Chapter 4 Results

Results of the study are presented in this chapter in 2 phases in line with their objectives. The phases are as follows:

Phase I: Evaluation of Mid Day Meal Programme in Rural Vadodara

- **Phase I A- Evaluation of MDM at school level**
  - School profile
  - Socio Economic profile of the subjects
  - Nutritional Status of the study subjects
  - Practices and perceptions regarding regarding MDM as well as sanitation and hygiene practices
  - Dietary and Nutrient Intakes of the subjects
  - Spot observations at school
- **Phase I B- Evaluation of MDM at centralised kitchen**
  - Process Observation
  - Spot Observations at the centralized kitchen
- **Phase I C- Nutrient Composition and quality attributes of MDM**
  - Nutrient content of the food items prepared at the centralized kitchen
  - Microbial profile of food prepared at the centralized kitchen at the time of cooking and at the time of serving

Phase II: Impact of Nutrition Health Education on the Nutritional Status of Moderate and Severely Undernourished Upper Primary School Children of Rural Vadodara

- **Phase 2 A- Screening of students for thinness**
  - Anthropometric Assessment of Children
- **Phase 2 B- Impact evaluation of Nutrition Health Education**

  on,
  - Growth
  - Hb levels

- Practices and perceptions regarding MDM, sanitation and hygiene practices
- MDM compliance
- Morbidity profile
- Cognitive development
- Physical work capacity
- Dietary intake

PHASE I: EVALUATION OF MID DAY MEAL PROGRAMME IN RURAL VADODARA

The villages of petrochemicals area of Vadodara having 47 Government Primary schools were selected in the study. As mentioned in the earlier chapter, there were 30 schools that were co-ed and had classes upto 8th standard. This area was divided on the map into three geographical areas in such a way that each area had 10 co-ed Government primary schools with primary and upper primary sections. Two out of 10 schools from each area was randomly selected for inclusion in this phase of the study. Thus, six co-ed Government primary schools from the villages in the vicinity of petrochemicals industries were selected in the study.

Infrastructure Facilities at the Schools:

All the selected schools had classes upto 8th Standard. As shown in Table 4.1, 83.3% of the schools had 8 or more classrooms. Only 3 of the 6 schools had a playground in the school premises. The other three schools did have smaller open space were children could play. Drinking water facility was present in 5 (83.3%) schools. All these schools had water purifiers for drinking water. Separate hand-washing stations were also available in these five schools. Water stations were vandalised in one of the selected schools hence drinking water facility and separate hand-washing stations were not available at the time of study. All the schools had separate toilets for girls and boys. Only two of the schools had separate space for MDM serving. These were open areas with tiled floor and shade. Half of the six selected schools were serving MDM in open place, two in corridors and one in playground.

Table 4.1 Infrastructure Facilitates at the Schools Selected in the Study (N=6)

Variable	N	%
Number of classrooms		
• <8	1	16.7
• >8	5	83.3
Separate Computer Room		
Playground	3	50
Drinking water facility	5	83.3
Water Purifier for Drinking Water	5	83.3
Separate Hand-washing Station	5	83.3
Separate Washrooms for Girls and Boys	6	100
Separate space for dining	2	33.3
MDM Serving Area:		
• Open Space	3	50
• Play Ground	1	16.7
• Corridor	2	33.3

Children enrolled for the study

This study was focused on school going adolescents of Government primary schools. Hence, 5th to 8th standard from 6 schools from rural Vadodara were included in the study. A total of 984 children were included for the anthropometric assessment, out of which 513 were boys and 471 were girls. Number of children enrolled from each school is given in Table 4.2.

Age of the children enrolled in the study ranged from 8 to 16 years. Majority of the children were of 10 to 13 years age (early-adolescence), with almost 50% in the age group of 11-13 years. A small proportion of children (15.1%) were also in school age/ pre-adolescence group, i.e. 8 to 10 years (Figure 4.1). Number of boys and girls in all the age groups were almost the same except for 14-15 years (70.6% boys, 29.4% girls) and 13-14 years age group (56.5% boys, 43.5% girls) (Table 4.3).

Anthropometric Measurements

Mean weight of the children