4.5±2.5	3.9±2.4	7.169*** EVNA
PAIRED "t" VALUE	26.054***	32.701***	40.192***	
11-11.11 Years				
INITIAL	26.0±4.2	27.0±4.8	26.4±4.5	2.190*
FINAL	29.6±5.7	32.0±6.3	30.7±6.1	3.849***
DIFFERENCE	3.7±2.4	5.0±3.3	4.3±2.9	4.555***
PAIRED "t" VALUE	21.386***	19.653***	27.866***	
12-12.11 Years				
INITIAL	28.9±6.4	30.2±5.1	29.5±5.8	1.456
FINAL	33.4±7.6	35.7±6.0	34.5±6.9	2.106*
DIFFERENCE	4.5±2.6	5.5±2.9	4.9±2.8	2.214*
PAIRED "t" VALUE	15.954***	17.129***	23.131***	
13-13.11 Years				
INITIAL	29.7±4.5	32.0±4.4	30.8±4.6	2.152*
FINAL	35.2±6.3	36.1±5.2	35.6±5.8	0.653
DIFFERENCE	5.5±3.1	4.1±2.8	4.8±3.0	1.947
PAIRED "t" VALUE	10.789***	8.250***	13.305***	
14-14.11 Years				
INITIAL	33.7±6.9	32.9±5.0	33.5±6.4	0.288
FINAL	38.7±8.6	35.8±5.5	38.0±8.0	0.834

DIFFERENCE	4.9±3.9	2.9±2.0	4.5±3.6	1.341
PAIRED "t" VALUE	6.097***	3.750*	6.747***	
15-15.11 Years				
INITIAL	39.9±11.5	40.4±3.2	40.1±8.8	0.069
FINAL	46.3±12.6	42.2±4.3	44.8±10.0	0.536
DIFFERENCE	6.4±2.4	1.8±4.5	4.6±3.8	1.950
PAIRED "t" VALUE	5.921**	0.687	3.431*	
16-16.11 Years				
INITIAL	37.9±6.2	28.2±0.0	36.3±6.8	1.430
FINAL	42.4±6.7	34.5±0.0	41.1±6.8	1.073
DIFFERENCE	4.5±4.6	6.3±0.0	4.8±4.2	-0.359
PAIRED "t" VALUE	2.166	-	2.788*	
Total				
INITIAL	21.8±5.7	21.4±5.8	21.6±5.8	1.838
FINAL	24.8±6.9	24.8±6.9	24.8±7.1	0.351^{EVNA}
DIFFERENCE	3.0±2.0	3.4±2.4	3.2±2.3	$5.893^{***EVNA}$
PAIRED "t" VALUE	59.616***	61.975***	85.223***	

*** Significant at P< 0.05 ** Significant at P<0.01**

***** Significant at P< 0.001**

EVNA – Equal Variance Not Assumed

Figure 4.3.3: Peak Weight Velocity of the Children

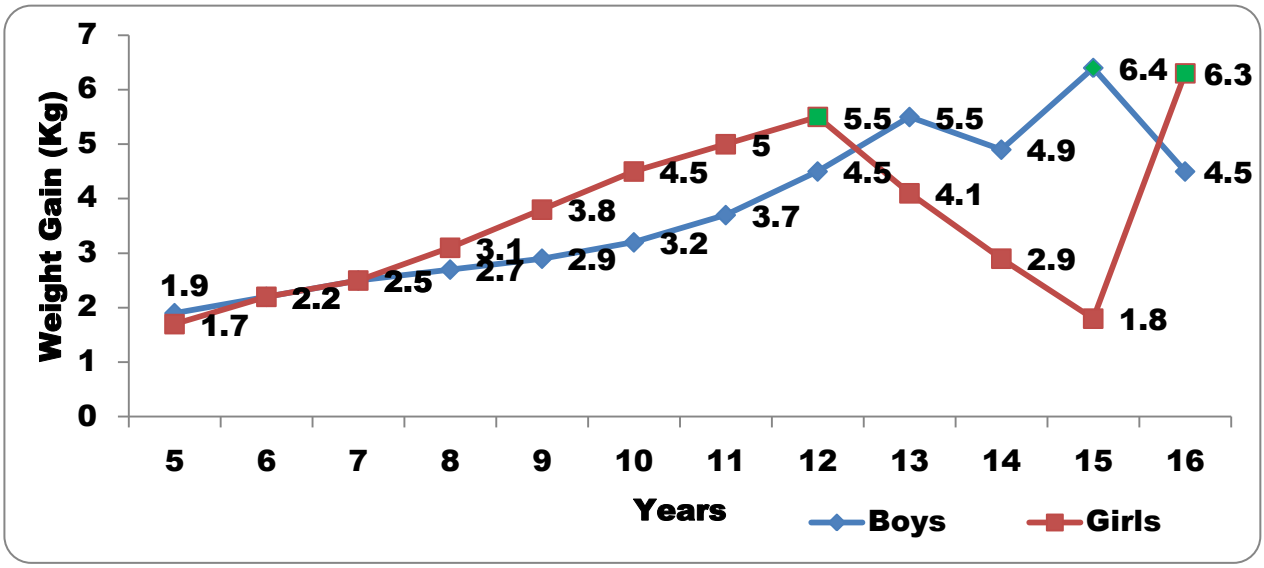


Figure 4.3.4: Peak Height Velocity of the Children

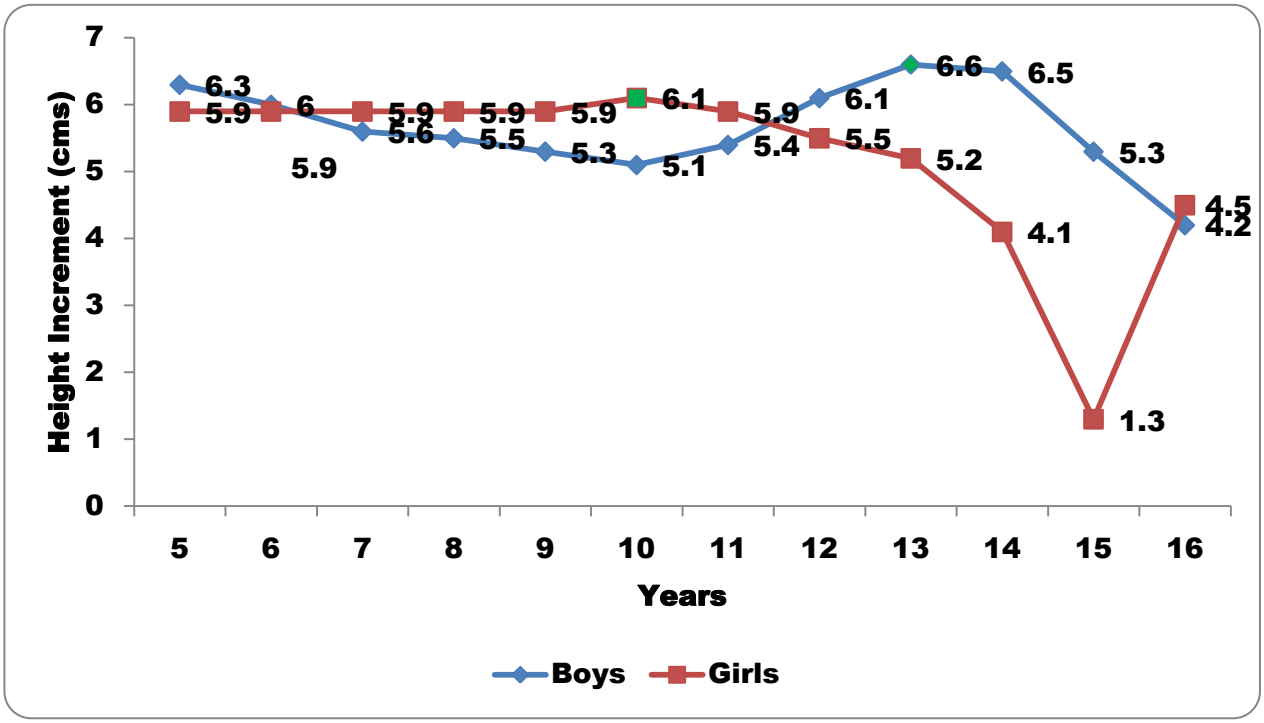


Table 4.3.28: Mean Height Of The Children Cross Tabulated By Age And Gender (Mean±SD, Cms)

Age (yr)	Boys	Girls	Total	"t" value
5 – 5.11 Years				
INITIAL	105.1±5.2	103.8±4.4	104.3±4.8	2.128*
FINAL	111.4±5.3	109.7±5.0	110.5±5.2	2.506*
DIFFERENCE	6.3±1.3	5.9±1.5	6.1±1.4	1.90
PAIRED "t" VALUE	50.893***	45.075***	66.026***	
6-6.11 Years				
INITIAL	110.6±5.8	108.6±5.5	109.5±5.8	3.691***
FINAL	116.6±6.2	114.5±5.7	115.4±6.0	3.742***
DIFFERENCE	6.0±1.5	5.9±1.8	5.9±1.6	0.771
PAIRED "t" VALUE	56.441***	51.940***	75.767***	
7-7.11 Years				
INITIAL	115.0±5.2	114.9±6.1	114.9±5.7	0.109
FINAL	120.6±5.4	120.8±6.3	120.7±5.9	0.464^{EVNA}
DIFFERENCE	5.6±1.5	5.9±1.5	5.8±1.5	2.282*
PAIRED "t" VALUE	56.166***	68.565***	88.073***	
8-8.11 Years				
INITIAL	119.7±5.7	120.3±6.2	120.1±6.0	1.154
FINAL	125.2±5.7	126.2±6.8	125.8±6.4	1.766^{EVNA}
DIFFERENCE	5.5±1.6	5.9±1.7	5.7±1.7	2.388*
PAIRED "t" VALUE	49.540***	60.325***	77.696***	
9-9.11 Years				
INITIAL	125.3±6.3	125.4±7.0	125.3±6.7	0.097
FINAL	130.6±6.5	131.3±7.5	131.0±7.0	1.262^{EVNA}

DIFFERENCE	5.3±1.8	5.9±1.9	5.6±1.9	4.428***EVNA
PAIRED "t" VALUE	47.747***	56.592***	72..802***	
10-10.11 Years				
INITIAL	130.5±7.2	130.1±7.0	130.3±7.1	0.597
FINAL	135.6±7.7	136.2±7.2	135.9±7.5	1.076
DIFFERENCE	5.1±1.5	6.1±1.9	5.6±1.8	7.175*** EVNA
PAIRED "t" VALUE	55.399***	57.751***	76.390***	
11-11.11 Years				
INITIAL	134.1±7.1	134.7±6.6	134.4±6.9	0.920
FINAL	139.5±8.0	140.7±6.8	140.0±7.5	1.493EVNA
DIFFERENCE	5.4±1.8	5.9±1.8	5.7±1.8	2.582*
PAIRED "t" VALUE	41.541***	43.024***	59.241***	
12-12.11 Years				
INITIAL	137.7±7.9	139.8±6.7	138.8±7.3	1.822
FINAL	143.8±7.9	145.3±5.9	144.6±7.0	1.392 EVNA
DIFFERENCE	6.1±2.3	5.5±2.4	5.8±2.3	1.518
PAIRED "t" VALUE	23.848***	21.078***	31.626***	
13-13.11 Years				
INITIAL	142.0±8.0	141.1±5.8	141.6±7.1	0.496
FINAL	148.6±9.2	146.3±5.9	147.5±7.9	1.194
DIFFERENCE	6.6±2.3	5.2±3.4	5.9±2.9	2.053*
PAIRED "t" VALUE	17.861***	8.534***	16.991***	
14-14.11 Years				
INITIAL	148.0±10.0	144.7±7.4	147.2±9.5	0.788

FINAL	154.4±10.7	148.9±5.9	153.1±10.0	1.310
DIFFERENCE	6.5±2.2	4.1±2.3	5.9±2.4	2.454*
PAIRED "t" VALUE	14.172***	4.873**	13.609***	
15-15.11 Years				
INITIAL	150.7±11.1	150.0±4.9	150.4±8.8	0.101
FINAL	156.0±11.7	151.3±5.2	154.3±9.6	0.640
DIFFERENCE	5.3±2.5	1.3±0.3	3.8±2.8	2.611*
PAIRED "t" VALUE	4.666*	8.000*	3.831**	
16-16.11 Years				
INITIAL	153.0±10.5	134.5±0.0	149.9±12.0	1.613
FINAL	157.2±9.2	139.0±0.0	154.2±11.1	1.812
DIFFERENCE	4.2±4.5	4.5±0.0	4.2±4.0	-0.061
PAIRED "t" VALUE	2.096	-	2.597*	
Total				
INITIAL	123.5±12.2	122.0±12.1	122.7±12.1	3.587***
FINAL	129.1±12.3	127.9±12.2	128.5±12.2	2.778**
DIFFERENCE	5.6±1.7	5.9±1.8	5.8±1.8	5.346***
PAIRED "t" VALUE	129.547***	140.761***	190.548***	

*** Significant at P< 0.05**

**** Significant at P<0.01**

***** Significant at P< 0.001**

EVNA – Equal Variance Not Assumed

maximum increase in mean height in case of boys (6.6 cms) was in the age group of 13-14 years and among girls (6.1 cms) at 10 years. It was also seen that the minimum increase in the mean height was at the age of 15 years among girls (1.3 cms) and among boys at 16 years (4.2 cms) **(Table 4.3.8)**. **This indicates that pattern of height increment among girls was markedly different from the boys.**

Impact of Intervention on BMI:

When BMI was calculated using weight and height data, it was found that the mean BMI of boys was 14.6kg/m^2 and for girls it was 14.9kg/m^2 after one year of intervention **(Table 4.3.6)**. The difference was statistically significant across the gender indicating that the mean BMI of girls was significantly higher than boys. The mean difference in BMI observed after one year of intervention was 0.6 in case of boys and 0.7 in case of girls, which was also statistically significant. **Thus, an overall increase in BMI was observed after one year of intervention which was statistically significant.** When the BMI was analyzed according to the age **(Table 4.3.9)**, it was seen that the mean increase in BMI was higher in the age group of 10-13 years as compared to other ages. Gender wise comparison revealed that mean BMI of girls was significantly higher than boys in the age group of 9-13 years.

Impact of Intervention on Growth Parameters of Severely Thin Children:

After one year of intervention, an attempt was made to assess the impact of MDM on severely thin children. Data was obtained for 342 children out of the total 483 severely thin children. Of the 342 children, 219 (64.0%) were boys and 123 (36.0%) were girls.

Weight: At baseline, the mean weight of the children was 18.9 kg while after one year of intervention, the mean weight of the children was 22.4 kg as shown in **Figure: 4.3.3.** Thus, overall a significant increase in the mean weight (3.5 kg) of the children was seen after one year of intervention. When the data was analyzed in relation to gender, a similar significant increase in the mean weight was seen for both boys and girls **(Figure 4.3.4).** Unlike the

Table 4.3.29: Mean BMI of the Children Cross Tabulated By Age And Gender (Mean±SD, kg/m2)

Age (yr)	Boys	Girls	Total	"t" value
5 – 5.11 Years				
INITIAL	13.6±1.1	13.6±1.2	13.6±1.2	0.538
FINAL	13.7±1.3	13.5±1.4	13.6±1.3	0.788
DIFFERENCE	0.4±1.0	-0.01±1.0	0.01±1.0	0.415
PAIRED "t" VALUE	0.432	-0.134	0.19	
6-6.11 Years				
INITIAL	13.6±1.0	13.5±1.0	13.6±1.0	1.017
FINAL	13.9±1.2	13.8±1.4	13.8±1.3	0.534
DIFFERENCE	0.3±1.0	0.3±1.0	0.3±1.0	0.356
PAIRED "t" VALUE	3.579***	4.381***	5.655***	
7-7.11 Years				
INITIAL	13.6±1.1	13.6±1.2	13.6±1.2	0.176
FINAL	14.1±1.4	14.0±1.6	14.0±1.5	0.680
DIFFERENCE	0.5±0.9	0.4±0.9	0.4±0.9	0.857
PAIRED "t" VALUE	7.537***	7.105***	10.326***	
8-8.11 Years				
INITIAL	13.8±1.2	13.9±1.4	13.8±1.3	0.483[EVNA]
FINAL	14.3±1.6	14.5±1.7	14.4±1.7	1.215
DIFFERENCE	0.5±0.9	0.6±1.0	0.6±1.0	1.399
PAIRED "t" VALUE	7.428***	10.394***	12.737***	
9-9.11 Years				
INITIAL	14.0±1.4	14.2±1.6	14.1±1.5	1.196[EVNA]

FINAL	14.6±1.7	15.1±2.1	14.9±1.9	3.030**EVNA
DIFFERENCE	0.6±0.9	0.9±1.1	0.8±1.0	4.073***EVNA
PAIRED "t" VALUE	11.246***	14.810***	18.359***	
10-10.11 Years				
INITIAL	14.2±1.3	14.5±1.8	14.4±1.6	2.197*EVNA
FINAL	14.9±1.7	15.7±2.4	15.3±2.1	4.632*** EVNA
DIFFERENCE	0.7±0.9	1.1±1.1	0.9±1.1	5.700*** EVNA
PAIRED "t" VALUE	12.143***	17.400***	20.700***	
11-11.11 Years				
INITIAL	14.4±1.2	14.8±1.8	14.6±1.5	2.634** EVNA
FINAL	15.1±1.6	16.1±2.3	15.5±2.0	4.723*** EVNA
DIFFERENCE	0.7±0.9	1.3±1.5	0.9±1.3	4.219*** EVNA
PAIRED "t" VALUE	10.790***	11.135***	14.888***	
12-12.11 Years				
INITIAL	15.1±1.9	15.4±1.7	15.2±1.8	1.001
FINAL	16.0±2.3	16.8±2.1	16.4±2.2	2.395*
DIFFERENCE	0.9±1.1	1.4±1.3	1.2±1.2	2.906**
PAIRED "t" VALUE	7.744***	10.112***	12.447***	
13-13.11 Years				
INITIAL	14.7±1.3	16.0±1.7	15.3±1.6	3.811***
FINAL	15.9±1.8	16.8±1.9	16.3±1.9	2.247*
DIFFERENCE	1.2±1.3	0.8±1.2	0.9±1.3	1.247
PAIRED "t" VALUE	5.445***	3.717**	6.535***	
14-14.11 Years				

INITIAL	15.2±1.6	15.7±1.7	15.3±1.6	0.627
FINAL	16.0±2.0	16.1±1.9	16.0±1.9	0.101
DIFFERENCE	0.8±1.7	0.4±0.8	0.7±1.5	0.526
PAIRED "t" VALUE	2.223*	1.467	2.526*	
15-15.11 Years				
INITIAL	17.2±3.0	18.0±2.4	17.5±2.6	0.415
FINAL	18.6±3.2	18.4±1.5	18.5±2.5	0.111
DIFFERENCE	1.4±0.5	0.4±1.9	1.0±1.2	1.245
PAIRED "t" VALUE	6.134**	0.341	2.412*	
16-16.11 Years				
INITIAL	16.1±1.3	15.6±0.0	16.0±1.2	0.359
FINAL	17.1±1.8	17.9±0.0	17.2±1.7	0.378
DIFFERENCE	0.9±1.1	2.3±0.0	1.2±1.1	1.032
PAIRED "t" VALUE	1.930	-	2.559	
Total				
INITIAL	14.0±1.4	14.1±1.6	14.1±1.5	1.587^{EVNA}
FINAL	14.6±1.7	14.9±2.1	14.7±2.0	$4.140^{***EVNA}$
DIFFERENCE	0.5±1.0	0.7±1.2	0.6±1.1	$5.138^{***EVNA}$
PAIRED "t" VALUE	22.345***	28.866***	34.808***	

*** Significant at P< 0.05**

**** Significant at P<0.01**

***** Significant at P< 0.001**

EVNA – Equal Variance not assumed

Figure 4.3.5: Impact of Intervention on Mean Weight (Kg) of Severely Thin Children

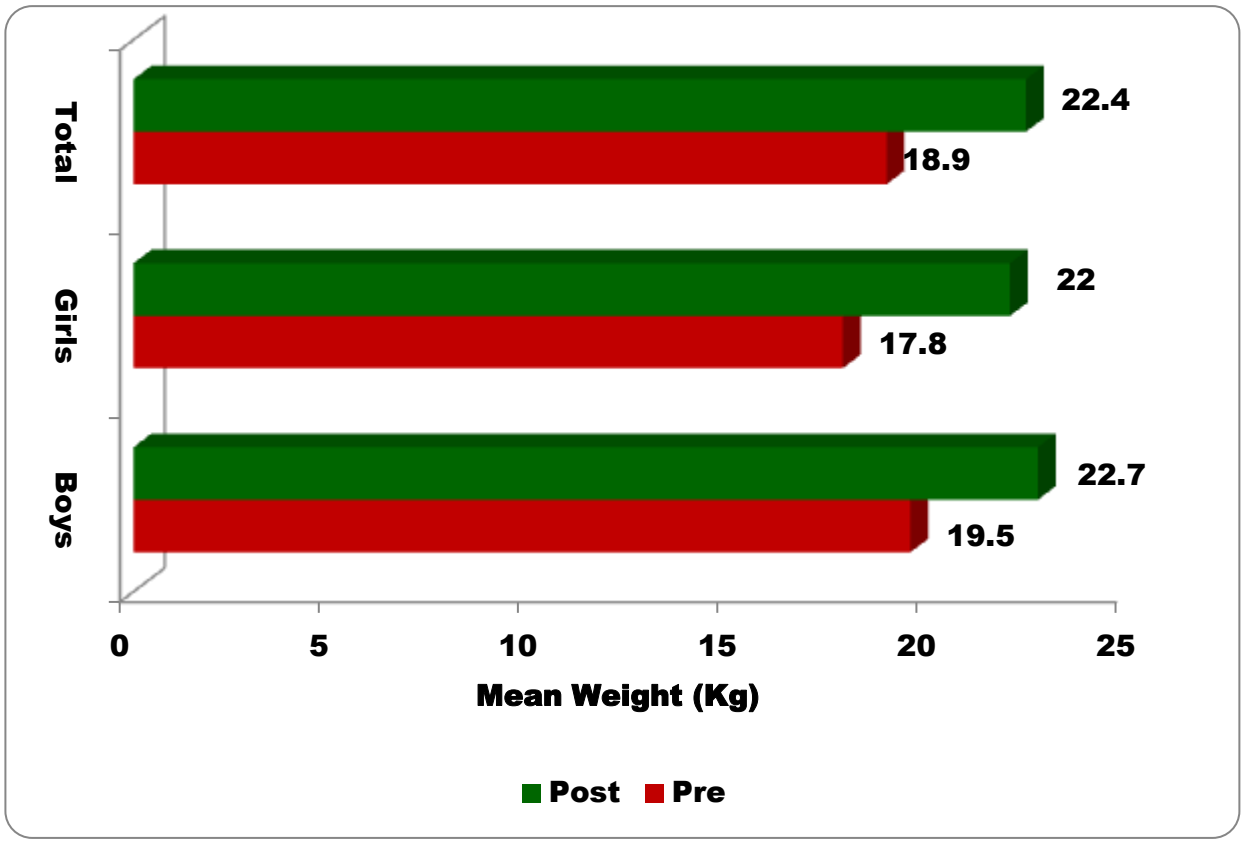
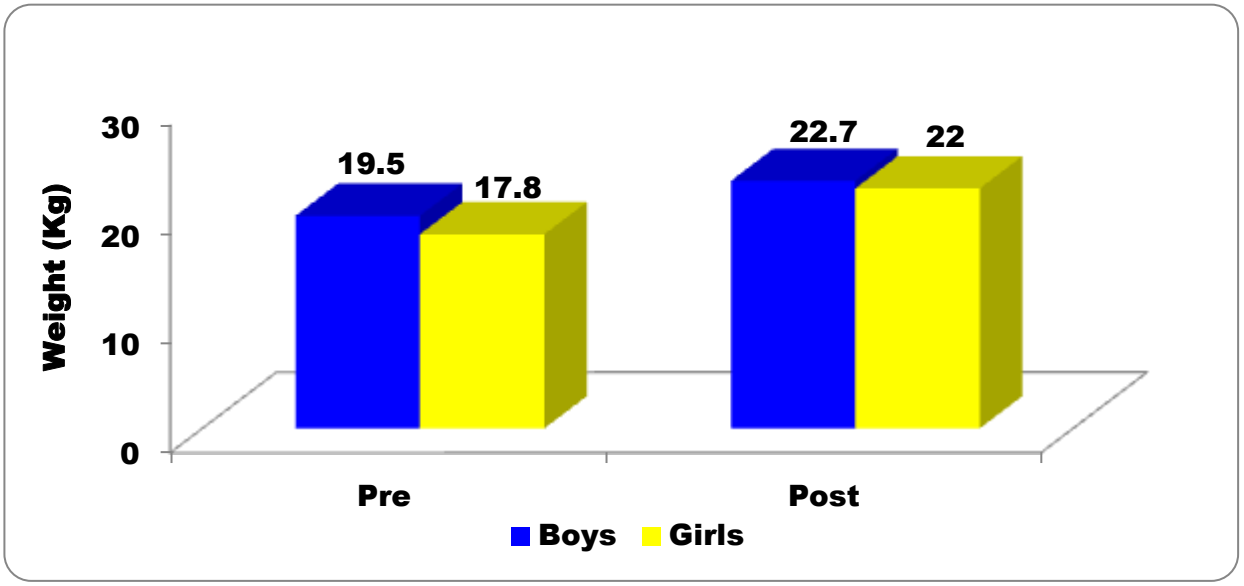


Figure 4.3.6: Impact of Intervention on Mean Weight (Kg) of Severely Thin Boys and Girls



impact seen above where the weight gain was significantly higher among girls, the weight gain was more among severely thin boys as compared to girls and the difference was statistically significant. Age wise data revealed that the final weight of the children in all age groups was higher than their initial weight. The maximum weight gain was seen in the age group of 11-14 years (**Table 4.3.10)**. Thus, at all ages, a rise in the mean weight of the children was observed. Gender wise comparison revealed that the mean weight gain was significantly higher among girls in the age range of 8-12 years as compared to boys.

Height: The impact of MDM intervention on the height of the severely thin children is represented in **Figure 4.3.5**. Among both the boys and the girls, a significant increase in the mean height was seen i.e. 5.4 cm in boys and 5.7 cm in girls. However, the increase in height was more among girls as compared to boys but the difference between the genders was not significant **(Figure 4.3.6)**. When data was analyzed according to age, a significant increment in height was observed among children in all age categories. The increase in height was the highest at 16 years (9.0 cm) among boys and at 12 years (6.7 cm) among girls **(Table 4.3.11)**.

BMI: The mean BMI of the children at baseline was 12.1kg/m^2 and after one year of intervention, the mean BMI was 13.2 kg/m^2. The increase in mean BMI (1.1kg/m^2) was statistically significant. Gender wise comparison revealed that there was significant increase in the mean BMI of both boys and girls after one year of intervention. However, the percent increase in mean BMI was higher among girls as compared to boys and the difference was statistically significant. The mean initial and final BMI of the children according to the age is shown in **Table 4.3.12**. It was found that there was significant increase in the mean BMI of the children at 11 years of age. When the data was analysed according to gender, it was found that among girls, significant increase in the mean BMI was seen at 9-10 years of age.

Table 4.3.30: Mean Weight of the Severely Thin Children Cross Tabulated By Age and Gender (Mean±SD, kg)

Age (yr)	Boys	Girls	Total	"t" value
5 – 5.11 Years				
INITIAL	13.1±1.2	12.3±1.8	12.8±1.5	1.012
FINAL	15.5±1.5	15.0±3.5	15.3±2.5	0.389
DIFFERENCE	2.4±1.6	2.7±3.0	2.5±2.3	0.228
PAIRED "t" VALUE	4.437**	2.313	4.437***	
6-6.11 Years				
INITIAL	15.7±3.0	12.5±1.8	14.9±3.0	2.462*
FINAL	18.7±3.7	15.1±2.1	17.7±3.7	2.210*
DIFFERENCE	2.9±1.7	2.6±1.7	2.8±1.7	0.466
PAIRED "t" VALUE	6.765***	3.588*	7.789***	
7-7.11 Years				
INITIAL	15.6±1.3	14.0±1.7	15.1±1.7	3.287**
FINAL	18.3±2.4	16.8±2.1	17.8±2.4	1.967
DIFFERENCE	2.7±1.7	2.8±1.7	2.7±1.7	0.176
PAIRED "t" VALUE	8.339***	6.236**	10.529***	
8-8.11 Years				
INITIAL	16.0±1.7	16.2±2.0	16.1±1.8	0.304
FINAL	18.5±2.0	19.9±2.9	19.2±2.6	1.979
DIFFERENCE	2.5±1.2	3.7±2.1	3.1±1.8	2.615*EVNA
PAIRED "t" VALUE	10.189***	9.001***	12.138***	
9-9.11 Years				
INITIAL	18.8±2.1	17.9±2.5	18.4±2.3	1.419

FINAL	21.6±2.7	22.2±3.9	21.9±3.2	0.542^{EVNA}
DIFFERENCE	2.9±1.6	4.3±2.3	3.5±2.1	2.528*^{EVNA}
PAIRED "t" VALUE	9.589***	8.798	12.201***	
10-10.11 Years				
INITIAL	20.1±2.2	19.5±2.4	19.9±2.2	1.043
FINAL	23.0±2.7	23.7±3.4	23.3±2.9	0.927
DIFFERENCE	2.9±1.6	4.2±2.1	3.3±1.8	2.623* ^{EVNA}
PAIRED "t" VALUE	12.314***	9.612***	14.764***	
11-11.11 Years				
INITIAL	22.1±2.4	21.8±2.6	22.0±2.4	0.423
FINAL	25.6±4.1	28.8±8.9	26.6±6.0	1.637
DIFFERENCE	3.5±2.2	7.0±8.0	4.6±4.9	1.580^{EVNA}
PAIRED "t" VALUE	8.640***	3.188**	6.084***	
12-12.11 Years				
INITIAL	23.7±2.8	23.2±2.9	23.4±2.8	0.480
FINAL	27.2±4.2	28.9±4.4	27.9±4.3	1.027
DIFFERENCE	3.6±2.3	5.8±2.0	4.5±2.4	2.674*
PAIRED "t" VALUE	6.268**	9.817***	9.899***	
13-13.11 Years				
INITIAL	27.5±3.4	-	27.5±3.4	-
FINAL	32.5±5.6	-	32.5±5.6	-
DIFFERENCE	4.9±3.4	-	4.9±3.4	-
PAIRED "t" VALUE	5.279***	-	5.279***	
14-14.11 Years				

INITIAL	26.3±3.2	26.5±0.0	26.3±3.0	0.071
FINAL	30.9±4.6	26.5±0.0	30.3±4.5	0.895
DIFFERENCE	4.6±4.2	0.0±0.0	4.0±4.2	1.025
PAIRED "t" VALUE	2.899*	-	2.702*	
15-15.11 Years				
INITIAL	22.0±0.0	-	22.0±0.0	-
FINAL	25.0±0.0	-	25.0±0.0	-
DIFFERENCE	3.0±0.0	-	3.0±0.0	-
PAIRED "t" VALUE	-	-	-	
16-16.11 Years				
INITIAL	29.0±0.0	-	29.0±0.0	-
FINAL	38.0±0.0	-	38.0±0.0	-
DIFFERENCE	9.0±0.0	-	9.0±0.0	-
PAIRED "t" VALUE	-	-	-	
Total				
INITIAL	**19.5±4.4**	**17.8±4.0**	**18.9±4.3**	**3.580*** **
FINAL	**22.7±5.5**	**22.0±6.1**	**22.4±5.7**	**0.978**
DIFFERENCE	**3.1±2.1**	**2.1±4.2**	**3.5±2.7**	**3.170** EVNA**
PAIRED "t" VALUE	**22.247*** **	**13.571*** **	**24.123*** **	

*** Significant at P< 0.05**

**** Significant at P<0.01**

***** Significant at P< 0.001**

Figure 4.3.7: Impact of Intervention on Mean Height (cms) of Severely Thin Children

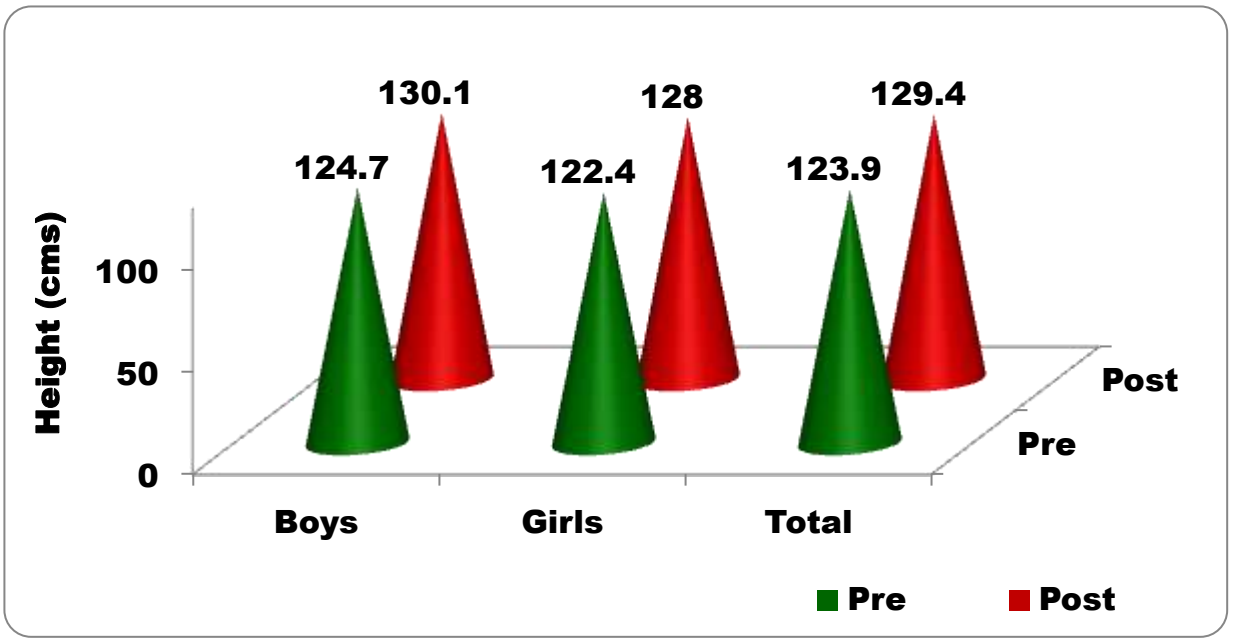


Figure 4.3.8: Impact of Intervention on Mean Height (cms) of Severely Thin Boys and Girls

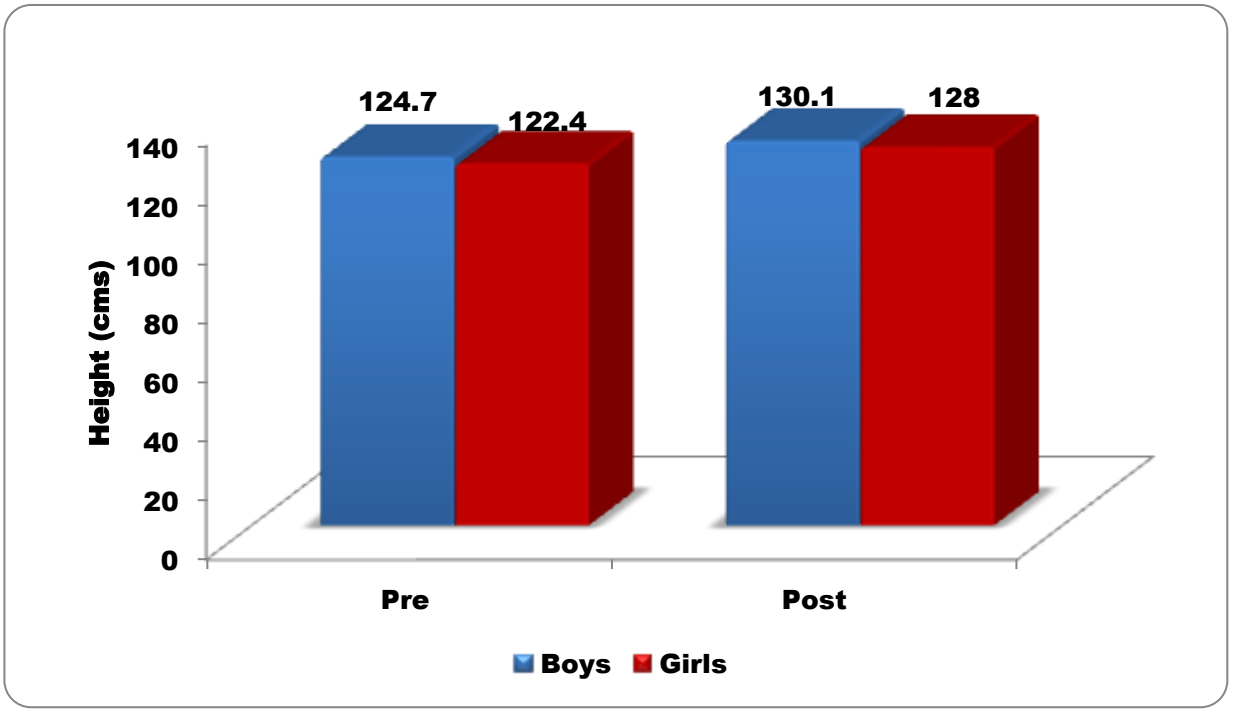


Table 4.3.31: Mean Height of the Severely Thin Children Cross Tabulated By Age and Gender (Mean±SD, Cms)

Age (yr)	Boys	Girls	Total	"t" value
5 – 5.11 Years				
INITIAL	105.9±5.2	105.1±6.9	105.5±5.8	0.271
FINAL	112.3±5.0	111.1±8.5	111.8±6.5	0.357
DIFFERENCE	6.4±1.1	6.0±2.6	6.2±1.9	0.403
PAIRED "t" VALUE	17.239***	6.036**	13.362***	
6-6.11 Years				
INITIAL	114.7±9.6	105.5±6.8	112.2±9.7	2.126*
FINAL	120.8±9.8	110.3±8.0	118.0±10.3	2.342*
DIFFERENCE	6.2±2.2	4.8±1.4	5.8±2.1	1.335
PAIRED "t" VALUE	10.986***	8.235***	12.894***	
7-7.11 Years				
INITIAL	114.0±4.8	110.9±6.3	113.0±5.5	1.748
FINAL	119.6±4.9	115.9±6.4	118.4±5.6	2.094*
DIFFERENCE	5.6±1.3	5.0±1.9	5.4±1.5	1.289
PAIRED "t" VALUE	22.328***	9.958***	22.749***	
8-8.11 Years				
INITIAL	116.1±6.2	119.1±6.0	117.6±6.2	1.752
FINAL	121.3±6.2	124.6±5.9	123.0±6.2	1.908
DIFFERENCE	5.2±1.2	5.4±1.1	5.3±1.1	0.729
PAIRED "t" VALUE	21.817***	25.807***	33.695***	
9-9.11 Years				

INITIAL	124.5±5.8	123.3±8.5	124.0±7.0	0.546 EVNA
FINAL	129.5±5.8	128.8±9.4	129.2±7.5	0.276 EVNA
DIFFERENCE	5.0±1.3	5.5±2.0	5.2±1.6	1.053 EVNA
PAIRED "t" VALUE	20.737***	12.860***	22.793***	
10-10.11 Years				
INITIAL	127.2±6.4	128.7±6.5	127.7±6.4	0.858
FINAL	131.9±6.6	134.5±7.0	132.8±6.8	1.455
DIFFERENCE	4.7±1.4	5.8±1.5	5.1±1.5	2.923**
PAIRED "t" VALUE	21.611***	18.582***	26.946***	
11-11.11 Years				
INITIAL	132.0±6.2	133.3±8.3	132.4±6.8	0.585
FINAL	137.2±7.6	139.5±8.5	137.9±7.8	0.853
DIFFERENCE	5.3±2.3	6.2±1.1	5.5±2.1	1.314
PAIRED "t" VALUE	12.483***	20.052***	17.695***	
12-12.11 Years				
INITIAL	134.7±7.2	134.3±7.2	134.5±7.1	0.144
FINAL	140.2±8.0	141.0±6.8	140.6±7.4	0.287
DIFFERENCE	5.5±3.1	6.7±1.7	6.1±2.6	1.239 EVNA
PAIRED "t" VALUE	7.198***	13.985***	12.315***	
13-13.11 Years				
INITIAL	142.5±7.6	-	142.5±7.6	-
FINAL	148.7±8.8	-	148.7±8.8	-
DIFFERENCE	6.2±2.2	-	6.2±2.2	-
PAIRED "t" VALUE	10.021***	-	10.021***	

14-14.11 Years				
INITIAL	139.9±5.9	137.5±0.0	139.6±5.5	0.376
FINAL	145.6±6.6	141.0±0.0	145.1±6.4	0.655
DIFFERENCE	5.8±1.7	3.5±0.0	5.5±1.8	1.273
PAIRED "t" VALUE	9.113***	-	8.876***	
15-15.11 Years				
INITIAL	132.0±0.0	-	132.0±0.0	-
FINAL	136.0±0.0	-	136.0±0.0	-
DIFFERENCE	4.0±0.0	-	4.0±0.0	-
PAIRED "t" VALUE	-	-	-	
16 – 16.11 Years				
INITIAL	141.0±0.0	-	141.0±0.0	-
FINAL	150.0±0.0	-	150.0±0.0	-
DIFFERENCE	9.0±0.0	-	9.0±0.0	-
PAIRED "t" VALUE	-	-	-	
Total				
INITIAL	**124.7±11.3**	**122.4±11.5**	**123.9±11.4**	**1.827**
FINAL	**130.1±11.5**	**128.0±12.0**	**129.4±11.7**	**1.559**
DIFFERENCE	**5.4±1.9**	**5.7±1.7**	**5.5±1.8**	**1.423**
PAIRED "t" VALUE	**42.821*** **	**37.617*** **	**56.440*** **	

*** Significant at P< 0.05**

**** Significant at P<0.01**

***** Significant at P< 0.001**

Table 4.3.32: Mean BMI of the Severely Thin Children Cross Tabulated by Age and Gender (Mean±SD, kg/m2)

Age (yr)	Boys	Girls	Total	"t" value
5 – 5.11 Years				
INITIAL	11.7±0.4	11.1±0.5	11.4±0.5	2.253*
FINAL	12.3±1.2	12.0±1.7	12.2±1.4	0.378
DIFFERENCE	0.6±1.4	0.9±2.0	0.8±1.6	0.322
PAIRED "t" VALUE	1.418	1.198	1.876	
6-6.11 Years				
INITIAL	11.9±0.3	11.2±0.4	11.7±0.4	4.454***
FINAL	12.7±1.2	12.5±1.8	12.6±1.4	0.385
DIFFERENCE	0.8±1.3	1.2±1.8	0.9±1.4	0.598
PAIRED "t" VALUE	2.567*	1.653	3.097**	
7-7.11 Years				
INITIAL	12.0±0.3	11.4±0.4	11.8±0.4	6.130***
FINAL	12.7±1.1	12.5±1.2	12.7±1.1	0.644
DIFFERENCE	0.7±1.1	1.1±1.3	0.9±1.2	1.057
PAIRED "t" VALUE	3.529**	3.265**	4.803***	
8-8.11 Years				
INITIAL	11.8±0.3	11.3±0.6	11.6±0.6	3.417** EVNA
FINAL	12.5±0.8	12.8±1.1	12.7±0.9	0.800
DIFFERENCE	0.7±0.9	1.4±1.2	1.1±1.1	2.374
PAIRED "t" VALUE	4.003**	5.843***	6.763***	
9-9.11 Years				
INITIAL	12.1±0.4	11.7±0.4	11.9±0.5	3.284**

FINAL	12.9±1.0	13.3±1.1	13.0±1.1	1.337
DIFFERENCE	0.8±1.0	1.6±1.2	1.1±1.1	2.613*
PAIRED "t" VALUE	4.415***	6.265***	7.176***	
10-10.11 Years				
INITIAL	12.4±0.4	11.8±0.6	12.2±0.6	5.307*** EVNA
FINAL	13.2±1.0	13.1±1.0	13.2±1.0	0.546
DIFFERENCE	0.8±0.9	1.3±1.0	1.0±1.0	2.037*
PAIRED "t" VALUE	5.873***	6.057***	8.195***	
11-11.11 Years				
INITIAL	12.7±0.5	12.2±0.6	12.5±0.5	2.566*
FINAL	13.5±1.0	14.7±3.8	13.9±2.3	1.129 EVNA
DIFFERENCE	0.8±0.9	2.5±3.8	1.3±2.3	1.542 EVNA
PAIRED "t" VALUE	5.350***	2.357*	3.839***	
12-12.11 Years				
INITIAL	13.0±0.5	12.8±0.4	12.9±0.5	1.254
FINAL	13.7±0.8	14.4±1.0	14.0±1.0	1.977
DIFFERENCE	0.7±0.7	1.7±0.8	1.1±0.9	3.224**
PAIRED "t" VALUE	4.547***	6.768***	6.968***	
13-13.11 Years				
INITIAL	13.5±0.4	-	13.5±0.4	-
FINAL	14.6±1.5	-	14.6±1.5	-
DIFFERENCE	1.1±1.5	-	1.1±1.5	-
PAIRED "t" VALUE	2.692*	-	2.692*	
14-14.11 Years				

INITIAL	13.4±0.7	14.0±0.0	13.5±0.7	0.898
FINAL	14.5±2.0	13.3±0.0	14.4±1.9	0.559
DIFFERENCE	1.2±2.3	0.7±0.0	0.9±2.2	0.765
PAIRED "t" VALUE	1.365	-	1.206	
15-15.11 Years				
INITIAL	12.6±0.0	-	12.6±0.0	-
FINAL	13.5±0.0	-	13.5±0.0	-
DIFFERENCE	0.9±0.0	-	0.9±0.0	-
PAIRED "t" VALUE	-	-	-	
16-16.11 Years				
INITIAL	14.6±0.0	-	14.6±0.0	-
FINAL	16.9±0.0	-	16.9±0.0	-
DIFFERENCE	2.3±0.0	-	2.3±0.0	-
PAIRED "t" VALUE	-	-	-	
Total				
INITIAL	**12.4±0.7**	**11.7±0.7**	**12.1±0.7**	**8.419*** **
FINAL	**13.2±1.2**	**13.2±1.8**	**13.2±1.5**	**0.101** EVNA
DIFFERENCE	**0.8±1.1**	**1.5±1.7**	**1.1±1.4**	**3.891*** ** EVNA
PAIRED "t" VALUE	**11.426*** **	**9.570*** **	**14.274*** **	

*** Significant at P< 0.05**

**** Significant at P<0.01**

***** Significant at P< 0.001**

An attempt was made to analysis the impact among those who reported to consume MDM against those reported those who reported not consuming as shown in **Table 4.3.13**.

Weight: The mean weight of children was 22 Kgs which was comparable among those who reported consuming MDM versus not consuming at baseline. However, after one year of intervention, the mean weight of the children consuming MDM was higher as compared to those not consuming. But the difference between the two groups was not significant. The weight gain was more among MDM consumers as compared to non consumers and the difference was significant.

Height: The mean height of children consuming MDM and not consuming MDM was comparable both at baseline as well as after one year of intervention and the height gain was similar among both the groups.

BMI: The initial mean BMI of those who reported to consume MDM and those who reported not consuming MDM were similar and no difference was observed. After one year of intervention, the mean BMI of those who reported consuming MDM was higher than those who were not consuming and the difference was statistically significant.

Impact of Intervention on Anthropometric Indices:

The mean weight for age Z scores for the children after one year of intervention is depicted in **Table 4.3.14**. The mean Z scores had negative values in both boys and girls. The mean Z scores according to WHO 2007 growth standards, for boys were -2.0±1.1 and for girls were -1.9±1.1. Thus, significant difference was observed in WAZ scores across the gender, wherein the Z scores for boys were higher than that of girls. The comparison between initial and final WAZ scores revealed that the mean Z scores were significantly lower after one year of intervention. When the Z scores were analyzed according to age, it was seen that there was significant reduction in the mean values in the age range of 6-9 years as per WHO 2007 growth standards and the difference was statistically significant among both boys and girls.

Table 4.3.33: Impact of Intervention on MDM Consumers and Non-Consumers

	MDM Consumers (N=2685)	Non-Consumers (N=462)	't' test
	Mean±SD	Mean±SD	
Weight			
Initial	22±6	22±6	0.264
Final	25±7	24±7	1.308
Difference	3.3±2.3	2.9±2.1	3.360**
Height			
Initial	122.8±11.9	122.2±12.7	1.042[EVNA]
Final	129±12	128±13	1.041[EVNA]
Difference	5.7±1.7	5.7±1.8	0.059
BMI			
Initial	14.1±1.5	14.1±1.6	0.684
Final	14.8±2.0	14.6±2.0	1.748
Difference	0.7±1.1	0.5±1.1	3.983***

Table 4.3.34: Mean WAZ of the Children According to WHO 2007 Growth Standards Cross Tabulated by Age & Gender (Mean±SD)

Age (yr)	Pre			Post			"t"value
	Boys	Girls	Total	Boys	Girls	Total	
5	-2.1±0.9	-2.1±0.9	-2.1±0.9	-2.1±1.1	-2.0±0.9	-2.1±1.0	2.300*
6	-2.1±1.0	-2.1±1.0	-2.1±0.9	-2.0±1.1	-1.9±1.0	-1.9±1.0	6.528***
7	-2.3±1.0	-2.00±1.0	-2.1±1.0	-2.0±1.1	-1.8±1.1	-1.9±1.1	9.282***
8	-2.3±1.0	-1.9±1.1	-2.1±1.1	-2.0±1.1	-1.8±1.2	-1.9±1.1	9.329***
9	-2.2±1.1	-2.00±1.1	-2.1±1.1	-2.0±0.9	-1.8±1.2	-1.9±1.0	3.965***
10	-1.9±1.4	-2.3±1.0	-2.1±1.2	.	.	.	
Total	**-2.2±1.0**	**-2.00±1.0**	**-2.1±1.0**	**-2.0±1.1**	**-1.9±1.1**	**-1.9±1.1**	

*** Significant at P< 0.05**

***** Significant at P< 0.001**

The mean height for age Z scores according to WHO 2007 growth standards is shown in **Table 4.3.15.** The mean Z scores were lower than the growth standards in case of both boys and girls. The post intervention HAZ scores were lower than the HAZ scores at baseline and the difference was statistically significant. Gender wise no difference was observed. Age wise analysis of HAZ scores revealed that the mean values were significantly lower in the age range of 5-14 years, except at 11 years of age according to WHO 2007 growth standards.

The mean BMI for Age Z scores of children according to WHO 2007 growth standards is shown in **Table 4.3.16**. The mean Z score values were lower than the reference standards for both boys and girls. Significant difference was observed in BMI for Age Z scores across the gender, wherein the Z scores for boys were higher than girls. After one year of intervention, the mean BAZ scores were significantly lower than the mean BAZ scores at baseline in relation to WHO 2007 growth standards. Age wise analysis revealed that the mean Z scores values were significantly lower in the age group of 6-13 years according to the growth standards.

Impact of Intervention on Prevalence of Malnutrition:

The impact of MDM on the prevalence of malnutrition among boys and girls in accordance with WHO 2007 growth standards was observed and calculated using Z scores. The percent prevalence of underweight after one year of intervention was found to be 47.5%, percent prevalence of stunting was 35.0% and percent prevalence of thinness was 29.7% as shown in **Table 4.3.17**.

Weight for Age (WAZ):

According to WHO 2007 growth standards, the overall prevalence of underweight decreased by 6.7% after intervention wherein 9.1% reduction was seen among boys and 4.6% among girls as shown in **Figure 4.3.7**. The reduction in the prevalence of underweight was statistically significant (Chi

Table 4.3.35: Mean HAZ of the Children According to WHO 2007 Growth Standards Cross Tabulated by Age & Gender (Mean±SD)

Age (yr)	Pre			Post			"t"value
	Boys	Girls	Total	Boys	Girls	Total	
5	-1.8±1.1	-1.8±0.9	-1.8±1.0	-1.6±1.0	-1.7±0.9	-1.7±1.0	10.454***
6	-1.7±1.1	-1.8±1.0	-1.7±1.1	-1.5±1.1	-1.6±1.0	-1.6±1.0	11.043***
7	-1.7±1..0	-1.6±1.0	-1.6±1.0	-1.6±0.9	-1.5±1.0	-1.5±1.0	11.169***
8	-1.7±0.9	-1.5±1.0	-1.6±1.0	-1.6±0.9	-1.5±1.1	-1.5±1.0	7.712***
9	-1.6±1.0	-1.6±1.1	-1.6±1.0	-1.5±0.9	-1.6±1.1	-1.6±1.0	5.087***
10	-1.5±1.1	-1.8±1.1	-1.6±1.1	-1.5±1.1	-1.7±1.1	-1.6±1.1	2.013*
11	-1.7±1.0	-1.9±1.0	-1.8±1.0	-1.7±1.1	-1.8±1.0	-1.8±1.0	0.873
12	-2.0±1.1	-2.0±0.9	-2.0±1.0	-2.0±1.1	-1.8±0.8	-1.9±1.0	2.308*
13	-2.3±1.1	-2.4±0.8	-2.3±1.0	-2.2±1.2	-2.1±0.9	-2.2±1.1	3.787***
14	-2.3±1.3	-2.3±1.1	-2.3±1.2	-2.1±1.3	-1.9±0.9	-2.0±1.2	4.263***
15	-2.5±1.4	-1.7±0.7	-2.2±1.2	-2.3±1.5	-1.7±0.8	-2.1±1.3	2.059
16	-2.7±1.3	-4.1±0.0	-3.0±1.3	-2.5±1.2	-3.6±0.0	-2.6±1.2	1.636
Total	**-1.7±1.0**	**-1.7±1.0**	**-1.7±1.0**	**-1.6±1.0**	**-1.6±1.0**	**-1.6±1.0**	

*** Significant at P< 0.05**

***** Significant at P< 0.001**

Table 4.3.36: Mean BAZ of the Children According to WHO 2007 Growth Standards Cross Tabulated by Age & Gender (Mean±SD)

Age (yr)	Pre			Post			
	Boys	Girls	Total	Boys	Girls	Total	"t"value
5	-1.5±1.1	-1.3±1.0	-1.4±1.0	-1.5±1.2	-1.4±1.1	-1.5±1.1	1.056
6	-1.6±0.9	-1.4±0.9	-1.5±0.9	-1.5±1.1	-1.3±1.0	-1.4±1.1	2.247*
7	-1.7±1.0	-1.4±0.9	-1.6±0.9	-1.5±1.1	-1.4±1.1	-1.4±1.1	4.213***
8	-1.7±1.1	-1.4±1.1	-1.5±1.1	-1.5±1.2	-1.3±1.1	-1.4±1.2	4.887***
9	-1.7±1.1	-1.5±1.1	-1.6±1.1	-1.6±1.2	-1.2±1.1	-1.4±1.2	8.541***
10	-1.8±1.1	-1.5±1.1	-1.7±1.1	-1.6±1.2	-1.2±1.2	-1.4±1.2	9.829***
11	-1.9±1.0	-1.7±1.1	-1.8±1.1	-1.8±1.1	-1.3±1.2	-1.6±1.2	7.405***
12	-1.9±1.3	-1.6±1.1	-1.8±1.2	-1.7±1.4	-1.2±1.1	-1.4±1.3	6.115***
13	-2.5±0.9	-1.6±0.9	-2.1±1.0	-2.0±1.2	-1.4±0.9	-1.8±1.1	3.113**
14	-2.4±1.1	-2.1±0.9	-2.4±1.1	-2.3±1.3	-2.0±1.1	-2.2±1.2	0.704
15	-1.6±1.9	-1.0±1.1	-1.4±1.5	-1.1±1.8	-0.9±0.7	-1.1±1.4	1.755
16	-2.5±0.9	-2.3±0.0	-2.4±0.8	-2.1±1.1	-1.3±0.0	-2.0±1.0	1.700
Total	**-1.8±1.1**	**-1.5±1.0**	**-1.6±1.1**	**-1.6±1.2**	**-1.3±1.1**	**-1.4±1.2**	

*** Significant at P< 0.05**

**** Significant at P<0.01**

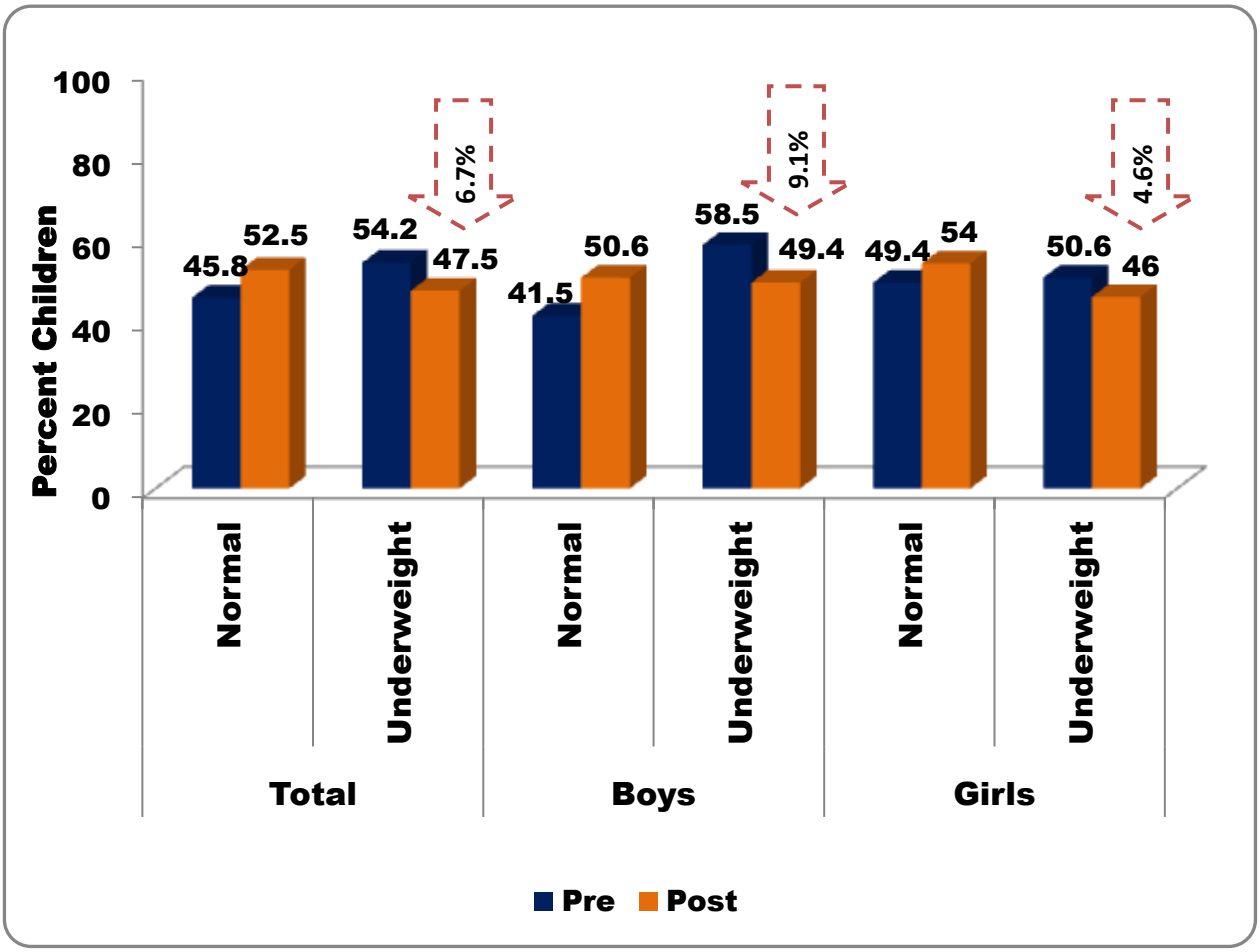
***** Significant at P< 0.001**

Table 4.3.37: Prevalence of Underweight (Z Scores <-2SD) In Children (N, %)

Nutritional Status		Boys (N=1649)		Girls (N=1875)		Total (N=3524)	
		N (%)	95%CI	N (%)	95%CI	N (%)	95%CI
WAZ							
Pre	Normal	433 (41.5)	39.1-43.9	633 (49.4)	47.1-51.7	1066 (45.8)	44.1-47.5
	Underweight	611 (58.5)	56.1-60.9	649 (50.6)	48.3-52.9	1260 (54.2)	52.5-55.9
Post	Normal	393 (50.6)	48.1-53.1	524 (54.0)	51.7-56.3	917 (52.5)	50.8-54.2
	Underweight	384 (49.4)	46.9-51.9	447 (46.0)	43.7-48.3	831 (47.5)	45.8-49.2
HAZ							
Pre	Normal	1021 (61.9)	59.5-64.3	1160 (61.9)	59.7-64.1	2181 (61.9)	60.3-63.5
	Stunting	628 (38.1)	35.7-40.5	715 (38.1)	35.9-40.3	1343 (38.1)	36.5-39.7
Post	Normal	1082 (65.6)	63.3-67.9	1207 (64.4)	62.6-66.6	2289 (65.0)	63.4-66.6
	Stunting	567 (34.4)	32.1-36.7	668 (35.6)	33.4-37.8	1235 (35.0)	33.4-36.6
BAZ							
Pre	Normal	996 (60.4)	58.0-62.8	1342 (71.6)	69.5-73.7	2338 (66.3)	64.7-67.9
	Thinness	653 (39.6)	37.2-42.0	533 (28.4)	26.3-30.5	1186 (33.7)	32.1-35.3
Post	Normal	1062 (64.4)	62.0-66.8	1415 (75.5)	73.5-77.5	2477 (70.3)	68.8-71.8
	Thinness	587 (35.6)	33.2-38.0	460 (24.5)	22.5-26.5	1047 (29.7)	28.2-31.2

Value in parenthesis indicates percentages

Figure 4.3.9: Impact of Intervention on the Prevalence of Underweight (Z Scores <-2) In Children



Square -3.49E2 (p<0.001)). Significant reduction in the prevalence of underweight among both boys (Chi square-5.08E2 (p<0.001)) and girls (Chi square-8.56E2 (p<0.001)) was observed as shown in **Table 4.3.18**.

Height for Age (HAZ):

The analysis of height for age Z scores showed a reduction in the prevalence of stunting from 38.1% to 35% using WHO 2007 growth standards. Thus, statistically significant reduction of around 3% (Chi square-2.49E3 (p<0.001)) in the prevalence of stunting was seen **(Figure 4.3.8)**. It was observed that reduction in the prevalence of stunting was significant in case of both the boys (Chi square-1.16E3 (p<0.001)) and girls (Chi square-1.33E3 (p<0.001)). However, when the data was cross tabulated with respect to gender, no significant difference was seen between boys and girls in relation to the growth standards.

BMI for Age (BAZ):

With the improvement in weight and height of the children, BMI for age showed significant improvement among boys and girls after one year of intervention. Thus, using BMIZ indicator, there was significant reduction from (33.7% to 29.7%) in the prevalence of thinness according to WHO 2007 growth standards. Similarly The reduction in the prevalence of thinness was 4% among boys and 3.9% among girls which was statistically significant **(Figure 4.3.9)**. Comparison between the gender, showed that the reduction in thinness was more among girls as compared to boys according to the WHO 2007 growth standards and the difference was statistically significant **(Table 4.3.18)**.

When comparison was made on the nutritional status across the gender as depicted in **Table 4.3.19**, it was seen that there was no significant difference among boys and girls in the prevalence of underweight. With respect to stunting, no significant difference was seen between boys and girls in relation to both the growth standards. However, comparison between the gender among the thin children, showed that the prevalence in thinness was less

Figure 4.3.10: Impact of Intervention on the Prevalence of Stunting (Z Scores <-2) In Children

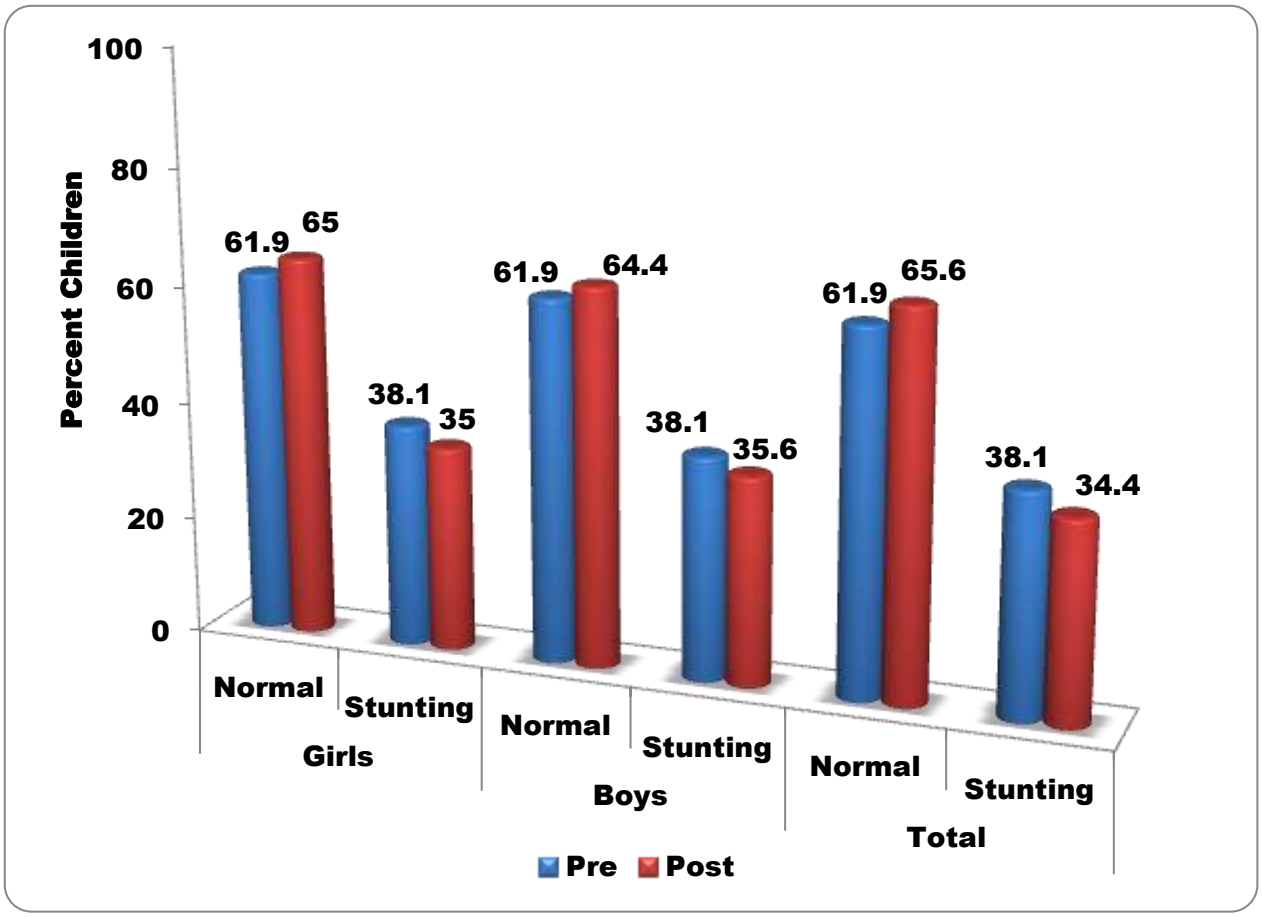


Figure 4.3.11: Impact of Intervention on the Prevalence of Thinness (Z Scores <-2) In Children

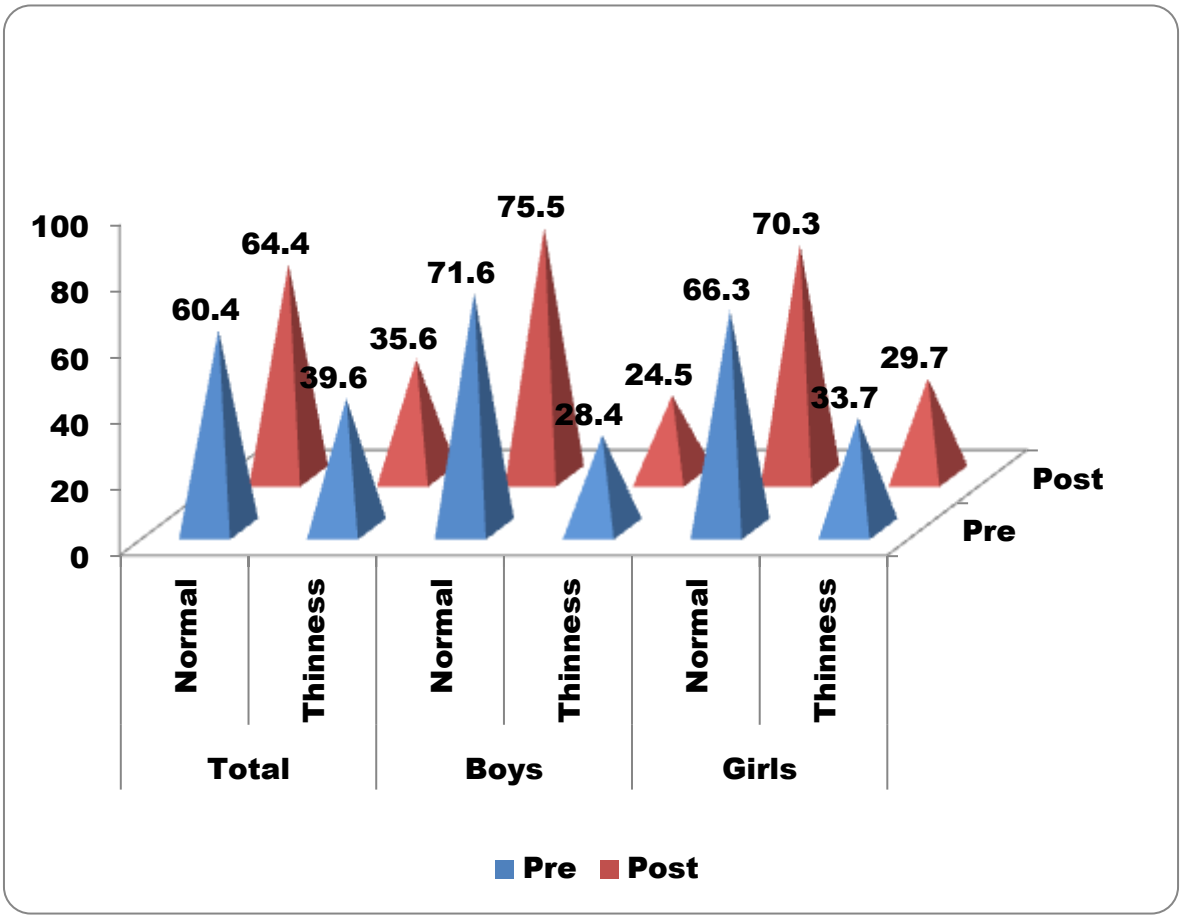


Table 4.3.38: Impact of Intervention on the Prevalence of Undernutrition (Z Scores <-2) In Children (N)

Nutritional Status	**Boys (N=1649)**		**Girls (N=1875)**		**Total (N=3524)**	
Underweight						
Post / Pre	Normal	Underweight	Normal	Underweight	Normal	Underweight
N	777		971		1748	
Normal	290	30	433	45	723	75
Underweight	103	354	91	402	194	756
CHI SQUARE	**3.49E2 (0.000)**		**5.08E2 (0.000)**		**8.56E2 (0.000)**	
Stunting						
Post / Pre	Normal	Stunting	Normal	Stunting	Normal	Stunting
Normal	989	32	1114	46	2103	78
Stunting	93	535	93	622	186	1157
CHI SQUARE	**1.16E3 (0.000)**		**1.33E3 (0.000)**		**2.49E3 (0.000)**	
Thinness						
Post / Pre	Normal	Thinness	Normal	Thinness	Normal	Thinness
Normal	864	132	1202	140	2066	272
Thinness	198	455	213	320	411	775
CHI SQUARE	**5.477E2 (0.000)**		**5.070E2 (0.000)**		**1.087E3 (0.000)**	

Table 4.3.39: % Prevalence of Undernutrition (Z score<-2SD) Cross Tabulated by Gender (N, %)

Variables	Boys	Girls	Chi Square (p-value)
WAZ			**1.98 (0.15)**
Normal	393 (42.9)	524(57.1)	
Underweight	384 (46.2)	447 (53.8)	
HAZ			**0.59 (0.44)**
Normal	1082 (47.3)	1207 (52.7)	
Stunting	567 (45.9)	668 (54.1)	
BMIZ			**51.41 (0.000)*** **
Normal	1062 (42.9)	1415 (57.1)	
Thinness	587 (56.1)	460 (43.9)	

***** Significant at P<0.001**

among girls as compared to boys and the difference was statistically significant.

Thus, according to WHO 2007 growth standards, overall the prevalence of underweight, stunting and thinness reduced by 6.7%, 3.1% and 4% respectively after one year intervention of MDM provided by TAPF.

The children were classified into different degrees of malnutrition using WHO 2007 growth standards. The prevalence of malnutrition assessed based on the severity, observed a positive shift in the severity of undernutrition as shown in **Table 4.3.20**. There was an overall 2.8% reduction in the prevalence of severe underweight according to WHO 2007 growth standards. The reduction in the prevalence of severe underweight was more for boys as compared to girls (5.1% Vs 0.9%). The major shift was seen from severe to moderate category. Also around 4.3% of boys and 4.8% of girls moved to normal category after intervention **(Figure 4.3.10)**.

The prevalence of stunting according to the severity is depicted in **Table 4.3.21.** As stunting represents long standing chronic malnutrition it was remarkable that there was an overall 1-2% reduction in the prevalence of severe stunting. The reduction in the prevalence of severe stunting was higher among girls as compared to boys. Even the shift to normal category was more in girls than boys **(Figure 4.3.11)**.

Table 4.3.22 represents the prevalence of thinness according to different grades. According to WHO 2007 growth standards, slight reduction in the prevalence of severe thinness was observed and the reduction was similar among boys and girls **(Figure 4.3.12)**.

Table 4.3.40: Prevalence of Underweight According To WHO 2007 Growth Standards (N, %)

Degree of Underweight	Boys (N=777)		Girls (N=971)		Total (N=1748)	
	Initial	Final	Initial	Final	Initial	Final
Normal	119 (11.4)	122 (15.7)	208 (16.2)	204 (21.0)	327 (14.1)	326 (18.6)
Mild	314 (30.1)	271 (34.9)	425 (33.2)	320 (33.0)	739 (31.8)	591 (33.8)
Moderate	381 (36.5)	253 (32.6)	449 (35.0)	304 (31.3)	830 (35.7)	557 (31.9)
Severe	230 (22.0)	131 (16.9)	200 (15.6)	143 (14.7)	430 (18.5)	274 (15.7)

Value in parenthesis indicates percentages

Figure 4.3.12: Prevalence of Severity of Undernutrition

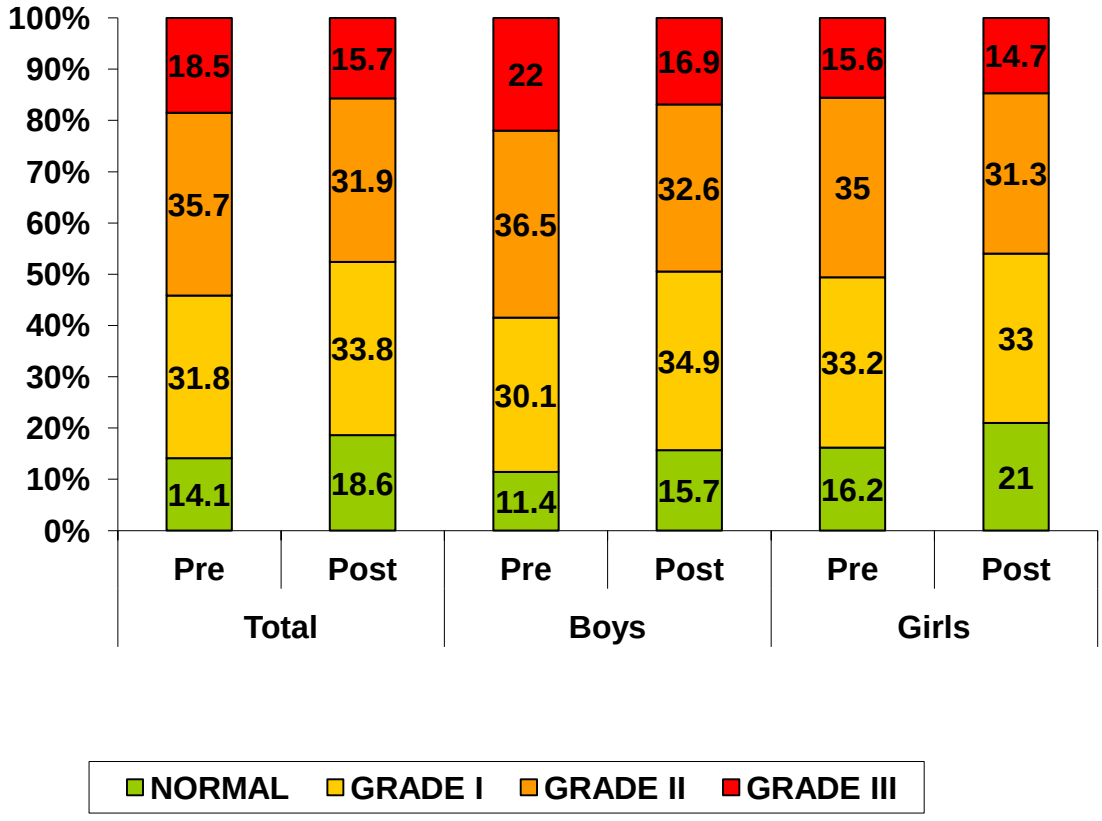


Table 4.3.41: Prevalence of Stunting according to WHO 2007 Growth Standards (N, %)

Degree of Stunting	Boys (N=1649)		Girls (N=1875)		Total (N=3524)	
	Initial	Final	Initial	Final	Initial	Final
Normal	395 (24.0)	425 (25.8)	417 (22.2)	469 (25.0)	812 (23.0)	894 (25.4)
Mild	626 (38.0)	657 (39.8)	743 (39.6)	738 (39.4)	1369 (38.8)	1395 (39.6)
Moderate	478 (29.0)	430 (26.1)	531 (28.3)	505 (26.9)	1009 (28.6)	935 (26.5)
Severe	150 (9.1)	137 (8.3)	184 (9.8)	163 (8.7)	334 (9.5)	300 (8.5)

Value in parenthesis indicates percentages

Figure 4.3.13: Prevalence of Severity of Stunting

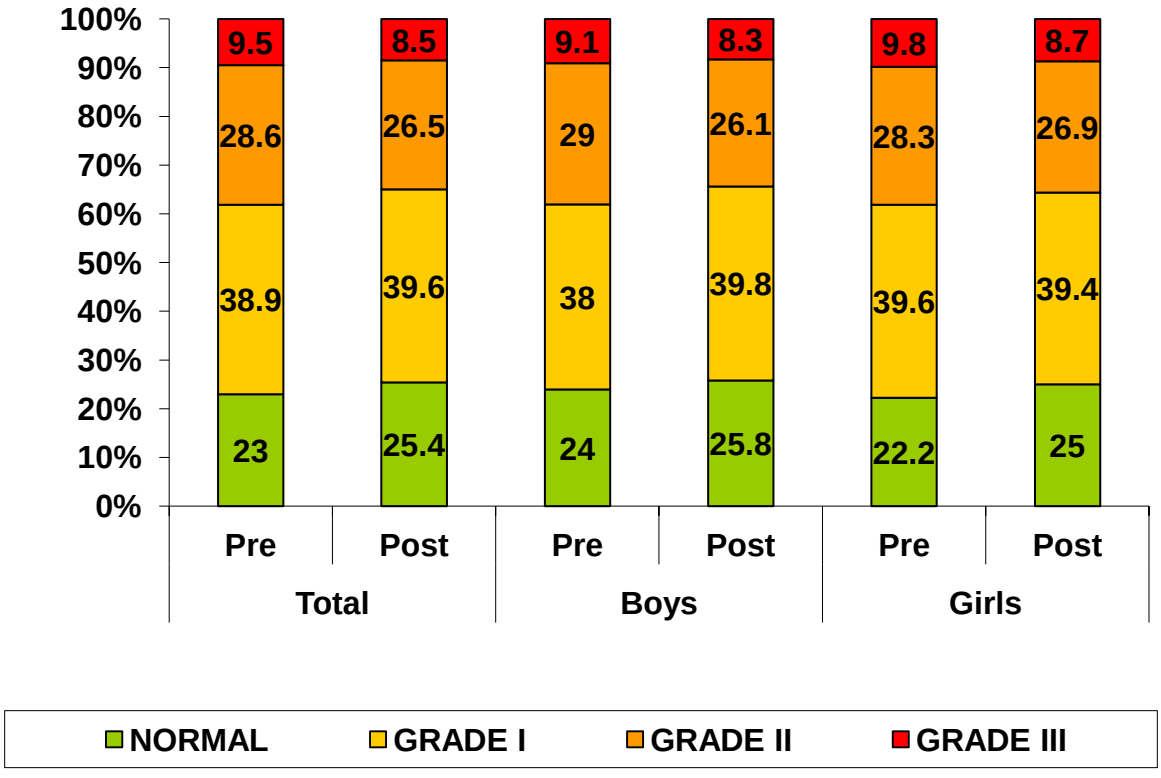
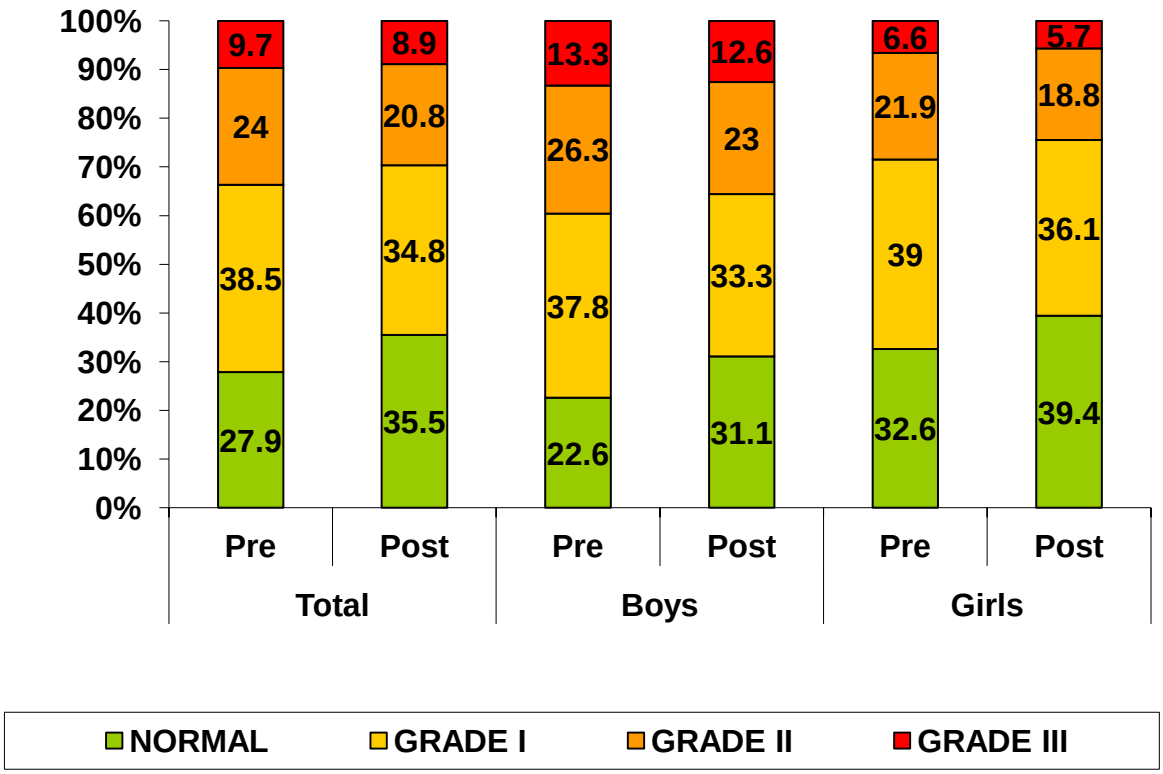


Table 4.3.42: Prevalence of Thinness according to WHO 2007 Growth Standards (N, %)

Degree of Thinness	Boys (N=1649)		Girls (N=1875)		Total (N=3524)	
	Initial	Final	Initial	Final	Initial	Final
Normal	372 (22.6)	513 (31.1)	611 (32.6)	738 (39.4)	983 (27.9)	1251 (35.5)
Mild	624 (37.8)	549 (33.3)	731 (39.0)	677 (36.1)	1355 (38.5)	1226 (34.8)
Moderate	434 (26.3)	380 (23.0)	410 (21.9)	353 (18.8)	844 (24.0)	733 (20.8)
Severe	219 (13.3)	207 (12.6)	123 (6.6)	107 (5.7)	342 (9.7)	314 (8.9)

Value in parenthesis indicates percentages

Figure 4.3.14: Prevalence of Severity of Thinness



Impact of Intervention on the Prevalence of Undernutrition among Severely Thin Children

Table 4.3.23 shows the baseline and post intervention prevalence of undernutrition among severely thin children in accordance to WHO 2007 standards.

Underweight: A positive shift in the prevalence and severity of underweight was seen after one year of intervention. There was 21% reduction in the prevalence of severe underweight (72.1% to 51.1%) among children. There was a higher shift among children from severe grade to moderate grade of undernutrition followed by moderate to mild category. Gender wise comparison showed that the shift was more among girls as compared to boys (**Table 4.3.24)**.

Stunting: There was only a slight reduction in the overall prevalence of stunting and an insignificant increase in the prevalence of severe stunting (1.3%) as depicted in **Table 4.3.25.** The prevalence of severe stunting increased more among boys as compared to girls**.** On the positive side, overall 1.1% shift in the normal category was seen showing a change from moderate to mild and mild to normal category.

Thinness: The data on prevalence of thinness (**Table 4.3.26**) showed a marked improvement among the severely thin children. The prevalence of thinness reduced by 50.9% after one year of intervention and it was more evident in girls (62.6%) than boys (44.3%).

Among the severely thin children, a significant reduction in the prevalence of underweight and stunting was seen as shown in **Table 4.3.27**. Of the 126 underweight severely thin children, 13.5% moved to normal category and among the 173 stunted children, 11.0% moved to normal category. The results were statistically significant.

Table 4.3.43: Prevalence of Undernutrition among Severely Thin children in accordance to WHO 2007 standards (N, %)

Parameters	Boys		Girls		Total	
	Pre	Post	Pre	Post	Pre	Post
Normal	5 (4.5)	15 (18.8)	5 (6.3)	8 (15.1)	10 (5.3)	23 (17.3)
Underweight	106 (95.5)	65 (81.2)	74 (93.7)	45 (84.9)	180 (94.7)	110 (82.7)
Normal	113 (51.6)	116 (53.0)	56 (45.5)	59 (48.0)	1699 (49.4)	175 (51.2)
Stunting	106 (48.4)	103 (47.00	67 (54.5)	64 (52.0)	173 (50.6)	167 (48.8)
Normal	0 (0)	30 (13.7)	0 (0)	35 (28.5)	0 (0)	65 (19.0)
Thinness	219 (100)	189 (86.3)	123 (100)	88 (71.5)	342 (100)	277 (81.0)

Values in parenthesis indicates percentage

Table 4.3.44: Impact of Intervention on the Prevalence of Underweight (Z-Scores) among Severely Thin Children (N, %)

Degree of Underweight	BOYS		GIRLS		TOTAL	
	Initial (N=111)	Final (N=80)	Initial (N=79)	Final (N=53)	Initial (N=190)	Final (N=133)
Normal	2 (1.8)	3 (3.8)	1 (1.3)	3 (5.7)	3 (1.6)	6 (4.5)
Mild	3 (2.7)	12 (15.0)	4 (5.1)	5 (9.4)	7 (3.7)	17 (12.8)
Moderate	28 (25.2)	23 (28.8)	15 (19.0)	19 (35.8)	43 (22.6)	42 (31.6)
Severe	78 (70.3)	42 (52.5)	59 (75)	26 (49.1)	137 (72.1)	68 (51.1)

Values in parenthesis indicates percentage

Table 4.3.45: Impact of Intervention on the Prevalence of Stunting (Z-Scores) among Severely Thin Children (N, %)

Degree of Stunting	Boys (N=219)		Girls (N=123)		Total (N=342)	
	Initial	Final	Initial	Final	Initial	Final
Normal	32 (14.6)	36 (16.4)	24 (19.5)	24 (19.5)	56 (16.4)	60 (17.5)
Mild	81 (37.0)	80 (36.5)	32 (26.0)	35 (28.5)	113 (33.0)	115 (33.6)
Moderate	76 (34.7)	67 (30.6)	42 (34.1)	40 (32.5)	118 (34.5)	107 (31.3)
Severe	30 (13.7)	36 (16.4)	25 (20.3)	24 (19.5)	55 (16.1)	60 (17.5)

Values in parenthesis indicates percentage

Table 4.3.46: Impact of Intervention on the Prevalence of Thinness (Z-Scores) among Severely Thin Children (N, %)

Degree of Thinness	BOYS (N=219)		GIRLS (N=123)		TOTAL (N=342)	
	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL
NORMAL	0 (0)	12 (5.5)	0 (0)	8 (6.5)	0 (0)	20 (5.8)
MILD	0 (0)	18 (8.2)	0 (0)	27 (22.0)	0 (0)	45 (13.2)
MODERATE	0 (0)	67 (30.6)	0 (0)	42 (34.1)	0 (0)	109 (31.9)
SEVERE	219 (100)	122 (55.7)	123 (100)	46 (37.4)	342 (100)	168 (49.1)

Values in parenthesis indicates percentage

Table 4.3.47: Impact of Intervention on Prevalence of Underweight and Stunting among Severely Thin children (N,%)

Pre \ Post	Normal	Underweight	Total	Chi Square
Normal	6 (85.7)	1 (14.3)	7	24.185***
Underweight	17 (13.5)	109 (86.5)	126	
Total	23 (17.3)	110 (82.7)	133	
	Normal	Stunting	Total	Chi Square
Normal	156 (92.3)	13 (7.7)	169	2.263E2***
Stunting	19 (11.0)	154 (89.0)	173	
Total	175 (51.2)	167 (48.8)	342	

Values in parenthesis indicates percentage

The age wise prevalence of undernutrition according to WHO 2007 growth standards is shown in **Table 4.3.28**. It indicates that prevalence of undernutrition based on WAZ scores decreases with an increase in age. Since undernutrition is indicated by WAZ scores, the results obtained with regards to the prevalence of undernutrition are more or less similar to those indicated by WAZ scores with regard to age.

Undernutrition in the form of stunting based on Height for Age Z scores post one year intervention across all the ages is depicted in **Table 4.3.29**. It was seen that the prevalence of stunting was more or less similar in the age group of 5-12 years after which the prevalence increased. The difference was statistically significant. Similar trend was observed in the prevalence of thinness as shown in **Table 4.3.30**.

The school wise prevalence of undernutrition among the children was also assessed and is represented in **Table 4.3.31**. The prevalence of underweight was the highest (56.5%) in Pujya Shri Dongreji Maharaj Prathmik Shala after one year of intervention. The prevalence of stunting was the highest (48.0%) in Vinobha BHave Prathmik Shala whereas the prevalence of thinness was the highest (40.1%) in Rushi Vishwamitra Prathmik Shala. When the prevalence data post one year of intervention was compared with the baseline data, it was observed that reduction in the prevalence of underweight was the highest in Sir Sayajirao Gaekwad Prathmik Shala (25.8%). Reduction in hte prevalence of stunting was the highest in Dr. Headgewar Prathmik Shala (5.8%) after one year of intervention, whereas reduction in the prevalence of thinness was found to be highest in Chandra Shekhar Azad Prathmik Shala (20.9%) among all schools.

In order to obtain a comprehensive measurement of the overall prevalence of undernutrition school children on the basis of their Z scores were categorized as per the sub groups of Composite Index of Anthropometric Failure (CIAF).

Table 4.3.48: Age Wise Prevalence of Underweight In Accordance to WHO 2007 Growth Standards (N, %)

Age (yr)	Boys (N=1649)		Girls (N=1875)		Total (N=3524)	
	Initial	Final	Initial	Final	Initial	Final
5	60 (44.8)	53 (43.8)	74 (55.2)	68 (56.2)	134 (56.3)	121 (50.8)
6	117 (47.2)	97 (46.9)	131 (52.8)	110 (53.1)	248 (56.9)	207 (47.5)
7	146 (52.0)	119 (31.0)	135 (48.0)	126 (51.4)	281 (54.9)	245 (47.9)
8	120 (46.3)	100 (26.0)	139 (53.7)	130(56.5)	259 (51.1)	230 (46.0)
9	155 (49.5)	15 (53.6)	158 (50.5)	13 (46.4)	313 (53.5)	28 (45.2)
10	13 (52.0)	0 (0)	12 (48.0)	0 (0)	25 (52.1)	0 (0)
Total	**611 (48.5)**	**384 (46.2)**	**649 (51.5)**	**447 (53.8)**	**1260 (54.2)**	**831 (47.5)**

Value in parenthesis indicates percentages

Table 4.3.49: Age Wise Prevalence of Stunting In Accordance to WHO 2007 Growth Standards (N, %)

Age (yr)	Boys (N=1649)		Girls (N=1875)		Total (N=3524)	
	Initial	Final	Initial	Final	Initial	Final
5	46 (42.6)	39 (41.5)	62 (57.4)	55 (58.5)	108 (45.4)	94 (39.5)
6	78 (45.3)	59 (44.4)	94 (54.7)	74 (55.6)	172 (39.4)	133 (30.5)
7	90 (52.0)	74 (47.7)	83 (48.0)	81 (52.3)	173 (33.8)	155 (30.3)
8	78 (44.6)	69 (41.6)	97 (55.4)	97 (58.4)	175 (34.5)	166 (32.7)
9	93 (45.4)	81 (41.3)	112 (54.6)	115 (58.7)	205 (35.0)	196 (33.5)
10	90 (40.4)	87 (41.2)	133 (59.6)	124 (58.8)	223 (37.2)	211 (35.2)
11	66 (47.8)	79 (53.4)	72 (52.2)	69 (46.6)	138 (37.6)	148 (40.3)
12	46 (54.8)	44 (57.9)	38 (45.2)	32 (42.1)	84 (50.9)	76 (46.1)
13	21 (52.5)	18 (52.9)	19 (47.5)	16 (47.1)	40 (57.1)	34 (48.6)
14	14 (82.4)	12 (80.0)	3 (17.6)	3 (20.0)	17 (56.7)	15 (50.0)
15	2 (66.7)	2 (66.7)	1 (33.3)	1 (33.3)	3 (37.5)	3 (37.5)
16	4 (80.0)	3 (75.0)	1 (20.0)	1 (25.0)	5 (83.3)	4 (66.7)
Total	628 (46.8)	567 (45.9)	715 (53.2)	668 (54.1)	1343 (38.1)	1235 (35.0)

Value in parenthesis indicates percentages

Table 4.3.50: Age Wise Prevalence of Thinness in Accordance to WHO 2007 Growth Standards (N, %)

Age (yr)	Boys (N=1649)		Girls (N=1875)		Total (N=3524)	
	Initial	Final	Initial	Final	Initial	Final
5	29 (4.4)	33 (5.6)	32 (6.0)	36 (7.8)	61 (5.1)	69 (6.6)
6	60 (9.2)	56 (9.5)	47 (8.8)	49 (10.7)	107 (9.0)	105 (10.0)
7	84 (12.9)	74 (12.6)	72 (13.5)	75 (16.3)	156 (13.2)	149 (14.2)
8	80 (12.3)	66 (11.2)	76 (14.3)	80 (17.4)	156 (13.2)	146 (13.9)
9	107 (16.4)	93 (15.8)	90 (16.9)	69 (15.0)	197 (16.6)	162 (15.5)
10	111(17.0)	107 (18.2)	105 (19.7)	83 (18.0)	216 (18.2)	190 (18.1)
11	100 (15.3)	87 (14.8)	67 (12.6)	41 (8.9)	167 (14.1)	128 (12.2)
12	37 (5.7)	37 (6.3)	27 (5.1)	15 (3.3)	64 (5.4)	52 (5.0)
13	27 (4.1)	20 (3.4)	11 (2.1)	8 (1.7)	38 (3.2)	28 (2.7)
14	14 (2.1)	10 (1.7)	5 (0.9)	4 (0.9)	19 (1.6)	14 (1.3)
15	1 (0.2)	1 (0.2)	0 (0)	0 (0)	1 (0.1)	1 (0.1)
16	3 (0.5)	3 (0.5)	1 (0.2)	0 (0)	4 (0.3)	3 (0.3)
Total	653 (55.1)	587 (56.1)	533 (44.9)	460 (43.9)	1186 (33.7)	1047 (29.7)

Value in parenthesis indicates percentages

Table 4.3.51: School Wise Prevalence of Undernutrition in Children using WHO 2007 Growth Standards (Z score<-2SD)

School Code	WAZ			HAZ			BMIZ		
	Pre	Post	Diff	Pre	Post	Diff	Pre	Post	Diff
1	55.3	29.5	25.8	33.2	27.9	5.3	31.1	19.5	11.6
2	45.5	40.5	5	30.5	26.8	3.7	34.6	29.2	5.4
3	39.2	26.8	12.4	24.8	22.5	2.3	33.6	33.8	-0.2
4	56.8	56.5	0.3	37.7	35.2	2.5	27.4	33.2	-5.8
5	51.1	43.2	7.9	37.1	37.0	0.1	35.0	19.2	15.8
6	61.5	48.9	12.6	33.3	31.0	2.3	38.8	17.9	20.9
7	60.6	54.6	6	49.0	48.0	1.0	40.6	27.9	12.7
8	72.2	51.1	21.1	42.0	43.8	-1.8	36.1	31.5	4.6
9	55.4	50.8	4.6	38.6	35.1	3.5	38.6	34.6	4
10	55.1	47.1	8	45.5	40.1	5.4	33.3	40.1	-6.8
11	50.3	48.0	2.3	40.3	36.8	3.5	30.6	30.5	0.1
12	50.0	41.3	8.7	34.2	32.4	1.8	27.3	25.9	1.4
13	67.2	45.7	21.5	43.9	44.3	-0.4	49.1	29.7	19.4
14	44.8	45.5	-0.7	34.4	28.6	5.8	22.4	25.3	-2.9
15	66.4	43.4	23	40.5	35.0	5.5	41.4	27.7	13.7
16	52.8	51.2	1.6	36.9	34.4	2.5	32.5	33.0	-0.5

According to CIAF as shown in **Table 4.3.32**, the prevalence of thinness among school children was 9.7%, the prevalence of thinness and underweight was 13.3%, the prevalence of stunting and underweight was 16.6%, the prevalence of stunting was 13.4% and the prevalence of underweight was 6.8%. There were 13.4% of the children who simultaneously had thinness, stunting and underweight (i.e. group D), which means that they had the most poor nutritional status.

Overall the prevalence of anthropometric failure was higher among boys (57.9%) as compared of girls (51.9%). When the prevalence was seen across the sub-groups, it was seen that the prevalence was higher among boys in each group except in case of stunting where higher prevalence was seen among girls. Age wise comparison revealed that the prevalence of anthropometric failure was higher among children less than 10 years of age (56.3%) as compared to older children (53.2%).

When the post intervention data was compared with the baseline data, it was seen that 45.3% of the children belonged to normal category with no prevalence of undernutrition **(Table 4.3.33)**. The overall prevalence of anthropometric failure reduced to 54.7% **(Figure 4.3.13)** i.e. there was an overall reduction by 7.1% after one year of intervention, with maximum reduction seen among the girls (7.3%) as compared to boys (6.9%).

Cross tabulation of CIAF classification as shown in **Table 4.3.34** that there was significant reduction in the prevalence of anthropometric failure, wherein 18% of the children who suffered from some kind of Anthropometric failure moved to the normal category after one year of intervention.

Haemoglobin Levels of the Children

Haemoglobin estimations were carried out on 662 children after one year of intervention. The mean haemoglobin level for boys was 11.2g/dl and for girls was 11.2g/dl as depicted in **Table 4.3.35**. As can be seen the mean

Table 4.3.52: CIAF Classification of Children with Anthropometric Failure Cross Tabulated By Gender And Age

	<10 years			≥10 years			Combined		
	Boys (777)	Girls (971)	Total (1748)	Boys (872)	Girls (904)	Total (1776)	Boys (1649)	Girls (1875)	Total (3524)
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
A	322 (41.4)	441 (45.4)	763 (43.6)	372 (42.7)	460 (50.9)	832 (46.8)	694 (42.1)	901 (48.1)	1595 (45.3)
B	35 (4.5)	29 (2.9)	64 (3.7)	183 (20.9)	95 (10.5)	278 (15.7)	218 (13.2)	124 (6.6)	342 (9.7)
C	120 (15.4)	113 (11.6)	233 (13.3)	-	-	-	120 (15.4)	113 (11.6)	233 (13.3)
D	85 (10.9)	104 (10.7)	189 (10.8)	164 (18.8)	119 (13.2)	283 (15.9)	249 (15.1)	223 (11.9)	472 (13.4)
E	129 (16.6)	161 (16.6)	290 (16.6)	-	-	-	129 (16.6)	161 (16.6)	290 (16.6)
F	36 (4.6)	54 (5.6)	90 (5.1)	153 (17.5)	230 (25.4)	383 (21.6)	189 (11.5)	284 (15.1)	473 (13.4)
Y	50 (6.4)	69 (7.1)	119 (6.8)	-	-	-	50 (6.4)	69 (7.1)	119 (6.8)
Total CIAF (B-F)	455 (58.6)	530 (54.6)	985 (56.3)	500 (57.3)	444 (49.1)	944 (53.2)	955 (57.9)	974 (51.9)	1929 (54.7)

A- Normal, B- Thinness only, C- Thinness and underweight, D- Thinness, stunting & underweight, E- Stunting & underweight, F- Stunting only and Y- Underweight only

Value in parenthesis indicates percentages

Table 4.3.53: Impact of Intervention on CIAF Classification of Children with Anthropometric Failure (N,%)

CIAF	Boys (N=1649)		Girls (N=1875)		Total (N=3524)	
	Initial	Final	Initial	Final	Initial	Final
A	580 (35.2)	694 (42.1)	765 (40.8)	901 (48.1)	1345 (38.2)	1595 (45.3)
B	194 (11.8)	218 (13.2)	143 (7.6)	124 (6.6)	337 (9.6)	342 (9.7)
C	174 (10.6)	120 (7.3)	145 (7.7)	113 (11.6)	319 (9.1)	233 (13.3)
D	285 (17.3)	249 (15.1)	245 (13.1)	223 (11.9)	530 (15.0)	472 (13.4)
E	214 (13.0)	129 (7.8)	264 (14.1)	161 (8.6)	478 (13.6)	290 (16.6)
F	129 (7.8)	189 (11.5)	206 (11.0)	284 (15.1)	335 (9.5)	473 (13.4)
Y	73 (4.4)	50 (3.0)	107 (5.7)	69 (3.7)	180 (5.1)	119 (6.8)
Total CIAF (B-F)	1069 (64.8)	955 (57.9)	1110 (59.2)	974 (51.9)	2179 (61.8)	1929 (54.7)

A- Normal, B- Thinness only, C- Thinness and underweight, D- Thinness, stunting & underweight, E- Stunting & underweight, F- Stunting only and Y- Underweight only
Value in parenthesis indicates percentages

Table 4.3.54: Cross tabulation of CIAF classification according to WHO (N,%)

Pre \ Post	Normal	Anthropometric Failure	Chi Square Value
Normal	1206 (89.6)	139 (10.3)	7.306E2 (0.000)
Anthropometric Failure	389 (17.9)	1790 (82.1)	

Value in parenthesis indicates percentages

Figure 4.3.15: Summary of Anthropometric Indices

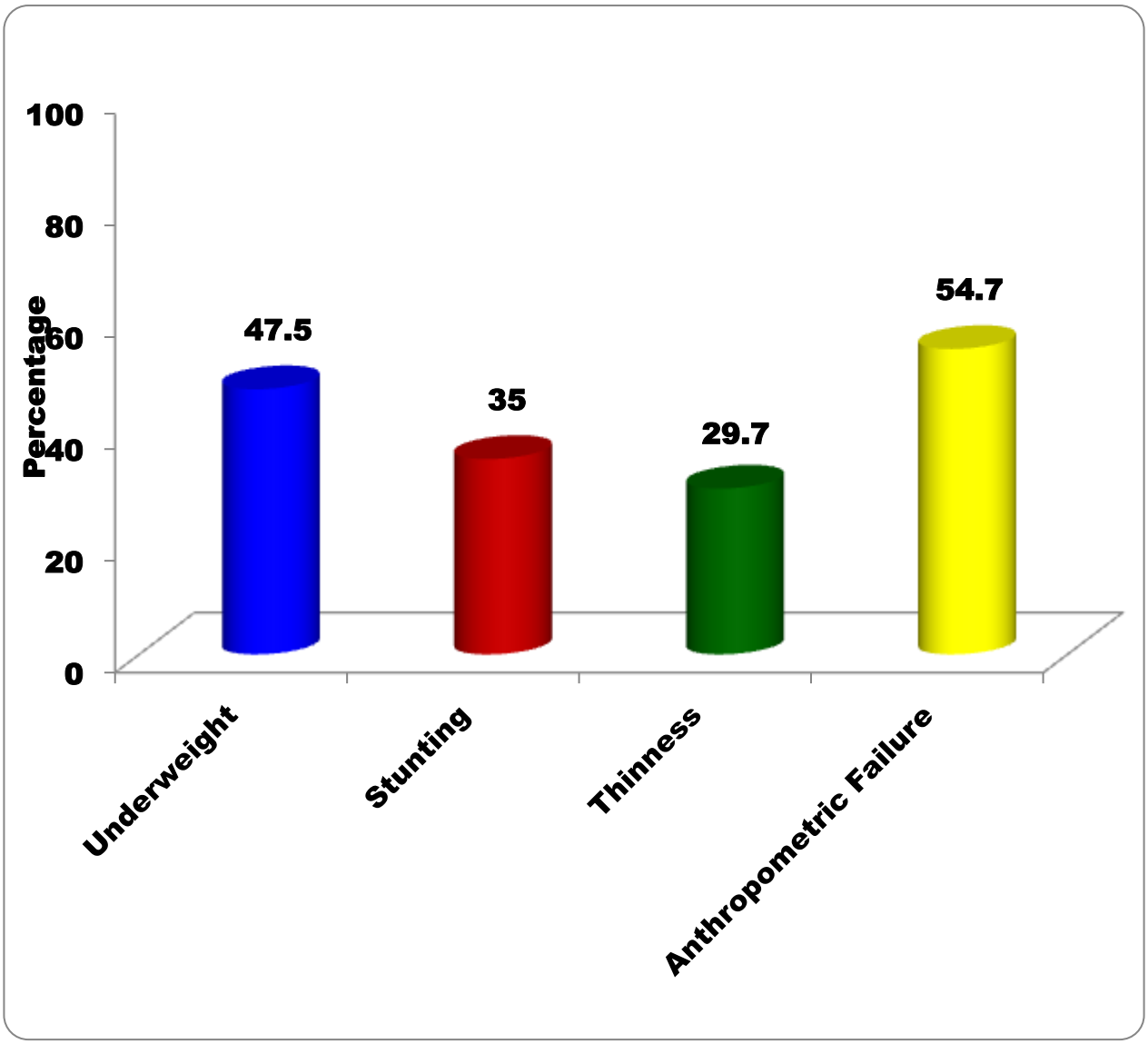


Table 4.3.55: Impact of Mid Day Meal on the Hemoglobin Levels of the Children (MEAN±SD, g/dl)

Age (yr)	Boys (329)	Girls (333)	Total (662)	"t" value
7-7.11 Years				
INITIAL	11.5±0.0	10.8±0.0	11.2±0.5	-
FINAL	11.5±0.0	11.2±0.0	11.4±0.2	-
DIFFERENCE	-	0.4±0.0	0.2±0.3	
PAIRED "t" VALUE	-	-	1.000	
8-8.11 Years				
INITIAL	10.6±0.8	10.1±0.8	10.3±0.8	3.136**
FINAL	11.0±0.9	11.2±1.0	11.1±1.0	-1.045
DIFFERENCE	0.4±0.9	1.1±0.8	0.8±0.9	-4.172***
PAIRED "t" VALUE	2.483*	10.295***	8.587***	
9-9.11 Years				
INITIAL	10.3±0.9	10.3±1.0	10.3±1.0	0.422
FINAL	11.0±1.1	11.5±1.1	11.2±1.1	-2.894**
DIFFERENCE	0.7±0.9	1.2±1.2	0.9±1.1	-3.434**EVNA
PAIRED "t" VALUE	7.033***	9.504***	11.428***	
10-10.11 Years				
INITIAL	10.6±1.0	10.1±1.0	10.3±1.1	3.448**
FINAL	11.4±1.1	11.2±1.2	11.1±1.3	1.405
DIFFERENCE	0.8±0.9	1.1±1.1	0.9±1.0	-1.798
PAIRED "t" VALUE	8.693***	10.374***	13.457***	
11-11.11 Years				
INITIAL	10.4±1.1	10.1±1.0	10.2±1.1	1.654

FINAL	11.1±1.3	11.2±1.2	11.1±1.3	-0.677
DIFFERENCE	0.7±1.1	1.2±1.0	0.9±1.1	-2.506*
PAIRED "t" VALUE	5.237***	8.718***	9.401***	
12-12.11 Years				
INITIAL	10.5±0.9	9.9±1.4	10.2±1.1	1.571
FINAL	11.7±1.2	10.6±1.7	11.1±1.5	2.428*
DIFFERENCE	1.2±1.1	0.7±0.7	0.9±0.9	1.753
PAIRED "t" VALUE	4.971***	4.848***	6.724***	
13-13.11 Years				
INITIAL	11.3±0.6	9.6±1.6	10.6±1.4	2.562*^{EVNA}
FINAL	12.1±1.1	10.0±1.8	11.2±1.7	3.165**
DIFFERENCE	0.9±1.1	0.4±1.0	0.6±1.1	0.925
PAIRED "t" VALUE	2.389*	0.903	2.452*	
14-14.11 Years				
INITIAL	9.8±0.6	10.6±0.0	9.9±0.6	-1.313
FINAL	12.1±1.4	12.0±0.0	12.1±1.2	0.081
DIFFERENCE	2.4±1.0	1.4±0.0	2.2±1.0	0.811
PAIRED "t" VALUE	4.488*	-	4.823**	
15-15.11 Years				
INITIAL	-	9.8±0.0	9.8±0.0	-
FINAL	-	10.5±0.0	10.5±0.0	-
DIFFERENCE	-	0.7±0.0	-	-
PAIRED "t" VALUE	-	-	-	-
16-16.11 Years				

INITIAL	9.4±0.0	11.3±0.0	10.4±1.3	-
FINAL	9.4±0.0	11.1±0.0	10.2±1.2	-
DIFFERENCE	-	-0.2±0.0	-0.1±0.1	-
PAIRED "t" VALUE	-	-	-1.000	-
Total				
INITIAL	**10.5±0.9**	**10.1±1.0**	**10.3±1.0**	**4.707*** **
FINAL	**11.2±1.2**	**11.2±1.2**	**11.2±1.2**	**0.232**
DIFFERENCE	**0.7±1.0**	**1.1±1.0**	**0.9±1.0**	**-4.425*** **
PAIRED "t" VALUE	**13.447*** **	**19.420*** **	**22.979*** **	

*** Significant at P< 0.05**

**** Significant at P<0.01**

***** Significant at P< 0.001**

EVNA – Equal Variance not assumed

haemoglobin level of the boys and the girls were more or less similar and the difference was not statistically significant. There was significant increase in the mean haemoglobin level of boys (0.7g/dl) and girls (1.1g/dl) post intervention. It was seen that the increase in the mean haemoglobin levels of the girls was significantly higher as compared to the boys. Age wise analysis revealed that the increment in mean haemoglobin levels was less among boys up to 11 years of age where in the increase in mean haemoglobin levels of girls was significantly higher at 8 and 9 years of age than reverse trend was seen where mean haemoglobin levels of girls was less than boys.

Table 4.3.36 shows the mean initial and final haemoglobin levels of the severely thin children. A significant increase (0.9 mg/dl) in the mean haemoglobin levels among severely thin children was seen after one year of intervention. It was seen that there was significant increase in the mean haemoglobin levels of both boys (0.8mg/dl) and girls (1.2 mg/dl). Age wise analysis revealed that there was no significant difference at each age among both boys and girls. However, when comparison was done between the gender, it was found that only at 9 years of age, the mean haemoglobin level of girls was significantly higher than boys. At all the other ages, the mean haemoglobin levels were comparable.

Impact of Intervention on Prevalence of Anaemia

The percent prevalence along with severity of anaemia among the school children is presented in **Figure 4.3.14.** The prevalence of anaemia was 62.5% with 34.9% of school children suffering from moderate anaemia, followed by mild anaemia (26.3%). Only 1.4% of the children were suffering from severe anaemia.

Age wise data (**Table 4.3.37**) revealed that the prevalence of anaemia was more among children aged 12-16 years (68.1%) as compared to children aged 5-11 years (61.9%). Around 4.3% of the children aged 12-16 years were severely anaemic which was also higher as compared to children aged 5-11 years (1.0%). Gender wise difference showed that more number of boys

Table 4.3.56: Age wise Mean Hemoglobin Levels of Severely Thin Children (Mean±SD)

	Boys		Girls		Total	
Age (yr)	Pre	Post	Pre	Post	Pre	Post
8	9.8±0.2	10.0±0.7	10.0±0.6	11.5±1.0	9.9±0.5	11.1±1.1
9	10.0±0.8	9.5±1.0	10.0±0.6	11.3±1.0**a	10.0±0.7	10.8±1.3
10	10.3±1.1	11.5±1.3	9.8±0.9	11.1±1.5	10.1±1.1	11.3±1.4
11	10.8±0.5	10.9±0.6	10.4±1.1	11.1±0.5	10.6±0.8	11.0±0.6
12	9.9±.7	11.7±0.7	10.0±1.0	11.0±0.6	9.9±0.8	11.3±0.7
13	11.1±0.3	11.4±1.6	0.0±0.0	0.0±0.0	11.1±0.3	11.4±1.6
14	11.1±0.0	0.0±0.0	0.0±0.0	0.0±0.0	11.1±0.0	0.0±0.0
Total	10.3±0.9	11.1±1.2	10.0±0.8	11.2±1.0	10.2±0.9	11.1±1.1
T test	4.148***		7.240***		7.582***	

** - $p<0.01$

a- Significant difference between boys and girls post mean Hb levels at 9 years

Figure 4.3.16: Percent Prevalence of Anaemia among Children after one year of Intervention

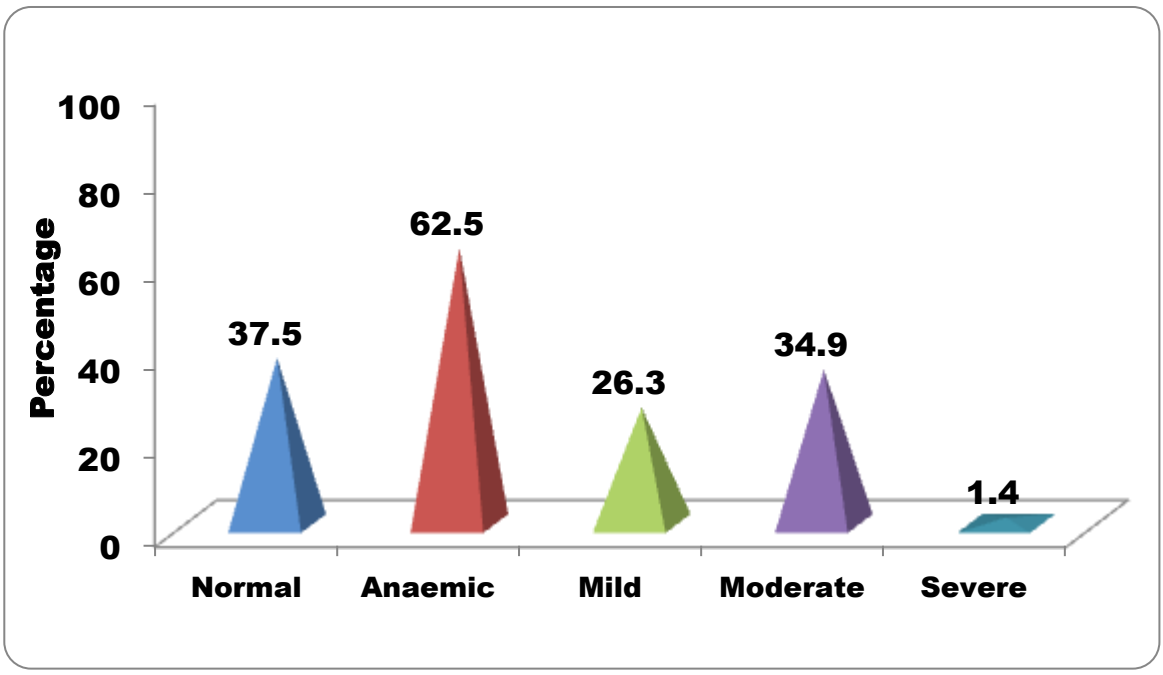


Table 4.1.57: Age wise % Prevalence of Anemia among Children

Anaemia Classification	Boys		Girls		Total	
	N (%)	CI	N (%)	CI	N (%)	CI
5-11 years	**(N=294)**		**(N=299)**		**(N=593)**	
Normal	105 (35.7)	30.1-41.3	121 (40.5)	34.8-46.2	226 (38.1)	34.1-42.1
Mild	74 (25.2)	20.1-30.3	79 (26.4)	21.3-31.5	153 (25.8)	22.2-29.4
Moderate	112 (38.1)	32.4-43.8	96 (32.1)	26.7-37.5	208 (35.1)	31.2-39.0
Severe	3 (1.0)	-0.2-2.2	3 (1.0)	-0.2-2.2	6 (1.0)	0.2-1.8
12-16 years	**(N=35)**		**(N=34)**		**(N=69)**	
Normal	16 (45.7)	28.9-62.5	6 (17.7)	4.6-30.8	22 (31.9)	20.7-43.1
Mild	9 (25.7)	10.9-40.5	12 (35.3)	18.9-51.7	21 (30.4)	19.3-41.5
Moderate	10 (28.6)	13.3-43.9	13 (38.2)	21.5-54.9	23 (33.3)	22.0-44.6
Severe	0 (0.0)	0	3 (8.8)	-0.9-18.5	3 (4.3)	-0.6-9.2
Total	**(N=329)**		**(N=333)**		**(N=662)**	
Normal	121 (37.0)	31.7-42.3	127 (38.1)	32.8-43.4	248 (37.5)	33.7-41.3
Mild	83 (25.2)	20.4-30.0	91 (27.3)	22.4-32.2	174 (26.3)	22.9-29.7
Moderate	122 (37.0)	31.7-42.3	109 (32.7)	27.6-37.8	231 (34.9)	31.2-38.6
Severe	3 (0.9)	-0.1-1.9	6 (1.8)	0.3-3.3	9 (1.4)	0.5-2.3

(63.0%) were anaemic as compared to the girls (61.9%). The prevalence was more of moderate category (37.0% boys Vs 32.7% girls). While in the severe category, the prevalence of anaemia was more among girls (1.8%) than boys (0.9%) as shown in **Figure 4.3.15**.

The percent prevalence of anaemia among school children before and after one year of intervention is shown in **Figure 4.3.16**. The prevalence of anaemia reduced from 90% to 62.5% and the reduction was statistically significant. A shift in the number of children with different degrees of anaemia was also observed as shown in **Table 4.3.38**. Maximum reduction was seen in the mild to normal category (60.4%). In the severe category also a shift was seen, where around 35% of the children moved from severe to moderate category.

When the haemoglobin levels of the children were cross tabulated with anthropometric indices **(Table 4.3.39)** it was seen that irrespective of the nutritional status of the school children, the mean haemoglobin levels of the children were almost similar and the difference between the groups was not significant statistically.

The frequency distribution of anaemic children as per their nutritional status is represented **in Table 4.3.40**. It was observed that the prevalence of anaemia was higher among children with mild undernutrition. When the gender difference was seen, it was found that the prevalence of anaemia was more among underweight girls as compared to underweight boys whereas it was more among thin boys as compared to thin girls. However, the prevalence of anaemia was comparable among stunted children.

The prevalence of anaemia was also seen among children with anthropometric failure. It was observed that 50.4% of the children with anthropometric failure had anaemia **(Table 4.3.41)**. The prevalence of anaemia was more among stunted children followed by children who were stunted, wasted and underweight.

Figure 4.3.17: Gender Wise Percent Prevalence of Anaemia

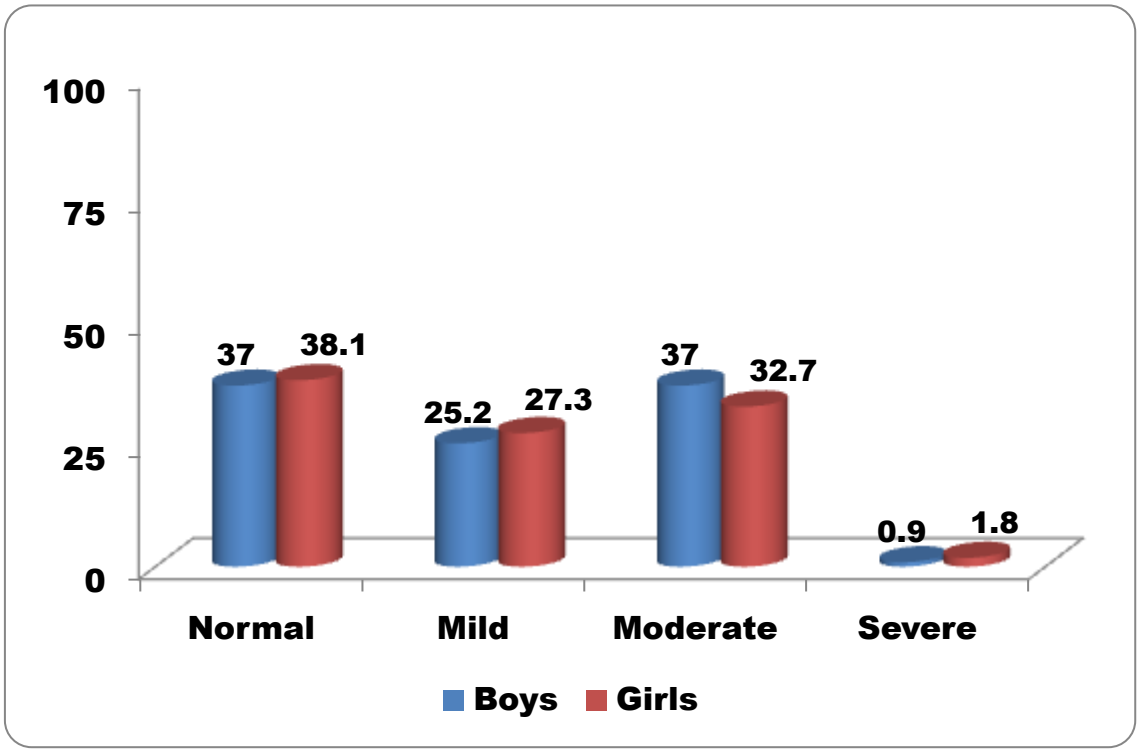


Figure 4.3.18: Impact of Mid Day Meal on the Percent Prevalence of Anaemia among Children

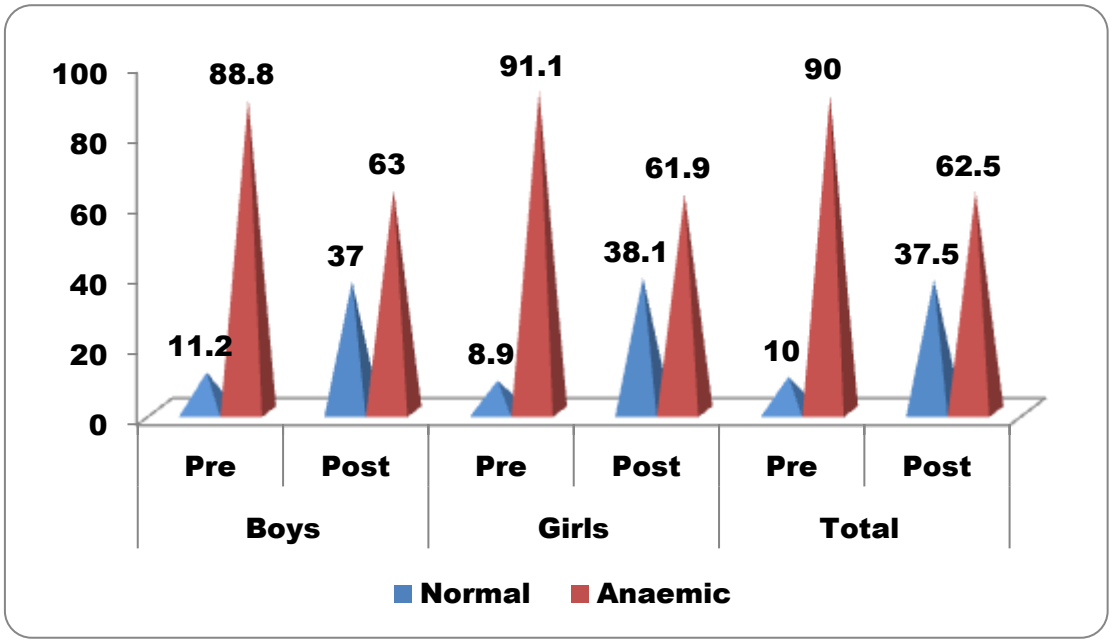


Table 4.3.58: Cross Tabulation of Anemia among School Children

Pre \ Post	Normal	Mild	Moderate	Severe	Total
Normal	54 (70.1)	17 (22.1)	6 (7.8)	0(0)	77
Mild	55 (60.4)	26 (28.6)	10 (11.0)	0(0)	91
Moderate	139 (29.1)	129 (27.0)	209 (43.8)	0(0)	477
Severe	0(0)	2 (11.8)	6 (35.3)	9 (52.9)	17
Total	248 (37.5)	174 (26.3)	231 (34.9)	9 (1.4)	662
Chi Square	4.356E2 (0.000)				

Table 4.3.59: Haemoglobin Levels Cross Tabulated with Nutritional Status of Children

Nutritional Status (Z Score)	N	Hemoglobin Levels (Mean ± SD)
WAZ		
Normal	21	10.8±0.7
Mild	45	11.0±1.0
Underweight	30	11.4±1.1
Severe Underweight	11	10.8±1.0
F Value	2.176	
HAZ		
Normal(≥-2SD)	184	11.2±1.2
Mild	264	11.3±1.2
Stunted (<-2SD)	167	11.2±1.2
Severe Stunted (<-3SD)	47	11.2±1.3
F Value	0.332	
BMIZ		
Normal(≥-2SD)	250	11.2±1.1
Mild	230	11.3±1.2
Thinness (<-2SD)	137	11.1±1.4
Severe Thinness (<-3SD)	45	11.0±1.3
F Value	0.869	

Table 4.3.60: Prevalence of Anaemia Cross Tabulated With Nutritional Status (%)

Nutritional Status	Boys	Girls	Total
WAZ			
Normal	13.3 (4)	29.3 (12)	22.5 (16)
Grade I	56.7 (17)	34.1 (14)	43.7 (31)
Grade II	16.7 (5)	24.4 (10)	21.1 (15)
Grade III	13.3 (4)	12.2 (5)	12.7 (9)
HAZ			
Normal	29.3 (61)	24.3 (50)	26.8 (111)
Grade I	36.5 (76)	40.8 (84)	38.6 (160)
Grade II	26.9 (56)	27.2 (56)	27.1 (112)
Grade III	7.2 (15)	7.8 (16)	7.5 (31)
BMIZ			
Normal	28.4 (59)	44.7 (92)	36.5 (151)
Grade I	35.6 (74)	33.0 (68)	34.3 (142)
Grade II	23.6 (49)	18.4 (38)	21.0 (87)
Grade III	12.5 (26)	3.9 (8)	8.2 (34)

Value in parenthesis indicates numbers

Table 4.3.61: Prevalence of Anaemia cross tabulated by CIAF

Anemia / CIAF	Normal (N=248)	Anemic (N=414)	Mild (N=174)	Moderate (N=231)	Severe (N=9)
A	137 (55.2)	205 (49.5)	87 (50)	115 (49.8)	3 (33.3)
B	30 (12.1)	54 (13.0)	19 (10.9)	33 (14.3)	2 (22.2)
C	10 (4.0)	6 (1.5)	2 (1.1)	4 (1.7)	0 (0)
D	21 (8.5)	61 (14.7)	28 (16.1)	31 (13.4)	2 (22.2)
E	5 (2.0)	4 (0.9)	1 (0.6)	3 (1.3)	0 (0)
F	45 (18.1)	78 (18.8)	36 (20.7)	40 (17.3)	2 (22.2)
Y	0 (0)	6 (1.5)	1 (0.6)	5 (2.2)	0 (0)
Total (B-Y)	**111 (44.8)**	**209 (50.4)**	**87 (50)**	**116 (50.2)**	**6 (66.7)**

A- Normal, B- Thinness only, C- Thinness and underweight, D- Thinness, stunting & underweight, E- Stunting & underweight, F- Stunting only and Y- Underweight only

Values in parenthesis indicate percentages

Impact of Intervention on Prevalence of Anaemia among Severely Thin Children

Post intervention the prevalence of anaemia among severely thin children was 73.2% as shown in **Table 4.3.42**. Out of the total anaemic children, majority belonged to the moderate category (40.2%) followed by mild category (32.9%). None of the children were severely anaemic. Though, 19.9% reduction was seen in the prevalence of anaemia, the reduction was not statistically significant **(Table 4.3.43)**.

Impact of MDM Intervention on the Morbidity Profile of Children

Table 4.3.44 shows the prevalence of the most common morbidities experienced by the children before and after one year of intervention. Only 12.9% of the children experienced any morbidity. Gender wise no difference was seen among boys and girls who experienced any morbidity. About 87.1% of the children reported that they did not experience any morbidity. The most common morbidities experienced by the school children were fever, cough and cold. Maximum children (77%) suffered from morbidity for 1-5 days. No significant reduction in the prevalence of morbidity was seen after one year of intervention as shown in **Table 4.3.45**.

Impact of Intervention on Morbidity Profile of the Severely Thin Children

Majority of the severely thin children did not face any morbidity, only about 17% of the severely thin children experienced common morbidities as represented in **Table 4.3.46**. Gender wise comparison revealed that girls experienced more morbidities as compared to boys. When the post intervention data was compared with baseline data, it was found that there was no significant difference in the prevalence of morbidities among severely thin children **(Table 4.3.47)**. The findings were similar in both the genders.

Table 4.3.62: Impact of Intervention on the Prevalence of Anemia among Severely Thin Children (N, %)

Anaemia Status	Boys		Girls		Total	
	Pre (N=65)	Post (N=39)	Pre (N=51)	Post (N=43)	Pre (N=116)	Post (N=82)
Normal	6 (9.2)	11 (28.2)	2 (3.9)	11 (25.6)	8 (6.9)	22 (26.8)
Anaemic	59 (90.8)	28 (71.8)	49 (96.1)	32 (74.4)	108 (93.1)	60 (73.2)
Mild	9 (13.8)	10 (25.6)	4 (7.8)	17 (39.5)	13 (11.2)	27 (32.9)
Moderate	50 (76.9)	18 (46.2)	44 (86.3)	15 (34.9)	94 (81.0)	33 (40.2)
Severe	0 (0)	0 (0)	1 (2.0)	0 (0)	1 (0.9)	0 (0)
Total	65	39	51	43	116	82

Value in parenthesis indicates percentage

Table 4.3.63: Impact of Intervention on the Prevalence of Anemia among Severely Thin Children (N, %)

Pre Anemic	Post Anemic		Total
	Normal	Anemic	
Normal	2 (66.7)	1 (33.3)	3 (100)
Anemic	16 (24.6)	49 (75.4)	65 (100)
Total	18 (26.5)	50 (73.5)	68 (100)
Chi Square	2.605		

Table 4.3.64: Morbidity Profile of the children before and after Intervention

	Health Problem	Boys (N=360)		Girls (N=391)		Total (N=751)	
		Initial	Final	Initial	Final	Initial	Final
	Yes	74 (20.6)	53 (14.7)	95 (24.3)	44 (11.3)	169 (22.5)	97 (12.9)
	No	286 (79.4)	307 (85.3)	296 (75.7)	347 (88.7)	582 (77.5)	654 (87.1)
	Type of illness						
1	Cough & cold	34 (45.9)	17 (32.1)	21 (22.1)	12 (27.3)	55 (32.5)	29 (29.9)
2	Headache	5 (6.8)	3 (5.7)	13 13.7)	4 (9.1)	18 (10.7)	7 (7.2)
3	Fever	17 23.0)	28 (52.8)	35 (36.8)	22 (50.0)	52 (30.8)	50 (51.5)
4	Stomachache	7 (9.5)	1 (1.9)	7 (7.4)	3 (6.8)	14 (8.3)	4 (4.1)
5	Vomiting	5 (6.8)	1 (1.9)	8 (8.4)	3 (6.8)	13 (7.7)	4 (4.1)
6	Diarrhoea	0 (0)	3 (5.7)	4 (4.2)	0 (0)	4 (2.4)	3 (3.1)
7	Toothache	0 (0)	0 (0)	2 (2.1)	0 (0)	2 (1.2)	0 (0)
8	Malaria	2 (2.7)	0 (0)	1 (1.1)	0 (0)	3 (1.8)	0 (0)
9	Other illness	4 (5.4)	0 (0)	4 (4.2)	0 (0)	8 (4.7)	0 (0)
	Period of illness						
1	1-5 days	53 (71.6)	40 (75.5)	73 (76.8)	35 (79.5)	126 (74.6)	75 (77.3)
2	6-10 days	14 (18.9)	12 (22.6)	20 (21.1)	6 (13.6)	34 (20.1)	18 (18.6)
3	11-15 days	2 (2.7)	1 (1.9)	2 (2.1)	3 (6.8)	4 (2.4)	4 (4.1)
4	Don't Know	5 (6.8)	0 (0)	0 (0)	0 (0)	5 (2.9)	0 (0)

Values in parenthesis indicates percentage

Table 4.3.65: Impact of Mid Day Meal Programme on Morbidity Profile of the Children (N, %)

Morbidities Experienced	Boys N=360		Girls N=391		Total N=751	
Post / Pre	Yes	No	Yes	No	Yes	No
Yes	14 (18.9)	60 (81.1)	15 (15.8)	80 (84.2)	29 (17.2)	140 (82.8)
No	39 (13.6)	247 (86.4)	29 (9.8)	267 (90.2)	68 (11.7)	514 (88.3)
CHI-SQUARE	1.307		2.586		3.492	

Table 4.3.66: Morbidity Profile of the Severely Thin Children Before and After Intervention Period

Morbidity Profile	Boys		Girls		Total	
	Initial (N=190)	Final (N=39)	Initial (N=112)	Final (N=43)	Initial (N=302)	Final (N=82)
Yes	41 (21.6)	6 (15.4)	39 (34.8)	8 (18.6)	80 (26.5)	14 (17.1)
No	149 (78.4)	33 (84.6)	73 (65.2)	35 (81.4)	222 (73.5)	68 (82.9)

Value in parenthesis indicates percentage

Table 4.3.67: Impact of Intervention on Morbidity Profile of the Severely Thin Children

Post / Pre	Health Problem		Total
	Yes	No	
Yes	4 (18.2)	18 (81.8)	22 (100)
No	10 (17.5)	47 (82.5)	57 (100)
Total	14 (17.7)	65 (82.3)	79 (100)
Chi Square	0.004		

Impact of MDM Intervention on School Enrolment and Attendance

An attempt was made to study the impact of the MDM programme provided by TAPF on enrolment and attendance of primary school children. The information on enrolment and attendance was collected from school records. An examination of the status of enrolment of the primary school children before and after provision of MDM through TAPF was carried out and is shown in **Table 4.3.48.** School strength was found to be highest in the Dr. Shyama Prasad Mukherjee Prathmik Shala with a total of 1350 children enrolled and the minimum strength was found in Chandrashekhar Azad Prathmik Shala with only 141 children enrolled for the academic year (2008-09).

The percent difference in enrolment was estimated by comparing the enrolment figures for the academic year 2008-09 and 2009-10. The percent decrease in enrolment was the highest in Rushi Vishwamitri Prathmik Shala with a drop of 13.2%, followed by Swami Vivekanand Prathmik Shala were enrolment dropped by 9.6%. Also, a positive trend was observed after the intervention, wherein three schools (Dr. Jagdish Chandra Bose Prathmik Shala, Sir Sayajirao Gaekwad Prathmik Shala and Dr. Hansa Mehta Prathmik Shala) showed a maximum rise in enrolment by 34.3%, 33.3% and 19.2% respectively. Overall, a rise in school enrolment was recorded by 2.6% wherein 3.8% rise in school enrolment was seen among boys and 1.4% among girls.

Class wise gender distribution of the school children is depicted in **Table 4.3.49**. The analysis presented indicates that girls outnumber boys in both primary and upper primary sections but the difference is statistically not significant **(Figure 4.3.17)**.

To analyse the impact of the programme on school attendance, the attendance records for one year when the programme was initiated and for next academic year were collected. The school wise mean attendance and percent mean attendance of primary school children was tabulated and is

Table 4.3.68: School Wise Children Enrolment and Percentage difference in Enrolment

Sr. No.	Name of the school	Children enrolled (2008-09)	Children enrolled (2009-10)	% increase/ decrease	Boys enrolled (2008-09)	Boys enrolled (2009-10)	% increase/ decrease	Girls enrolled (2008-09)	Girls enrolled (2009-10)	% increase/ decrease
1.	Sir Sayajirao Gaekwad Prathmik Shala	253	339	33.3 (86)	134	173	29.1 (39)	119	166	39.5 (47)
2.	Pujya Shri Rang Avadhoot Prathmik Shala	422	415	-1.7 (7)	224	216	-3.6 (8)	198	199	0.5 (1)
3.	Maa Veer Bai Prathmik Shala	142	143	0.7 (1)	86	86	0 (0)	56	57	1.8 (1)
4.	Pujya Shri Dongreji Maharaj Prathmik Shala	648	668	3.1 (20)	313	347	10.9 (34)	335	321	-4.2 (14)
5.	Dr. Jagdish chandra Bose Prathmik Shala	315	423	34.3 (108)	149	219	46.9 (70)	166	204	22.9 (38)
6.	Chandrashekhar Azad Prathmik Shala	141	155	9.9 (14)	64	83	29.7 (19)	77	72	- 6.5 (5)
7.	Dr. Hansa Mehta Prathmik Shala	333	397	19.2 (64)	164	178	8.5 (14)	169	219	29.6 (50)
8.	Vinobha Bhave Prathmik Shala	175	174	-0.6 (1)	85	85	0 (0)	90	89	-1.1 (1)

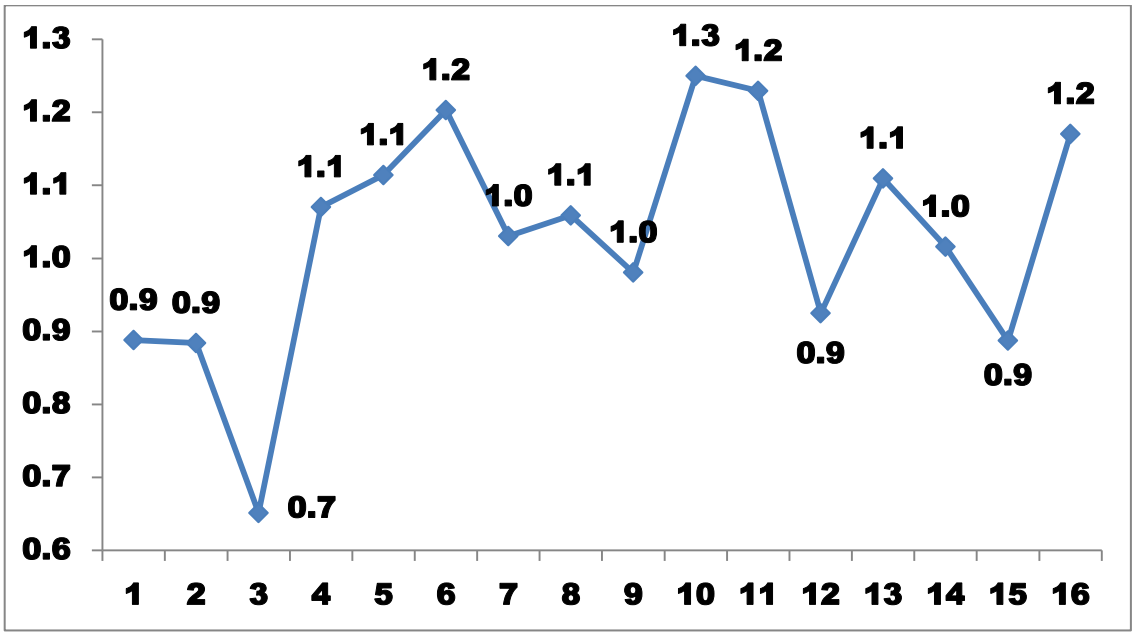
9.	Dr. Baba Saheb Ambedkar Prathmik Shala	307	334	8.8 (27)	155	167	7.7 (12)	152	167	9.9 (15)
10.	Rushi Vishwamitra Prathmik Shala	549	477	-13.1 (72)	244	214	-12.3 (30)	305	263	-13.8 (42)
11.	Swami Vivekanand Prathmik Shala	622	562	-9.6 (60)	279	247	-11.5 (32)	343	315	-8.2 (28)
12.	Zaverchand Meghani Prathmik Shala	256	297	16.0 (41)	133	150	12.8 (17)	123	147	19.5 (24)
13.	Dr. Rajendra Prasad Prathmik Shala	289	279	-3.5 (10)	137	139	1.5 (2)	152	140	-7.9 (12)
14.	Dr. Hedgewar Prathmik Shala	504	477	-5.3 (27)	250	235	-6.0 (15)	254	242	-4.7 (12)
15.	Rajaram Mohan Roy Prathmik Shala	268	266	-0.7 (2)	142	147	3.5 (5)	126	119	-5.6 (7)
16.	Dr. Shyama Prasad Mukherjee Prathmik Shala	1350	1339	-0.8 (11)	622	617	-0.8 (5)	728	722	-0.7 (5)
	TOTAL	**6574**	**6745**	**2.6 (171)**	**3181**	**3303**	**3.8 (122)**	**3393**	**3442**	**1.4 (49)**

Table 4.3.69: Standard wise Gender Distribution of Primary School Children Enrolled in 2008-09

Class wise	Total (6574)	Boys (3181)	Girls (3393)	Ratio Girls:Boys
Standard 1	1117 (17.0)	520 (16.3)	597 (17.6)	1.1
Standard 2	1019 (15.5)	483 (15.2)	536 (15.8)	1.1
Standard 3	1034 (15.7)	516 (16.2)	518 (15.3)	1.0
Standard 4	917 (13.9)	441 (13.9)	476 (14.0)	1.1
Standard 5	869 (13.2)	431 (13.5)	438 (12.9)	1.0
Standard 6	829 (12.6)	393 (12.4)	436 (12.8)	1.1
Standard 7	789 (12.0)	397 (12.5)	392 (11.6)	1.0
Chi Square		4.891		

Value in parenthesis indicates percentage

Figure 4.3.19: School Wise Ratio of Girls: Boys



presented in **Table 4.3.50**.Analysis revealed that the mean maximum mean attendance was recorded in Maa Veer Bai Prathmik Shala with 201 days and minimum mean attendance was recorded for Pujya Shri Dongreji Maharaj Prathmik Shala with only 165 days out of the 216 working days in the academic year 2008-09. While, in the year 2009-10, the maximum mean attendance was seen in Maa Veer Bai Prathmik Shala, Raja Ram Mohan Roy Prathmik Shala and Dr. Rajendra Prasad Prathmik Shala with 211 days, 209 days and 206 days respectively. Minimum mean attendance was recorded for Dr. Jagdish Chandra Bose Prathmik Shala and Pujya Shri Dongreji Maharaj Prathmik Shala with 173 and 177 days out of 227 working days.

When comparison was made between mean attendance of the academic year 2008-09 and 2009-10, it was seen that there was significant improvement in the attendance rate as shown in **Table 4.3.51**. In the academic year 2008-09, the mean attendance was 181 days which improved to 190 days in the academic year 2009-10 as shown in **Figure 4.3.18**. The attendance rate for both boys and girls improved similarly and the results were statistically significant. Attendance rate for girls was significantly higher than that for boys for both the academic year.

Standard wise comparison shown in **Figure 4.3.19** revealed that the mean school attendance increased drastically among children studying in 1^{st} standard. Comparison between the standards also showed that the mean attendance of the school children significantly increased with increase in standards. However, no significant difference was seen in mean attendance of children studying in 7^{th} standard as shown in **Table 4.3.52.**

Analysis was also done among children who reported consuming MDM versus those who reported they don't consume MDM and is represented in **Table 4.3.53**. It was found that the mean attendance of the children who consumed MDM was 182 days which was similar to those who were not consumed (180 days) in the academic year 2008-09. However, post one year of intervention, significant increase in the mean attendance of school children who reported that they consume MDM provided by TAPF was observed.

Table 4.3.70: School Wise Mean Attendance and % Attendance of Primary School Children for the Academic Year (08-09) and (09-10)

Name of the School	2008-09			2009-10		
	Boys (Mean±SD)	Girls (Mean±SD)	Total (Mean±SD)	Boys (Mean±SD)	Girls (Mean±SD)	Total (Mean±SD)
Sir Sayajirao Gaekwad P. Shala	179±20 (83.0)	183±28 (84.5)	181±25 (83.7)	189±21 (83.4)	193±19 (85.2)	191±20 (84.2)
Pujya Shri Rang Avadhoot P. Shala	185±17 (85.6)	186±18 (86.3)	186±17 (85.9)	186±26 (81.8)	195±14 (85.8)	190±22 (83.6)
Maa Veer Bai P. Shala	201±8 (93.1)	200±11 (92.4)	201±10 (92.8)	211±14 (92.9)	212±15 (93.5)	211±15 (93.1)
Pujya Shri Dongreji Maharaj P. Shala	162±36 (75.1)	168±32 (77.6)	165±34 (76.4)	177±25 (77.9)	177±23 (78.0)	177±24 (77.9)
Dr. Jagdish chandra Bose P. Shala	173±11 (80.2)	177±12 (81.7)	175±12 (81.0)	172±11 (75.6)	175±13 (77.1)	173±12 (76.4)
Chandrashekhar Azad P. Shala	169±43 (78.2)	181±11 (83.6)	176±29 (81.4)	183±19 (80.6)	185±17 (81.4)	184±18 (81.0)
Dr. Hansa Mehta P. Shala	185±14 (85.8)	178±19 (82.6)	182±17 (84.1)	191±19 (84.3)	190±7 (83.8)	191±19 (84.0)
Vinobha Bhave P. Shala	168±22 (77.8)	174±11 (80.8)	171±18 (79.2)	187±21 (82.5)	194±14 (85.7)	191±18 (83.9)
Dr. Baba Saheb Ambedkar P. Shala	175±33 (81.0)	181±22 (83.9)	178±28 (82.5)	179±27 (78.9)	181±23 (79.9)	180±25 (79.4)
Rushi Vishwamitra P. Shala	191±12 (88.4)	189±16 (87.3)	190±14 (87.8)	188±15 (83.0)	190±20 (83.8)	189±18 (83.5)
Swami Vivekanand P. Shala	178±20 (82.5)	174±18 (80.6)	176±19 (81.4)	181±20 (79.6)	179±25 (79.1)	180±23 (79.3)
Zaverchand Meghani P. Shala	182±12 (84.1)	178±26 (82.2)	179±21 (83.0)	197±13 (86.6)	199±13 (87.7)	198±13 (87.2)

Dr. Rajendra Prasad P. Shala	179±26 (82.7)	179±25 (82.7)	179±26 (82.7)	206±18 (90.7)	207±19 (91.0)	206±18 (90.8)
Dr. Headgewar P. Shala	185±14 (85.4)	183±18 (84.8)	184±16 (85.1)	182±20 (80.3)	187±19 (82.6)	185±20 (81.5)
Rajaram Mohan Roy P. Shala	190±21 (88.1)	201±16 (92.9)	196±19 (90.7)	209±14 (91.9)	209±19 (92.2)	209±17 (92.1)
Dr. Shyama Prasad Mukherjee P. Shala	178±33 (82.6)	191±24 (88.6)	186±29 (85.9)	183±18 (80.7)	191±19 (84.2)	188±19 (82.7)
Total	**179±27 (82.9)**	**183±23 (84.7)**	**181±25 (83.9)**	**188±20 (81.9)**	**191±20 (83.4)**	**190±20 (82.7)**
T test	4.227***EVNA			**4.613*****EVNA**		

Table 4.3.71: Impact of Mid Day Meal Programme on the Mean Attendance of Primary School Children

Mean Attendance	Boys (N=1271)	Girls (N=1448)	Total (N=2719)	"t" value
2008-09	179±27	183±23	181±25	4.180***EVNA
2009-10	188±20	191±20	190±20	4.238***EVNA
DIFFERENCE	9±26	8±25	9±25	
PAIRED "t" VALUE	12.110***	12.466***	17.381***	

Table 4.3.72: Mean Attendance of the Children According to Standards (Mean±SD)

Standard	Attendance 2008-09	Attendance 2009-10	**'t' test**
1	73±50	165±24	**7.456*** **
2	170±30	186±24	**12.144*** **
3	180±23	188±20	**8.155*** **
4	185±19	189±20	**3.746*** **
5	185±19	194±17	**10.171*** **
6	191±17	193±16	**3.265** **
7	181±10	183±33	**0.322**
ANOVA	**105.19*** **	**19.767*** **	

Figure 4.3.20: Mean Attendance of School Children

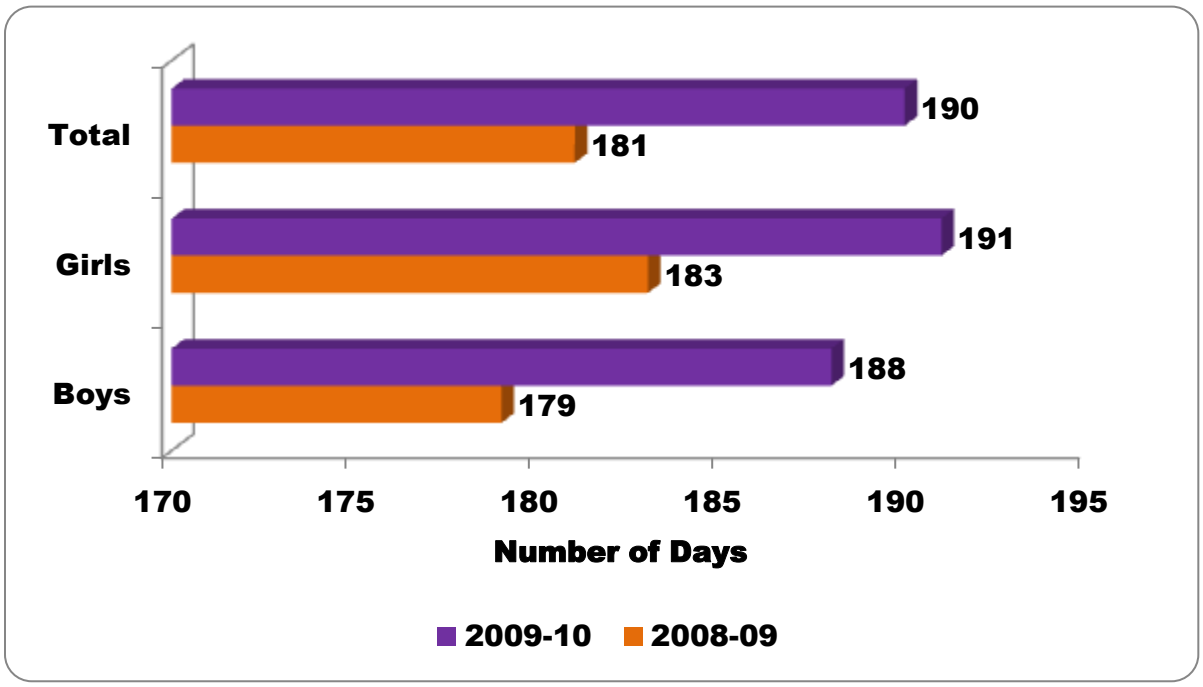


Figure 4.3.21: Standard Wise Mean Attendance Rate of the School Children

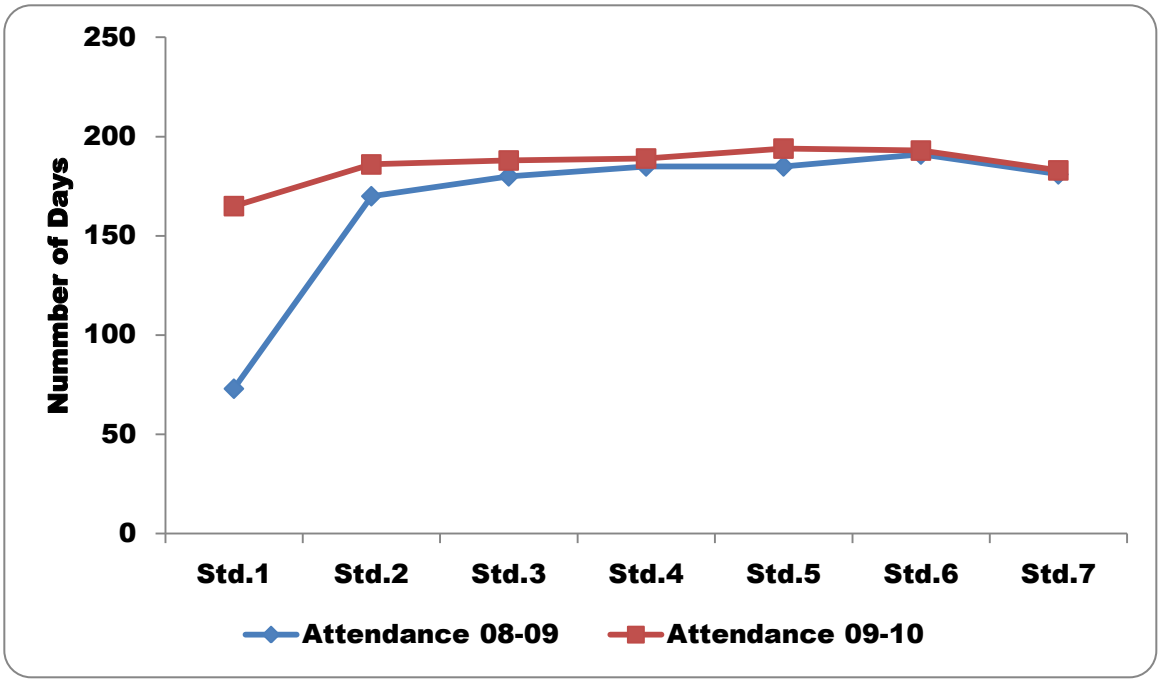


Table 4.3.73: Mean Attendance among MDM Consumers and Non-Consumers (Mean±SD)

	MDM Consumers	Non Consumers	**"t" value**
Attendance 2008-09	182±25	180±23	1.506
%Attendance 2008-09	84.4±11.5	83.4±10.6	
Attendance 2009-10	190±20	184±22	5.147***
%Attendance 2009-10	83.6±8.9	81.2±9.6	

***** Significant at P<0.001**

Table 4.3.74: Impact of Mid Day Meal Programme on the Mean Attendance of the Severely Thin Children

Mean Attendance	**Boys (N=181)**	**Girls (N=99)**	**Total (N=280)**	**"t" value**
2008-09	180±24	185±21	182±23	1.776
2009-10	189±22	197±20	192±21	1.703
DIFFERENCE	9±24	12±20	10±23	
PAIRED "t" VALUE	5.175***	5.974***	7.546***	

***** Significant at P<0.001**

Impact of Intervention on School Attendance of the Severely Thin Children

The mean attendance of severely thin children was 182 days in the academic year 2008-09. While in the academic year 2009-10, the mean attendance was 192 days. Thus, the intervention showed a positive impact on the mean attendance of the severely thin children as depicted in **Table 4.3.54.** There was significant improvement in the school attendance in case of both the boys and the girls, however, between the genders, the mean attendance of the girls was higher than boys in both the academic year but the difference was not statistically significant.

Impact of MDM Intervention on Scholastic Performance

The educational achievement of the school children was assessed by secondary data obtained from school records. Data analysis revealed that 74.9% of the children cleared their examinations whereas 3.2% were unable to do so in the academic year 2008-09 **(Table 4.3.55)**. Out of the total number of children, 22.0% were those for whom the data was not available because either they were new admissions or belonged to 1st standard. In the academic year 2009-10, there was an improvement in the pass % as a total of 94.8% passed their examinations and 5.2% failed. Gender wise analysis revealed that the performance was better among girls as compared to the boys.

Impact of TAPF mid day meal was also evident on classroom performance of the children as depicted in **Table 4.3.56**. It was seen that there was significant improvement among those who had failed in the academic year 2008-09, as 83.0% of them passed their examination in 2009-10. This difference was statistically significant. **Thus, it can be said that MDM provided by TAPF is serving as an incentive to not only to attend schools, but also helping them to benefit more from education.**

Table 4.3.75: Academic Gender Wise Scholastic Performance of Primary School Children (N, %)

	Boys (N=1649)	Girls (N=1875)	Total (N=3524)
2008-09			
NA	363 (22.0)	411 (21.9)	774 (22.0)
Fail	59 (3.6)	53 (2.8)	112 (3.2)
Pass	1227 (74.4)	1411 (75.3)	2638 (74.9)
2009-10			
NA	1 (0.1)	2 (0.1)	3 (0.1)
Fail	113 (6.9)	69 (3.7)	182 (5.2)
Pass	1535 (93.1)	1804 (96.2)	3339 (94.8)

NA – Data not available

Table 4.3.76: Impact of MDM on Scholastic Performance of Primary School Children (N,%)

	2009-10		Total
2008-09	Fail	Pass	
Fail	19 (17.0)	93 (83.0)	112
Pass	121 (4.6)	2516 (95.4)	2637
Total	140 (5.1)	2609 (94.9)	2749
Chi Square	34.044***		

Value in parenthesis indicates percentages

*** - $p<0.001$

Grade wise analysis revealed that a shift in the grade of the school children was seen as shown in **Table 4.3.57.**

An attempt was also made to assess the scholastic performance of children in relation to their nutritional status. It was found that no significant difference was observed among underweight vs. Normal. as well as among thin vs. Normal. However significant difference was seen among stunted and normal children wherein less number of stunted children cleared their examination. Even less number of thin children cleared their examination as compared to the normal's but the difference was statistically not significant **(Table 4.3.58)**.

Impact of mid day meal provided by TAPF was also studied on scholastic performance of children who were underweight, stunted and thin at baseline. Significant improvement was seen among these children as about 84% of the underweight children cleared their exams in the next academic year. Similarly, 88% of the stunted and 86% of the thin children also cleared their exams in the academic year 2009-10 as shown in **Table 4.3.59**.

The impact of MDM provided by TAPF was significant even on the scholastic performance of severely thin children. As about 83% of the children cleared their exams in the academic year 2009-10 who were fail in the academic year 2008-09 **(Table 4.3.60)**.

Table 4.3.77: Year Wise Scholastic Performance of School Children

Grades	Result 08-09		Result 09-10		Difference	
	N	%	N	%	N	%
A	881	25.0	1044	29.6	163	4.6
A+	178	5.1	213	6.0	35	0.9
Ab	13	0.4	21	0.6	8	0.2
B	794	22.5	893	25.3	99	2.8
B+	679	19.3	888	25.2	209	5.9
C	79	2.2	207	5.9	128	3.7
D	27	0.8	94	2.7	67	1.9
F	99	2.8	161	4.6	62	1.8
NA	774	22.0	3	0.1		

NA – Data not available

Table 4.3.78: Scholastic Performance of School Children Cross Tabulated by Nutritional Status

		Pass	Fail	Total	Chi-Square
Underweight	Normal	868	49	917	0.964
	Underweight	795	36	831	
	Total	1663	85	1748	
Stunting	Normal	2153	133	2286	5.601*
	Stunting	1186	49	1235	
	Total	3339	182	3521	
Thinness	Normal	2344	131	2475	0.261
	Thinness	995	51	1046	
	Total	3339	182	3521	

Table 4.3.79: Impact of MDM provided by TAPF on Scholastic Performance of Underweight, Stunted and Thin Children

		Pass - 10	Fail - 10	Total - 10	Chi-Square
Underweight	Pass - 09	900 (96.7)	31 (3.3)	931	19.357***
	Fail - 09	43 (84.3)	8 (15.7)	51	
	Total - 09	943 (96.0)	39 (4.0)	982	
Stunting	Pass - 09	958 (96.2)	38 (3.8)	996	7.915**
	Fail - 09	44 (88.0)	6 (12.0)	50	
	Total - 09	1002 (95.8)	44 (4.2)	1046	
Thinness	Pass - 09	845 (95.3)	42 (4.7)	887	7.465**
	Fail - 09	36 (85.7)	6 (14.3)	42	
	Total - 09	881 (94.8)	48 (5.2)	929	

Value in parenthesis indicates percentage

Table 4.3.80: Impact of MDM provided by TAPF on Scholastic Performance of Severely Thin Children

		Result 2009-10			
		Pass	Fail	Total	Chi-Square
Result 2008-09	Pass	257 (95.5)	12 (4.5)	269	6.636*
	Fail	10 (83.3)	2 (16.7)	12	
	NA	54 (88.5)	7 (11.5)	61	
	Total	321 (93.9)	21 (6.1)	342	

NA – Data not available

HIGHLIGHTS

- Significant increase in the mean weight, height and BMI of the children after one year of intervention, even among severely thin children.
- The mean Z scores after one year of intervention had negative values but were significantly lower than at baseline.
- Overall the prevalence of underweight, stunting, thinness and anthropometric failure reduced by 6.7%, 3.1%, 4% and 7.1% respectively after one year intervention of MDM provided by TAPF.
- Prevalence of anaemia significantly reduced from 90% to 62.5%.
- Significant improvement in the attendance rate was seen during the academic year 2009-10.
- Scholastic performance of school children improved significantly.

Discussion:

Micronutrient deficiencies are a critical concern among children in developing countries, affecting their growth and cognitive development. They are commonly associated with the consumption of monotonous diets lacking important micronutrients. An effective strategy to combat these deficiencies is the fortification of commonly consumed foods (Muttaya et al 2009).

Programs for addressing micronutrient malnutrition in India have focused mainly on preschool children and women of reproductive age. With the exceptions of deworming, iodization of salt, and fortification of commercially available foods, no clear policies exist on addressing micronutrient malnutrition among schoolchildren in most states of India. Even in places where these policies exist, implementation and coverage of these programs is usually poor (Osei 2010).

As Mid Day Meal Programme plays an essential role in the lives of many school aged children. Government of Gujarat introduced fortified wheat flour into the mid day meal programme in the September'2009. The Mid day meal programme has also been strengthened with the interventions of Private and corporate

Partnerships (Nambiyar, Pande, & Solanki, 2010). One such example of innovation in delivery of Public services through the Private Partnerships is school meals through centralized kitchen provided by NGOs.

The present study assesses the impact of transition of the programme in Vadodara city from cooking meals at school to its current form of providing nutritious, hot and hygienically cooked meals prepared at a centralized kitchen by an NGO i.e. The Akshay Patra Foundation.

In 2000, The Akshaya Patra Foundation (TAPF) was founded to address the dual challenges of hunger and education in India. The organization provided nutrition-rich mid day meals to extremely underprivileged children in India with the aim of increasing school enrolment, reducing drop-out rates, and improving academic performance (Upton et al., 2007). In Vadodara, centralized kitchen by TAPF was started in November'2009.

The impact of mid day meals delivered by TAPF was seen on growth parameters, IDA, prevalence of morbidities, enrolment and attendance and school performance of primary school children.

Evidence of the impact of SFPs on children's growth and body composition remains inconclusive due to the mixed results reported from different studies. A few studies found a positive effect of school feeding on children's growth and anthropometric indices, while others showed no effect (Jomaa, McDonnell, & Probart, 2011).

However, the observations from the present study suggest that the mid day meal provided by TAPF has made an appreciable impact on the nutritional status of school children. The total weight gain after one year of intervention was 3.1 kg with higher increase seen among girls (3.4 kg) as compared to the boys (3.0 kg). Significant increase in the mean height was observed (5.8 cm), with 5.6cm

among boys and 5.9 cm among girls. Thus, the impact of MDM provided by TAPF was better among girls as compared to the boys.

A study carried out among municipal school children of Bangalore also reported significant increase in body weight (3.7 kg) and height (6.1 cm) from baseline after 12 months of intervention of fortified biscuits and drink with multiple micronutrients and n-3 fatty acids. According to them, the increase in weight and height exceeded the increase expected from Indian norms (2.4 kg and 5.5 cm respectively). Possible reasons could be due to positive effects of micronutrients on growth (Muthayya et al., 2009)

Another systemic review and meta analysis conducted by Kristjansson et al., (2009), to explore the impact of school feeding programme on physical and psychosocial variables in school aged children showed an overall small, non-significant change in height between children who did or did not receive meals at school in three randomised control trials, whereas a significant increase in height was observed in controlled before and after trials. However, authors found a stronger and more consistent effect of school feeding on weight gain from the three RCTs and three CBA trials that were analyzed; a gain that ranged between 0.25 to 0.75 kg a year.

Sarma KV et al., (2006) conducted a study on the effect of micronutrient supplementation for a period of 14 months on health and nutritional status of schoolchildren. The results showed a significant increase in mean increments of height and weight scores in the supplemented group compared with the placebo group. Velocity of weight (3.56 kg versus 3.00 kg) was significantly ($P < 0.01$) higher with supplementation. The limitation of the study was that in the study there was no control group, because the school meal provided by TAPF was given in all the schools of Vadodara city so there was no option for having a control group.

At baseline, 54%, 38% and 33% of the children were underweight, stunted and thin respectively. After one year of intervention of fortified MDM provided by

TAPF, the prevalence of underweight, stunting and thinness was significantly reduced by 6.1%, 3% and 4% respectively. Even the prevalence of overall anthropometric failure (CIAF) was significantly reduced from 61.8% to 54.7% (i.e. overall 7.1%). Thus, the MDM provided by TAPF had a positive effect on the nutritional status of school children.

One of the departmental studies focused on assessing the impact of multiple micronutrient fortified flour and nutri-candy on growth and haemoglobin levels of preschool children (3-6 y) for a period of 60 days in urban slums of Vadodara. The results showed a decrease in the prevalence of stunting by 16% (46% vs. 30%) and wasting (36% vs. 30%) by 6 % (Iyer & Bothra, 2008).

Despite the mid day meal programme going since decades, almost universal population at baseline were anaemic, indicating that the program mainly designed to address protein-energy malnutrition and did not supply enough micronutrients to prevent or eliminate existing iron deficiency anaemia. However, significant reduction (27.5%) in the prevalence of anaemia was observed after one year of intervention of fortified meals.

The possible reason could be explained by Fiedler et al., (2012) study, who reported the proportion of the population with inadequate intake of iron is reduced by 100% or virtually eliminated among MDM population post year of introduction of fortification of wheat flour in Gujarat as the estimated average intake of iron under MDM programme increased from 11.3 mg to 15.5 mg after fortification. There is global evidence that wheat flour fortification across 70 countries has reduced multiple micronutrient deficiencies. Data from programme in Canada, USA, Chile, Costa Rica and South Africa has reported a reduction in the prevalence of anaemia by 16-33% (*WHEAT FLOUR FORTIFICATION*, 2009).

Osei et al., (2010) in a study conducted in schools of Garhwal found that the prevalence of anaemia was significantly decreased after an 8 month intervention

of multi-micronutrient fortified cooked meals given at schools. Another study reported the prevalence of iron deficiency anaemia decreased significantly from 33% to 14% in the group of school children (aged 5-11 years) receiving fortified rice under MDM, whereas it increased marginally in group receiving unfortified rice (31% to 37%) over a period of 8 months (Radhika et al., 2011)

There was low incidence of any morbidity experienced (%) post one year of intervention. Although the evidence suggested reduction (%) in the incidence of any morbidity experienced, the difference was statistically not significant. Possible factor contributing to lack of significance could be less number of children experienced morbidity at baseline.

Similar findings were observed by various authors Thankachan et al., (2012); Arsenault et al., (2009); Manger et al., (2008); and van Stuijvenberg et al., (1999) who reported multiple micronutrient fortified trials have shown reduction in the incidence rate of morbidities.

The study also evaluates the impact of a programme of providing free hot cooked nutritious fortified school meals on improving participation rates of primary school children.

The results analysed indicates that the hot cooked meal provided by TAPF significantly improved enrolment rate as well as attendance rate of children especially children studying in 1st Standard. The results imply that the cooked meal scheme programme may be effective in raising the daily school participation of children in lower grades compared to the offsite dry rations programme. These results are supported by the evidence from previous survey data and anecdotal evidence on the impact of the meal programme is impressive in terms of enrolment, attendance and dropout rates in India (Dreze and Kingdon, 2000; Dreze and Goyal, 2003; Hamid & Hamid, 2012). These studies suggest that school meal programmes are particularly effective in increasing the school

enrolment rates of first graders in rural areas. Qualitative data on perceptions of school headmasters and parents from this survey also suggests that younger children were more attracted to attending school due to the programme which makes it easier to ensure that their school participation is more regular. (Afridi, 2011).

The research study on the impact of Mid Day Meal Scheme on the enrolment of elementary school students in the Union Territory of Chandigarh reported significant increase in the percentage of enrolment of students at primary level and upper primary levels over the period of three years after the initiation of Mid Day Meal Scheme. (Nangia & Poonam, 2011).

An evaluation covering a ten-year period of WFP-assisted school feeding in Kenya reported that the school meal has a significant positive effect on indicators such as enrolment, attendance rates, primary completion rates, and exam scores. Specifically, enrolment and attendance rates were higher, particularly in the early grades, in those schools that offered the school meal. The primary completion rate was also higher when meals were present, particularly for girls. With regard to learning indicators, the children in schools with regular meals scored higher in their last exam (Timothy et al., 2010).

The academic performance of children impacts their future educational attainment and health and has therefore emerged as a public health concern (Florence 2008).

The present study assessed the impact of fortified meals provided by centralized kitchen on the classroom performance of the school children. Though the scholastic performance of students is by and large determined by different other factors. The numerous causes of underachievement include the poor quality of teaching, the unavailability of text books, teaching methods and tools used parental resistance to formal education, low attendance rates in the classroom,

and socio economic condition. Nutrition, or the lack of it, has recently been recognized as an important additional factor because studies have identified under- nutrition with poor school achievement. Iron deficiency in school children also reduces some aspects of their ability to learn and providing iron improves these capacities (Acham et al., 2012). However, midday meal has helped children to overcome from the stage of classroom hunger.

Regular attendance is closely related to scholastic achievement, which our study also demonstrated. A definite link was observed between regular meals and children's academic achievement (Acham et al., 2012).

Afridi, Barooah, & Somanathan, (2014) studied the effect of school meal program on students attention in class. The study was conducted on 400 children from 16 poor performing public school in Delhi. The results showed that school meals led to an improvement in classroom attention and the improvement was significant in sessions held after meals were consumed.

Laxmaiah et al., (1999) conducted a study on impact of mid day meal programme on educational and nutritional status of 2694 school children from 60 schools in Karnataka. Results of the study indicated a marginally higher scholastic performance among MDM beneficiaries when compared with non MDM beneficiaries.

Another study conducted by Paul & Mondal, (2012) to assess the impact of MDM programme on academic performance of upper primary school children (n=300) of Burdwan district of West Bengal also reported significant association between school meals and academic performance of children.

In conclusion, school meals provided by TAPF had positive impact on nutritional and educational outcomes in terms of better growth and nutritional status of school children with increased attendance rate and improved classroom performance.

PHASE IV: WORKSHOP ON MID DAY MEAL PROGRAMME FOR MUNICIPAL SCHOOL TEACHERS OF VADODARA

A one day workshop on MDM was conducted for the Municipal School Teachers of urban Vadodara. Two teachers from each school the Principal and the MDM liaison teacher (or other teacher) were invited for the workshop. In all 195 teachers out of which 49% were Principal, 45% were teachers and only 6% of MDM liaison teachers participated in the workshop.

Technical sessions on under nutrition, importance of Mid Day Meal Programme, its objectives and differences in MDM Programme before and after the involvement of the Akshay Patra Foundation and results of the spot observations carried during the study were presented to the teachers. A video film of the Akshay Patra Foundation depicting the entire functioning of the kitchen was also presented to the teachers during the workshop **(Figure 4.4.1).**

Feedback from teachers

A self-administered semi-structured questionnaire was used to assess the knowledge of the teachers regarding the objectives of the MDM Programme and to gather their feedback regarding the MDM Programme. The feedback was collected from 195 teachers, of which 49.23% were principals and 45.13% were other teachers, and only 5.41% were MDM liaison teachers. The identification of the objectives by the teachers has been depicted in **(Table 4.4.1)**. Majority of the teachers identified the following objectives:

- Improvement in health and nutritional status of children (76.92%)
- Improvement in school attendance (67.69%)
- Improvement in scholastic performance (37.44%)
- Reduction in classroom hunger (37.36%)

A few teachers also identified another important objective:

- Improvement in girl child education (1.53%)

Figure 4.4.22: Designation of Teachers Participated in Workshop

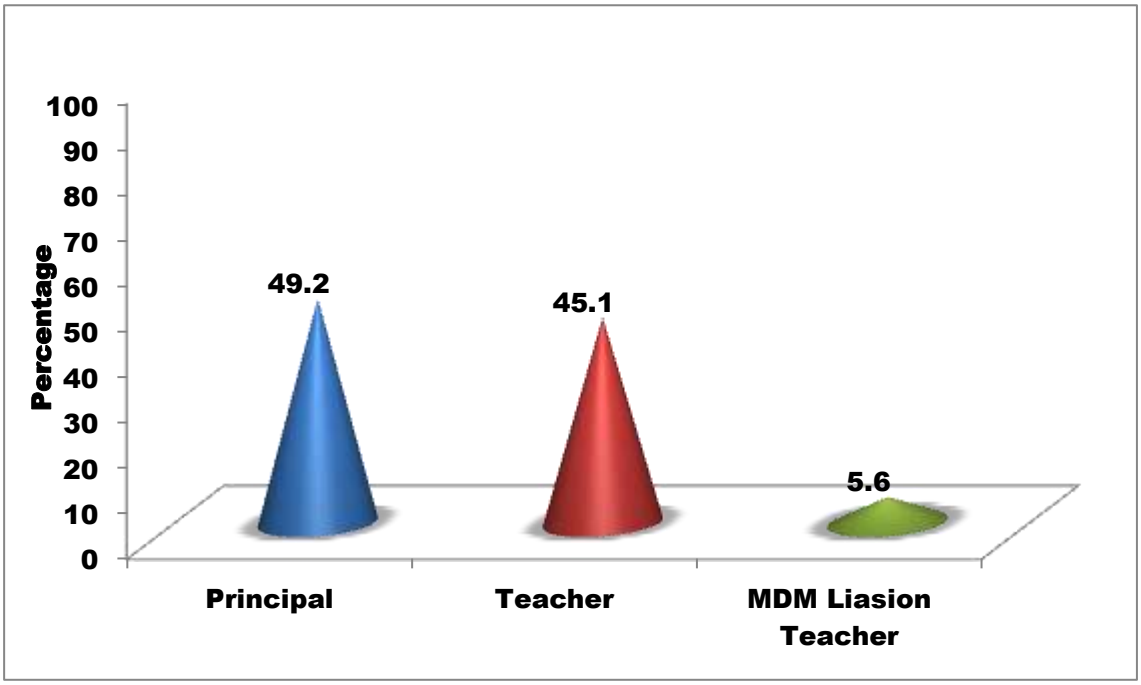


Table 4.4.81: Opinion of Teachers regarding Mid Day Meal Programme

Sr. No	Parameters	No.	%
1.	Objectives of the Mid Day Meal Programme*		
	1) Increase in the attendance of school children	132	67.69
	2) Increase in the scholastic performance of school children	73	37.44
	3) Reduction in classroom hunger	67	37.36
	4) Improvement in growth and development of the children	150	76.92
	5) Reduction in the school drop out	57	29.23
	6) Increase in girl child education	3	1.53
	7) Others	4	2.05
	8) No answer	8	4.10
2.	How much food should be given to child in Mid Day Meal Programme		
	1) Enough quantity to satisfy hunger of children	60	30.77
	2) As per eating capacity	21	10.77
	3) As per age of children	40	20.51
	4) As per standard	14	7.17
	5) As per caloric requirement	32	16.41
	a. Correct	20	62.50
	b. Incorrect	12	37.50
	6) As per standard ration	60	30.77
	a. Correct	10	18.34
	b. Incorrect	50	83.34
	7) No answer	12	6.15
3.	Adequate food given to children in the Mid Day Meal Programme		
	1) Yes	188	96.41
	2) No	7	3.90

The teachers were asked about the rationale for the quantity of MDM to be given per child according to the guidelines. It was found that only about 1/3rd of the teachers could correctly identify standard ration (30.77%) and caloric requirement (16.41%) as the underlying principles for deciding the quantity of MDM to be given to each child.

Among the teachers who mentioned caloric requirement as the basis for the quantity of MDM to be served to each child, 62.5% of the teachers could correctly state the energy required i.e. 450 Kcal for primary school children and 700 Kcal for upper primary school children.

Among the teachers who described standard ration as the basis for the quantity of MDM to be served to each child, only 18.34% of the teachers could correctly mention the ration i.e. 100g for primary school children and 150g for upper primary school children.

When inquired about the adequacy and quality of MDM provides to school children **(Table 4.4.2)**, majority of the teachers were of the opinion that the food provided was sufficient (96.41%) and of good quality (88.72%).

All the teachers (99.49%) felt that the children liked the food given in the MDM Programme through the The Akshay Patra Foundation, and the most liked food items by the children were Sukhadi (79.48%), Dal (70.25%) and Rice (63.58%). Plain Roti (12.82%) and Masala roti (17.43%) were the least liked food items **(Figure 4.4.2)**. These observations are similar to those observed during our spot observations.

All the teachers were of the opinion that provision of MDM cooked in the centralized kitchen of Akshay Patra is better than cooking MDM in individual schools (Figure 4.4.3) because both the quality of food (65.12%) and hygiene (61.02%) is maintained in the Akshay Patra kitchen.

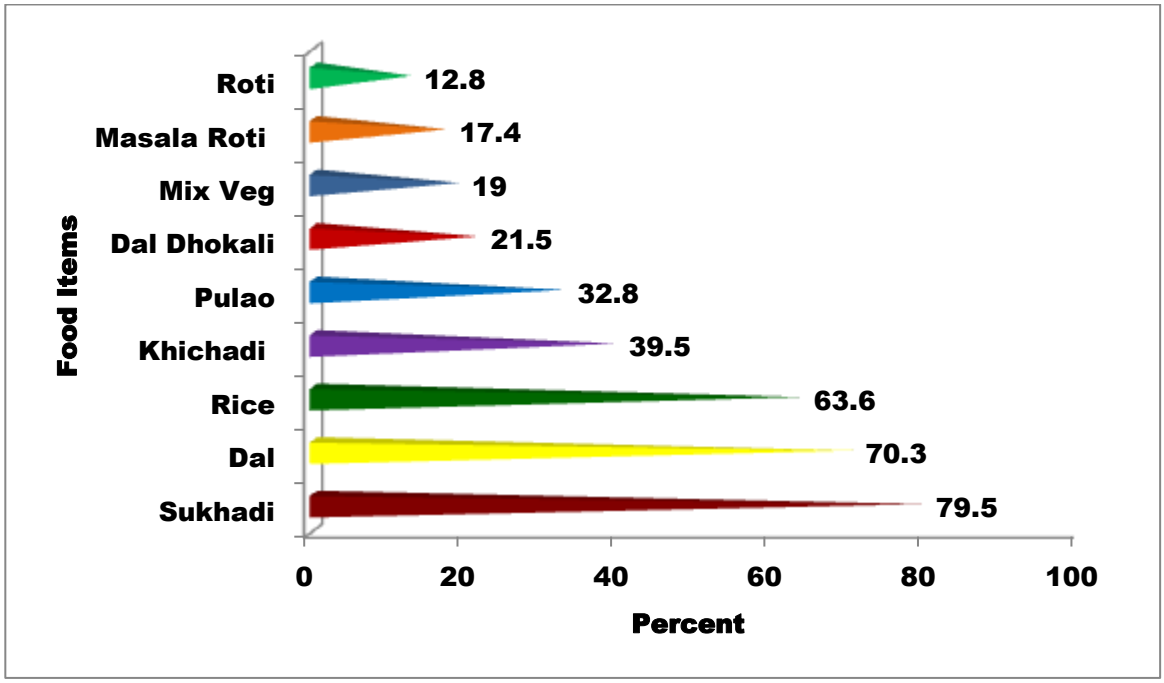
Majority of the teachers were satisfied with the quality of the food provided by Akshaypatra (98.46%), cleanliness of the vessels used for bringing the food to the school (88.72%) and timely supply of food (78.46%) **(Table 4.4.2)**.

Table 4.4.82: Opinion of the Teachers Regarding MDM Provided by TAPF

Sr. No	Parameters	No.	%
1.	Quantity of food provided by TAPF in the Mid Day Meal Programme is sufficient for the children?		
	3) Yes	188	96.41
	4) No	7	3.90
2.	Quality of Mid Day Meal provided by TAPF for the school children		
	1) Good	183	88.72
	2) Average	21	10.77
	3) Poor	0	0.0
	4) No answer	1	0.51
3.	Children like the food given in Mid Day Meal Programme		
	1) Yes	194	99.49
	2) No	1	0.51
4.	Best cooking method for MDM		
	1) In school	0	0.0
	2) Through Akshay Patra Foundation	195	100.0
4.1	Reasons *		
	1) Cleanliness is maintained	119	61.02
	2) Quality of food is maintained	127	65.12
	3) Timely supply of food	34	17.43
	4) Modern technology is used	19	9.73
	5) Tasty and variety in food	8	4.10
	6) No answer	31	15.89
5.	Satisfaction with the work of TAPF in terms of		
	1) Quality and quantity of food	192	98.46
	2) Timely supply of food	153	78.46
	3) Cleanliness of food containers	173	88.72
	4) Cleanliness of serving vessels	145	73.36

* Multiple responses

Figure 4.4.23: Teachers Perception about Most Liked Food Item By the Children



It was found that majority (97.95%) of the teachers had tasted the food provided by Akshay Patra at least once, whereas, 38.74% out of them reported tasting the food every day **(Table 4.4.3).**

When inquired about the difficulties faced while implementing the MDM Programme only 12.82% teachers reported that they faced some problems. About 86% of the teachers reported no problems faced in implementing the MDM programme. The problems faced by them were mainly related to the infrastructure facilities available in the school like not enough space for having school meals, improper water facility and cleaning of dining area not done after the children ate **(Table 4.4.4)**. **As no problems in implementing the programme was reported by majority of the teachers, it implied that teachers were happy with the MDM programme provided by TAPF.**

According to most of the teachers, improvement in school attendance (98.46%), increase in school attendance of girls (92.82%), improvement in scholastic performance (93.85%) and rise in the enrolment of girl child (84.62%) was seen because of the MDM provided by Akshay Patra **(Table 4.4.5)**. Thus overall the teachers were happy and satisfied with the ongoing MDM programme through the Akshay Patra Foundation.

Group Discussion

In the workshop, group discussion was also held where the teachers were divided into five groups - each comprising of 40 teachers. Each group was given a topic related to the MDM Programme. The teachers were supposed to discuss the topic and later on, a representative from each group was asked to present the highlights of the discussion.

Topics of group discussion were as follows:

Group-1: Objectives of the Mid Day Meal Programme

1. Change in School attendance due to Mid Day Meal Programme
2. Whether MDM has any effect on girl child enrollment and attendance
3. Effect on health and nutritional status of the children
4. Effect of MDM on scholastic performance

Table 4.4.83: Tasting of Food by the Teachers

Sr. No	Parameters	No.	%
1	Tasting of food by the teachers		
	1) Yes	191	97.95
	2) No	4	2.05
1.1	If yes, how frequently		
	1. Daily	74	38.74
	2. 2-3 times in a week	54	28.27
	3. 4-5 times in a week	27	14.14
	4. Sometimes	19	9.95
	5. No answer	17	8.90
1.2	If No, Why		
	1. Due to health	1	25
	2. Have lunch and come to school	2	50
	3. No answer	1	25

Table 4.4.84: Problems Faced In Implementing MDM Programme

1.	Difficulty faced in implementing MDM		
	1. Yes	25	12.82
	2. No	168	86.15
	3. No answer	2	1.03
1.1	If yes, what are the difficulties faced		
	1. Less no. of helpers	3	12.0
	2. Helpers don't come on time/ don't work properly	3	12.0
	3. Not enough space to have MDM	4	16.0
	4. Food containers are not kept inside the school premises so children have to carry the containers	2	8.0
	5. Shortage of water supply	3	12.0
	6. School is not cleaned properly after MDM	6	24.0
	7. Others	4	16.0
	8. No answer	7	28.0

Table 4.4.85: Perceptions of Teachers about MDMP Provided by TAPF

1.	Increase in attendance of school children due to MDM		
	1. Yes	192	98.46
	2. No	2	1.03
	3. No answer	1	0.51
2.	Increase in attendance of girls in school due to MDM		
	1. Yes	181	92.82
	2. No	6	3.08
	3. No answer	5	2.56
	4. Not applicable	3	1.54
3.	Increase in scholastic performance of school children		
	1. Yes	183	93.85
	2. No	6	3.08
	3. No answer	6	3.08
4.	Increase in girls enrolment in school		
	1. Yes	165	84.62
	2. No	19	9.74
	3. No answer	8	4.10
	4. Not applicable	3	1.54

Group-2: Functioning of the Akshay Patra Foundation

1. Services provided by the Akshay Patra Foundation in Vadodara district under MDM Programme
2. Changes experienced in the MDM Programme after Akshay Patra's involvement
3. How satisfying is the Akshay Patra Foundation's functioning
4. Opinion about the Akshay Patra Foundation

Group-3: Role of teachers in improving Mid Day Meal Programme

1. What can we do to bring awareness about Mid Day Meal Programme among children? How?
2. How to encourage children to consume Mid Day Meal?
3. How to create awareness regarding MDM among the parents of the students?
4. How can we guide the helpers to serve MDM according to the age of the child?
5. How can we involve parents to make the MDM programme more effective?
6. What can education department do? How?

Group-4: Problems faced in implementing the MDM Programme

1. Do you face any problems from the students and their parents in running the MDM?
2. Any other problems faced in implementation of the MDM programme?
3. What can we (teachers) do in order to solve these problems?
4. Do you face any difficulty in filling up the MDM attendance registers and the forms given by Akshay Patra?

Group-5: Attitude of the parents towards MDM and their expectations from the programme

1. Parents' reactions regarding the MDM programme
2. Are the parents aware about the MDM Programme?
3. Expectations of the parents from MDM programme

4. What should be the role of parents in the programme?

Highlights of the discussion presented by the representatives from each group are given below:

Group-1: Objectives of the Mid Day Meal Programme

- According to the group, the main objective of the MDM Programme was the overall development of the children.
- The health of the school children has improved after MDM provided by The Akshay Patra Foundation.
- Also the group felt that under the MDM programme, healthy and nutritious food is provided to poor children who do not get proper nutrition at home. Thus, illnesses arising due to nutritional deficiency are prevented.
- They believed that improvement in school attendance was observed due to the MDM provided by the Akshay Patra Foundation.
- The programme also led to improvement in girl child attendance.
- The attention span has also improved.
- The teachers were of the opinion that MDM has created awareness among both the students and their parents, and children of working parents have also started coming to the school regularly.

Group-2: Functioning of the Akshay Patra Foundation

Services given by Akshay Patra in urban Vadodara under the MDM programme:

- The teachers opined that the food provided by the Akshay Patra Foundation is cooked scientifically, is hygienic, fresh and nutritious.
- They also observed that the food is transported to all the schools in sterilized vessels in insulated vehicles so that the children get hot cooked nutritious meals every day.
- The group felt that the occasional provision of chocolates and biscuits in addition to the weekly menu was appreciable as it provided variety in the menu.

- The teachers appreciated the appointment of helpers by the Akshay Patra Foundation for serving the food in the schools.

Changes observed in the MDM Programme due to involvement of the Akshay Patra Foundation:

- The group observed that the involvement of TAPF in the MDM Programme led to an improvement in school attendance and school enrollment. It also led to increase in girl child enrollment and improvement in the health of the children.
- They also believed that now there was encouragement from the parents for consuming MDM.

How satisfying is the functioning of the Akshay Patra Foundation?

- The teachers felt very satisfied with the functioning of the Akshay Patra Foundation as they addressed the complaints quickly and suggestions given by the schools were implemented by them promptly.
- They appreciated the cooperation given by the functionaries of Akshay Patra.
- They also said that the quality of food has improved and now hot, nutritious and hygienic food is served to children which in turn have improved their health.

Suggestions given by the teachers for better functioning of the Akshay Patra Foundation:

- The quantity of the food should be increased.
- Appointment of the helpers should be according to the strength of the children in school as few schools needed more number of helpers to serve the children.
- Salary of the helpers should be given regularly.
- Recipes like laddu, idli, masala dosa should be included to add variety to the menu.

- Occasionally seasonal fruits should be given to the children.

Group-3: Role of teachers in improving Mid Day Meal Programme

- Teachers should eat every day with the students because, students imitate their teachers. Thus, they can be encouraged to consume MDM.
- Teachers should give information regarding the importance of various food items such as pulses, vegetables given by Akshay Patra and its benefits to the children.
- They should give information about the various nutrients derived from food.
- Teachers should regularly organize parents meetings and sensitize the parents about the quality of food and organization providing MDM to the school children.
- Parents should be given MDM food during the parents meetings to make them aware about it.
- Teachers should make sure that the Akshay Patra helpers serve proper amount to minimize plate waste as well as should encourage children not to waste food.
- Education department should also organize seminars for teachers and parents to make them aware about objectives of MDM Programme and various public private organizations helping in achieving the objectives of MDM.

Group-4: Problems faced in implementing the MDM Programme

- Awareness about MDM should be increased by involving media.
- MDM registers and monitoring forms should be made simpler, (data on only total registered number of children and number of children consuming MDM should be solicited).
- The meals should be served at 9:30am in the morning school. As during the recess time children have snacks from outside due to which either they skip the meals or eat less in the afternoon.

- Children are fond of food items like sukhadi and biscuits very much. They should be given such items every day or frequently.
- Few modifications in the present menu should be done to make the menu exciting to the children. Few suggestions are like according to the festivals, menu should be given like gajjar halwa, fafda and jalebi.
- Children cannot wash their dishes properly. Hence, some provision for dish washing should be made.
- Provision for safe drinking water also should be there.
- All the schools have not yet received the plates.

Group-5: Attitude of the parents towards MDM and their expectations from the programme

- The teachers responded that around 80% of the parents are aware about the MDM programme and their children are getting nutritious meals.
- The menu should keep on changing so that there is variation in the taste of the food which would make MDM more acceptable.
- Along with Sukhadi, sweet preparation like *ladoo* should also be given.
- Different types of flours (like bajari or makai flour) should be used in masala roti.
- Akshay Patra should organize parents meetings in each school.

Feedback from Akshay Patra

Akshay Patra has purchased a Laddoo making machine. The machinery is expected to come by May end. This machine will produce 5000 laddoos per hour.

- Idli machine will also be used from June in Akshay Patra. This machine has the capacity to produce 5000 idlis per hour.
- Akshay Patra has agreed to organize meeting of teachers and parents. Meeting would be organized in the Akshay Patra Hall.
- Awareness about Akshay Patra can be generated through advertisement in radio and television.

HIGHLIGHTS

- **Few teachers were aware about the objectives of MDM Programme.**
- **Sukhadi, Dal and Rice were the most liked food item by the children.**
- **The best cooking method is MDM provided by TAPF as quality of food and hygiene is maintained.**
- **Only 12% faced problems in implementing MDM programme and the issues were related to monthly forms and MDM registers, infrastructure facilities and water supply.**
- **Improvement in school attendance (98.46%), especially among girls (92.82%), improvement in scholastic performance (93.85%) and rise in the enrolment of girl child (84.62%) was seen because of the MDM provided by Akshay Patra.**
- **Teachers also suggested that awareness about MDM should be increased by involving media.**

Discussion

School feeding programmes have, in theory, the potential to contribute to at least three Millennium Development Goals: to reduce the proportion who suffer from hunger (Goal 1) and are underweight; to help achieve universal primary education (Goal 2); and to promote gender equality (Goal 3) through effects on school enrolment, attendance, retention, concentration and attainment (Hall et al., 2007). Realizing health and educational benefits of an effective school feeding programme important tools of poverty reduction and economic development. The MDM Scheme in India is the largest school meal programme in the world (Alim et al., 2012), covering an estimated 139 million children with bold objectives: to enhance enrolment, retention and attendance among primary school children while simultaneously improving their nutritional status.

As Teachers hold an important role in effective and smooth implication of MDM, in the present study capacity building of the Municipal Teachers of urban

Vadodara was carried out in order to strengthen their skills for quality of programme implementation.

The main objective of the MDM according to the teachers was overall development of the children i.e. improvement in the health and nutritional status of the school children (76.9%). 67.7% of the teachers also reported that the objective of the MDM programme is to improve the school attendance. More than 1/3rd of the teachers could report improvement in scholastic performance and reduction in class room hunger as the objective of MDM programme. **This indicates that all teachers are not aware about the objectives of MDM programme.**

A descriptive study were 50 school teachers' from 20 primary schools of Jagadhary block of district Yamunanagar were interviewed also showed similar results where only 34% of teachers responded that the government has introduced Mid day meal to save children from malnutrition, universalization of primary education and to stop wastage and stagnation as the objectives of the scheme (Bhargav & Bhargav, 2011).

According to the teachers, the performance of Akshay Patra was very good and the food provided was cooked scientifically. It was hygienic, fresh and nutritious and transported in sterilized vessels. Helpers were appointed for serving the food in the schools. Co-operation from the functionaries of Akshay Patra was appreciated and complaints and suggestions were addressed quickly.

According to the teachers (99.5%), children liked the MDM provided by Akshay Patra. Sukhadi (79.5%), dal (70.2%) and rice (63.8%) were the most liked items by the children. Plain Roti (12.8%) and Masala Roti (17.4%) were the least liked food items.

Similar findings were seen in a study conducted to assess the implementation of Akshara Doasha programme in Hubli. They reported that the most liked food item

was rice, sambar provided by an non-religious organisation and rice, sambar and curd provided by religious organisation as they ranked these food items to be first (Bellary, 2009). Similarly a study conducted in Delhi, (Samson, Noronha, & De, 2007) also reported that children loved dal chawal, chhole chawal and pooris in comparison to other menu, supplied in the MDM programme.

Teachers were asked about what quantity of meal should be given to the children as per the MDM programme. Only 16.4% could write about the caloric norms of MDM. However, 62.5% out of those teachers could mention correctly the energy requirements for Children through MDM (i.e. 450 Kcal for 1st to 4th standard and 700 Kcal- 5th to 7th standard). Only 31% of the teachers mentioned quantity of meal to be given according to ration. Of those who reported majority of them (83.6%) did not know the correct ration. Thus, the knowledge of teachers regarding the Mid Day Meal Programme was poor and shows the need for sensitizing them regarding the same. In a study conducted in Yamunanagar, 78% of teachers knew that the ration allotted is 100g per student (Bhargav & Bhargav, 2011).

Various studies have reported the need for separate administration for meal management (Jain and Shah, 2005) (Rana, 2005). Cooking at centralized kitchen could be the answer for this as in the present study, majority of the teachers were satisfied with the quantity (96.4%) and quality (88.7%) of the MDM provided by Akshay Patra. All the teachers said that provision of MDM cooked in the centralized kitchen of Akshay Patra was better than cooking MDM in school especially in urban areas where space is a constraint. The main reason stated for this was the quality of food (65.1%) and hygiene (61.0%) maintained in the Akshay Patra kitchen. Majority of the teachers were also satisfied with the quality of the food (98.5%) and cleanliness of the utensils used for bringing the food (88.7%). Almost 97.9% of the teachers said that they had tasted the food provided by Akshay Patra. 38.7% out of these teachers said that they tasted the food every day. Similar findings were noted by Bellary (2009) and Deodhar et al.,

(2010) who reported that central cooking was better compared to school kitchen. In a study conducted by Faculty of Social Work, it was found that the teachers were satisfied with the services provided through the MDM scheme and thus felt that the MDM provided by Akshay Patra Foundation should be continued (Nambiyar, Pande, & Solanki, 2010).

During the group discussion, Teachers' opined that quantity of the food should be increased, more helpers should be appointed for serving the meal, salary of the helpers should be regularized, and there should be variety in the recipes like laddu, idli, masala dosa, and seasonal fruits should be included in the menu.

Other studies across India are also in accordance with the present study were teachers have opined that MDM staff should be increased (Kanani & Elayath, 2008), seasonal fruits to be included in the menu (Deodhar, 2007)

In few schools of Mysore, they have fruit garden and all seasonal fruits are given as a supplement to the school meals (Srinivas, 2008). **Such healthy practices should be adopted in schools were school campus have large compound.**

Mid day meal can act as a regular source of "supplementary nutrition" for children and have facilitated their health growth. Significant number of teachers reported that the health of school children has improved after the introduction of TAPF in Mid Day Meal Programme. The results are supported with the findings of Aeri & Singh, (2014) who found that the programme had positive effect on health status of school children in Agra city, Uttar Pradesh.

Teachers also felt that there was improvement in school attendance (98.5%), especially of girls (92.8%) after the commencement of food being provided by TAPF. Further improvement in scholastic performance (93.9%) and girl child enrolment (84.6%) was seen because of the MDM provided by Akshay Patra. In a study conducted in Jaipur, teachers and parents also reported that more children are attending school after Akshaya Patra had started its operation. (AC

Nielsen ORG MARG Pvt Ltd, 2006). Similar responses were reported by Blue (2005) in Udaipur, Robinson (2007) in Madhya Pradesh, Kanani and Elayath (2008) in Vadodara.

Teachers play an important role in improving the MDM Programme. They felt that eating with the children will encourage them to consume MDM and not to waste the food. They suggested that teachers should give information about nutrients derived from food given by Akshay Patra and its benefits to the children. School should organize parents meetings and sensitize them about the quality of MDM and Akshay Patra organization. Education department should also organize seminars for teachers and parents to make them aware about MDM programme.

Best practices in the state of Karnataka, revealed that the teachers taste the meal before serving to the children, ensure that the children wash their plates and keep it clean and educate them about cleanliness and hygiene. Thus teacher's participation and contribution make it possible to serve MDM to children without interruption (Srinivas, 2008).

Problems faced in implementing the MDM Programme were very less (12.8%). The problems faced by them were mainly related with the infrastructure facilities available in the school. e.g.- proper cleaning of dining area after meals which was neglected and children not washing their dishes properly. Hence, some provision for dish washing and provision for safe drinking water should be made. For monitoring and evaluation, the teachers recommended that the MDM registers and monitoring forms should be made simpler, and for increasing awareness about MDM, media should be involved.

To summarize there is a need for capacity building of teachers to create awareness about the objective of the Mid Day Meal Programme as well as nutritional and educational value of Mid Day Meal Programme. As MDM served by centralized kitchen yield better outcomes in relation to acceptability and quality of meals, such models should be strengthened.

Phase V: KAP of Parents, Teachers and Children

A one day workshop on MDM was conducted for the Municipal School Teachers of urban Vadodara to create awareness regarding undernutrition in school children, importance of MDM, and to obtain their feedback regarding MDM provided by The Akshay Patra Foundation (TAPF).

The workshop was conducted in the month of March'2011, after that, in the new academic year, teachers, school children and their parents were interviewed using a semi structured questionnaire. The objective was to obtain their feedback regarding the changes observed after the workshop in the implementation of the MDM programme at the school level as well as variety in the menu provided by TAPF.

All teachers (n=125) from 16 schools, along with 20 children, equal distribution of boys and girls, with 10 children from 3^{th}-4^{th} standard and 10 children from 5^{th}-7^{th} standard from each school (n=301) and all the parents (n=71) who could be contacted at the school, were interviewed to assess their views and perceptions which are as follows.

Feedback from Teachers

A total of 125 teachers were interviewed from 16 schools. Overall, 92% of the teachers said that Mid day Meal given by TAPF had brought about a positive impact in children as shown in **(Figure 4.5.1)**.

According to (88%) of the teachers, an improvement in the attendance of the school children was noticed. However, 63% of the teachers also reported an improvement in the enrollment of school children due to MDM provided by the TAPF **(Figure 4.5.2)**.

Figure 4.5.1: Impact Seen in Children Due to Mid Day Meal given by Akshay Patra Kitchen

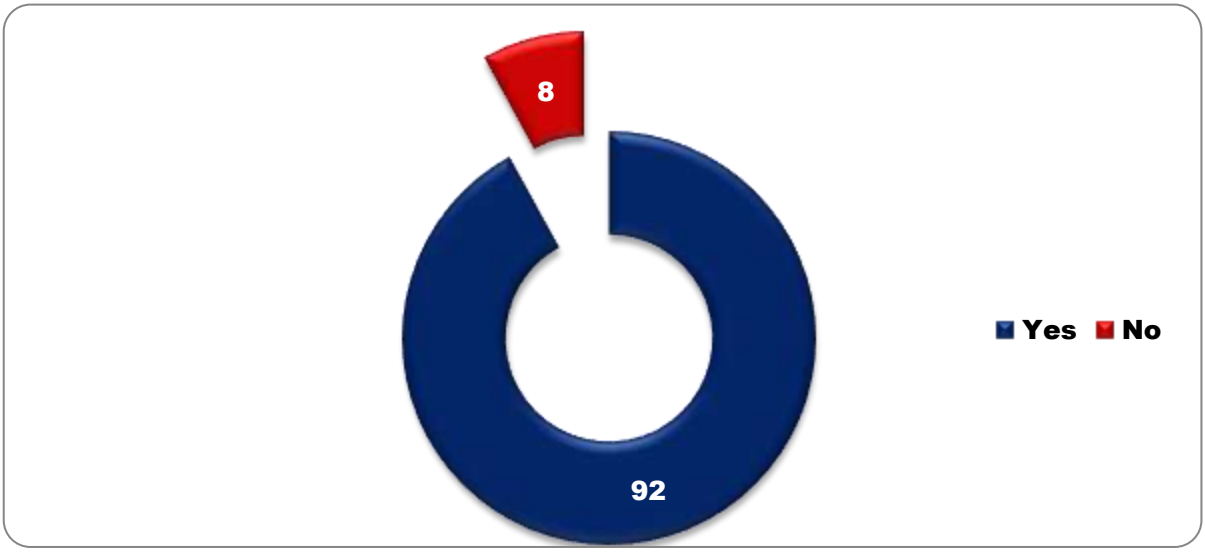
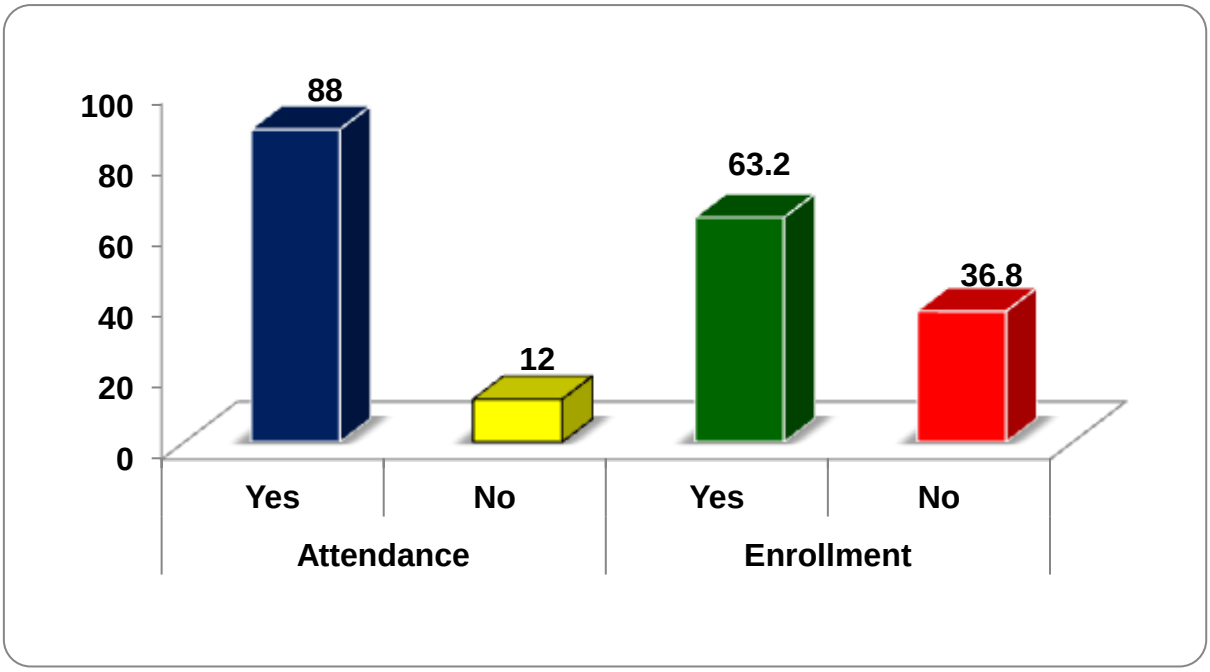


Figure 4.5.2: Impact of MDM provided through TAPF on Attendance and School Enrolment



These findings clearly indicate that Mid day Meal provided by TAPF is a step towards achieving Millennium Development Goals of Universal primary education to all children.

Around 78% teachers also observed positive changes in the interest of children towards education and acquiring knowledge after the introduction of Mid day Meal provided by the Akshay Patra Foundation as they are no longer hungry in the school hours **(Figure 4.5.3)**.

When the teachers were inquired regarding the changes seen in menu provided by the Akshay Patra Foundation after the workshop, 60% said that there was no change and the food provided was good and needed no improvement. While, 21% teachers felt that there was an improvement in the taste of food. Also, about 18% of the teachers felt that the quality of food had considerably improved. 9.6% of the teachers also reported change in the recipes (like Idli) or modification in the recipes (like consistency of rice, texture of sukhadi) was done **(Table 4.5.1). The findings suggest that the suggestions given by the teachers in the workshop were immediately accepted by TAPF and were implemented in the new academic year.**

Majority of the teachers opined that there was no change (45%) observed in the school after the workshop. Only a few changes such as arrangements for washing plates (15%), motivation by teachers (10%) to consume MDM and minimize the plate waste, and increase in number of helpers for serving Mid day Meal (2%) were observed **(Table 4.5.1).** 13% of the teachers also reported good attendance and no drop out, this could be due to motivation of teachers to consume MDM.

When asked about the improvements needed in the the Akshay Patra Kitchen, 26.4% of the teachers responded that no improvement was needed in the TAPF menu as the quality of food was good. However 43.2% of the teachers felt that

Figure 4.5.3: Children's Interest towards Education after MDM

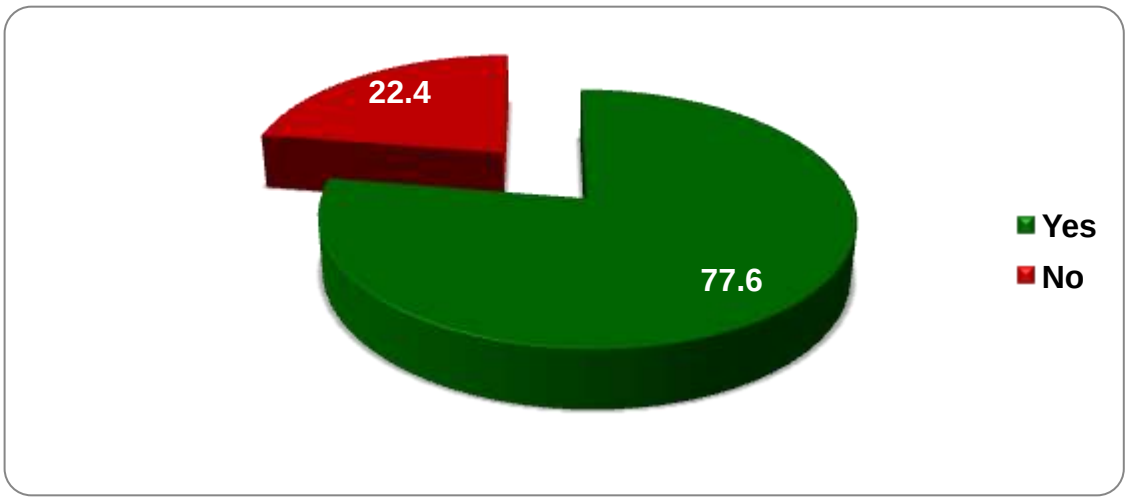
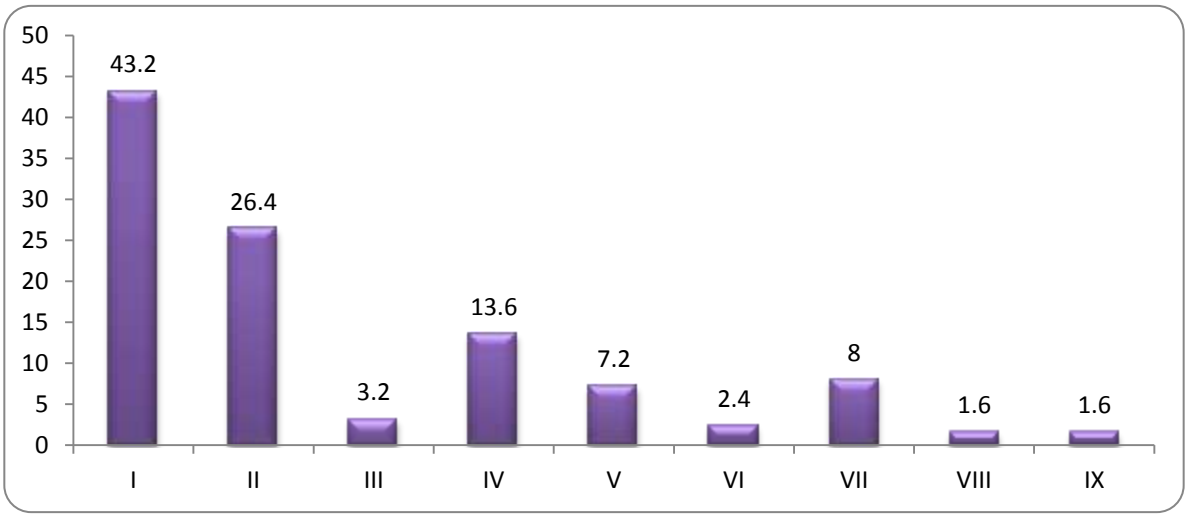


Figure 4.5.4: Teachers Feedback Regarding Improvement Needed in TAPF Kitchen



I	change in recipe/taste
II	No change
III	Seasonal vegetables can be added
IV	More variety to be added
V	Improvement in consistency of Food

VI	**Khichadi should be given frequently**
VII	**No response**
VIII	**Quantity of food should increase**
IX	**Arrangements for sitting & washing dishes & serving**

Table 4.5.1: After the workshop changes observed by the Teachers at the Akshay Patra Foundation and at the school level

Changes Seen After the Workshop			
Akshay Patra*	**%**	**Schools**	**%**
No change	60	No change	44.8
Improvement in taste	20.8	Motivation by teachers	9.6
Good quality food	18.4	Increase in helping hand	1.6
Modifications in recipes/newer recipes	9.6	Made arrangements for washing plates	15.2
No response	8.8	No response	15.2
More helpers for serving	0.8	Good attendance	12.8
		No drop out	0.8

***Multiple responses**

there should be change in the taste and recipes or more variety should be added (13.6%) like seasonal vegetables (3.2%) in the menu. Few teachers (1.6%) also suggested that arrangements for sitting and washing plates should be done by Akshay Patra helpers **(Figure 4.5.4)**.

Positive improvements were also reported by the teachers wherein 62.4% of them felt that their children had gained weight and height because of consuming Mid-Day Meal on a regular basis. About 36% of the teachers felt that there was improvement in overall health of the children and 16% felt that the children suffered less from common ailments **(Figure 4.5.5).** Only a small percent of teachers (1.6%) felt no change in the nutritional status of the school children. **Thus, majority of the teachers felt that there was improvement in the nutritional status of the school children with meals offered by TAPF.**

Feedback from Children with respect to Quality of food

A feedback was taken from children regarding the quality of meal provided by TAPF under MDM programme. Also their preference for the delivery of school meals was asked. As small children could not answer the questions, feedback was taken from children studying in 3^{rd} – 7^{th} standards. A total of 301 children were interviewed regarding the MDM delivered by TAPF.

According to majority of the children (84.7%), the quality of food provided by TAPF was much better than the earlier Mid Day Meal Menu and they looked forward to being served the mid-day meal provided by TAPF **(Figure 4.5.6)**.

Almost universal population mentioned that they were consuming MDM provided by TAPF. When asked about the frequency of the consumption/week, approximately 50% of the children said that they were consuming MDM for all the 6 days. Only about 13.8% of the children were consuming MDM for 2 days or

Figure 4.5.5: Teachers' Perception Regarding Improvement seen in Children's Health Due to MDM

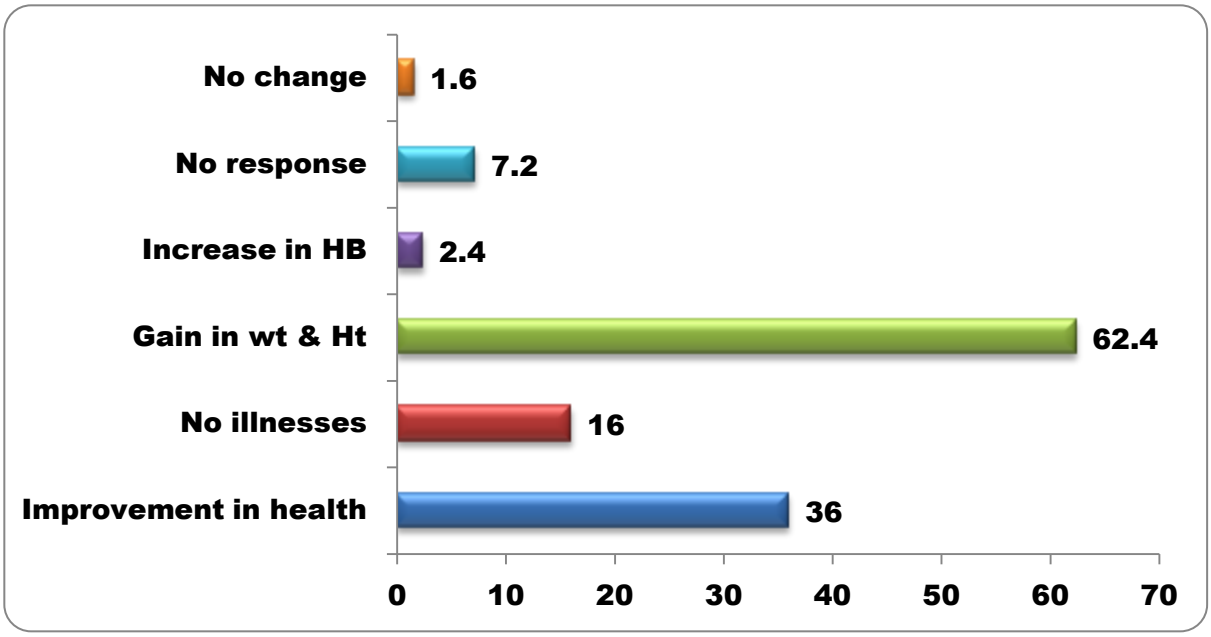
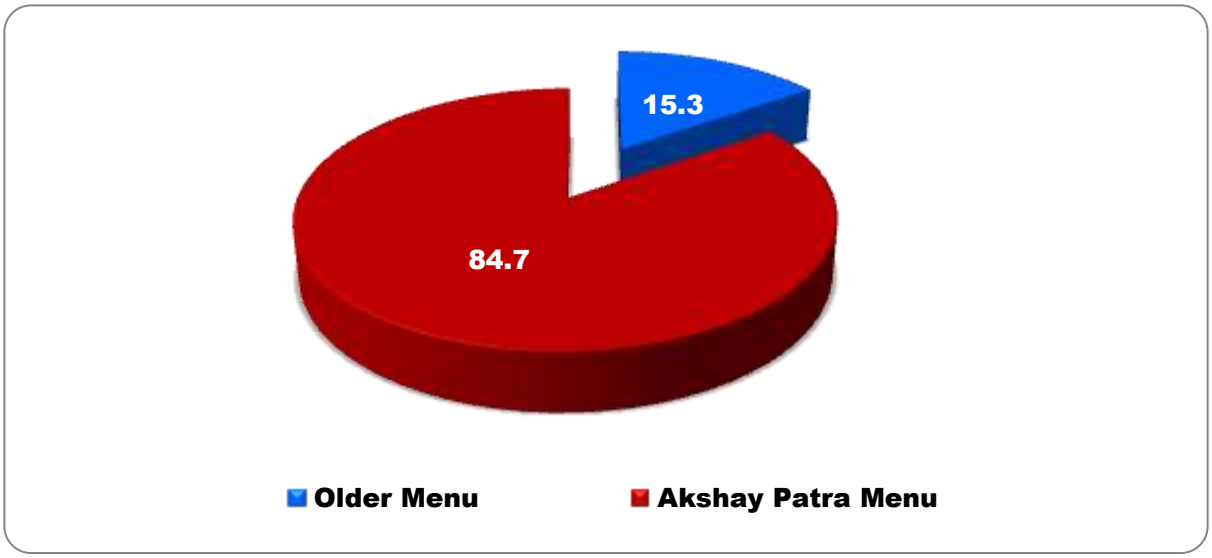


Figure 4.5.6: Children's liking towards Mid Day Meal Provided



less than 2 days. Almost everyone liked the Mid Day Meal given by the Akshay Patra Foundation. With respect to the preferences of the children, it was found that 53.1% of the children liked Dal and Rice the most, followed by 16.7% who liked Khichadi, and 12.8% preferred Sukhadi **(Table 4.5.2). The results were similar in other phase of the study also.**

Feedback from Parents

Parents who visited the schools during school hours either to drop their children to schools or to pickup after the school were interviewed to know their perceptions about MDM provided by TAPF. In all, 71 parents were interviewed.

Nearly 99% of the parents acknowledged that their children were consuming the Mid Day Meal provided by TAPF in the school and about 75% of the parents informed that their children ate the food all 6 days in a week. According to the parents, their children liked the Mid Day Meal and the most liked food item were same as told by the children who were interviewed i.e. Dal, Rice, followed by Khichadi and Sukhadi **(Table 4.5.3)**.

When inquired about the effect of MDM on health of their children, improvements in the health of the children were reported by the parents wherein 46.5% of the parents felt that their children had gained weight & height and around 20% of the parents were of the opinion that their child's health had improved after consuming Mid Day Meal provided by TAPF **(Figure 4.5.7)**. Only 27% of the parents felt no change in their child's health. **Thus, majority of the parents felt improved health of their children after MDM supplied by TAPF.**

According to majority of the parents Mid Day Meal provided by the Akshay Patra Foundation was good (69%) **(Figure 4.5.8)**. When inquired as to what their children discussed about MDM with them, parents said that their children

Table 4.5.2: Mid Day Meal Consumed by the Children

Do you Consume MDM given by the Akshay Patra Foundation	**%**
Yes	**96.3**
No	**3.7**
How many days in a week?	
1day	**4.5**
2days	**9.3**
3days	**16.2**
4days	**10.0**
5days	**13.1**
6days	**46.9**
Like the MDM given	
Yes	**99.3**
No	**0.7**
Most liked food item	
Dal, Rice	**53.1**
Khichdi	**16.7**
Sukhadi	**12.8**
Roti, Masala Roti	**12.5**
Dal Dhokali	**11.8**
Sabji	**4.5**
Pulao	**4.5**

Table 4.5.3: Parents' Awareness Regarding Mid Day Meal Consumed by the Children

Does your child consume MDM given in the school	**%**
Yes	**98.6**
No	**1.4**
How many days in a week?	
3days	**2.9**
4days	**15.7**
5days	**7.1**
6days	**74.3**
Like the MDM given	
Yes	**100.0**
No	**0.00**
Most liked food item	
Dal, Rice	**52.1**
Khichdi	**31.0**
Sukhadi	**23.9**
Dal Dhokali	**11.3**
Roti	**5.6**
Dudhi Chana Sabji	**1.4**

Figure 4.5.7: Parents' Perception about Improvement in their children's health after Mid Day Meal Programme

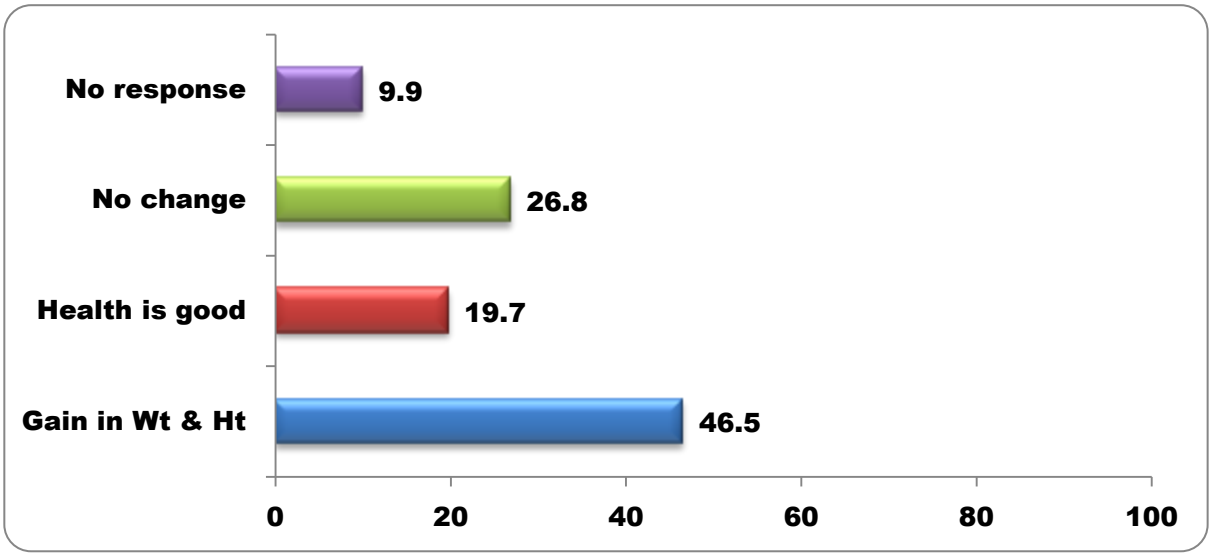
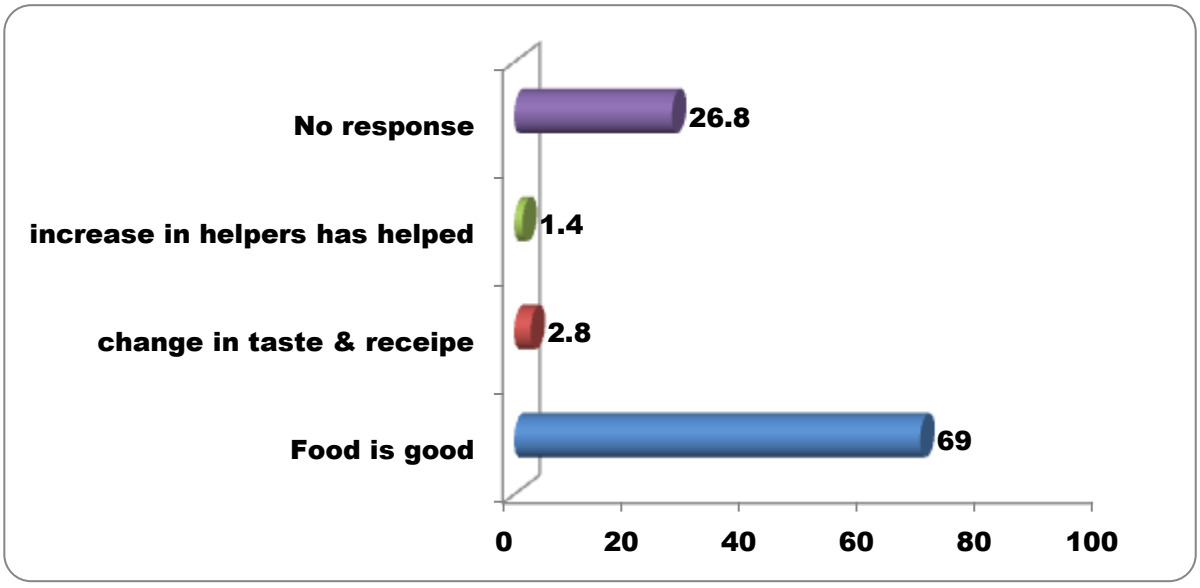


Figure 4.5.8: Parents' Opinion regarding the Akshay Patra Foundation



discussed that the Mid day Meal provided was good (38%) and they liked the food (19.7%) given in the school **(Table 4.5.4)**.

Parents suggested that there should be variety in the menu (34%) given by TAPF. Very few parents also suggested adding seasonal vegetables (2.8%), and giving sprouted pulses (1.4%) as part of the Mid Day Meal menu **(Table 4.5.5)**.

HIGHLIGHTS

- **Teachers felt a positive impact in the nutritional status of school children after the introduction of meals provided by TAPF.**
- **An improvement in school attendance and enrolment was also reported by teachers.**
- **Teachers suggested change in the taste or modifications in the recipes provided by TAPF so as to break the cadence of monotonous food.**
- **Children preferred meals provided by TAPF as compared to the meals cooked at schools as the quality of food provided by TAPF was good.**
- **50% of the children reported that they were consuming MDM on all the school days.**
- **The most preferred food item by the children was Dal, Rice and Sukhadi.**
- **All the parents acknowledged that their children were consuming MDM offered by TAPF.**
- **Majority of the parents felt improvement in the health of their children after TAPF intervention as the food provided**

Table 4.5.4: Children's Discussion about MDM with their Parents

Response	%
Menu	**8.5**
Food is good	**38.0**
Likes the food	**19.7**
Change in taste	**1.4**
No response	**32.4**

Table 4.5.5: Parents' Suggestions regarding improvement in MDM Menu

Suggestions	%
Quantity of food should increase	**2.8**
No change	**19.7**
Consistency of food items should improve (Roti, Rice, Dal Dhokali)	**7.0**
Change in taste	**11.3**
Provide variety	**33.8**
Include sprouted pulses	**1.4**
Add seasonal veg	**2.8**
No response	**21.1**

Discussion:

As schools are increasingly recognized as key site for promoting health eating habits among children, meals provide in school can act as an important vehicle to impart knowledge regarding nutrition and healthy eating practices. Active involvement of teachers, parents and children play a crucial role in the success of MDM Programme. Thus, a need was felt to obtain their feedback regarding MDM provided by centralized kitchen i.e. TAPF.

The present study reports improvement in the attendance and enrolment among school children as per the observations made by the teachers. Thus, the study shows that MDM provided by TAPF helps in full filling the objectives of MDM programme and substantial progress towards Millennium Development Goals especially Goal 2 i.e. Universal primary education to all.

Various studies done by Chauhan (2011) in Gwalior, Madhya Pradesh, Bellary (2009) in Dharwad, Karnataka, Josephine & Raju (2008) in Andhra Pradesh and a report by A.C. Neilson ORG MARG (2006) in Jaipur, Rajasthan have also stated teachers reporting increased enrolment and attendance among school children after the introduction of MDM by a NGO.

Around 78% of the teachers felt positive attitude of children towards education after the introduction of TAPF for MDM programme. The possible reasons could be reduction in class room hunger because of nutritious meals thereby increasing the attention span of children during school hours.

Numerous studies carried out in past by Dreze and Goyal (2003), Jain and Shah (2005), Sen (2005), and Mathur (2005), have complemented Mid Day Meal as a means for reducing class room hunger irrespective of meals cooked at school or provided by a NGO.

Our study suggests that the implementation of the MDM programme by a NGO helps in meeting nutrition and food safety. The weekly menu provided by TAPF shows a variety of meals offered, however, the condiments and seasonings being very similar each day, the sensory variety may be missing. This could be the reason for a change in menu or for variety in menu as reported by teachers (57%) and parents (45%).

Majority of the teachers felt that there was improvement in health of the children after introduction of school meals provided by TAPF and also suggested for continuation of the programme. This also suggests that TAPF is successful in achieving the objective of Mid Day Meal to improve the nutritional status of school children.

With respect to the feedback obtained from children, majority of them (85%) preferred meals provided by TAPF as compared to meals cooked at school as universal population interviewed like meals given by TAPF. The most liked food item was Dal & Rice, followed by Khichadi and a sweet preparation called Sukhadi.

Similar findings were reported by A.C. Neilson ORG Marg (2006) in Jaipur where all children (99%) reported that they were consuming MDM provided by TAPF. 94% of the children also reported that they liked TAPF Mid Day Meal. Another study carried out by Nambiyar et al (2010) in Vadodara reported 80% of the children preferred MDM given by TAPF.

All the parents were aware about the Akshay Patra Kitchen providing school meals. According to all the parents, meals given by TAPF were liked by their children. The most liked food items reported by the parents were same as reported by the children i.e. Dal & Rice, Khichadi and Sukhadi.

66% of the parents perceived that the health of their children had improved after taking meals at school which is being provided by TAPF. Out of these, 46.5% of the parents could mention that health is improved in terms of increased weight and height.

A study conducted to collect opinion from beneficiary mothers towards the functioning of mid day Meal programme with the help of central kitchen food supply in Dharwad district of Karnataka revealed that majority of the mothers reported that, after introduction of school meals, there was an improvement in the health (84.45%) and alertness (81.11%) of the children. Even 88.89% of mothers reported that physical growth of child was also improved. Similarly Naik (2005) reported that 72% of parents in Karnataka felt that their child had gained weight because of mid-day meal programme and 59% of the parents felt that their children suffered less from common ailments like cold and cough (Bellary, Karkannavar, & Ashalatha, 2013).

About 70% of the parents reported that the meal provided by TAPF was good and they were satisfied. In confirmation with present results, 85% of parents in Rajasthan as reported by Mathur (2005), 80% of the parents in Madhya Pradesh, 60% of the parents in Karnataka as reported by Afridi (2005), 90% of the parents in Karnataka as reported by Naik (2005) 96% of the parents in Madhya Pradesh as reported by Jain and Shah (2005), 53% of the parents in Delhi (Noronha and Samson, 2005) and 51% of the parents in Gwalior as reported by Chauhan (2011) were satisfied with the quality of meal under MDM programme and preferred for continuation.

Irrespective of the school meals cooked in school premises or provided by a centralized kitchen like TAPF, majority of the teachers, parents and children were satisfied with the implementation of the MDM Programme. **Thus, the overall results points towards the satisfactory response of MDMP by TAPF.**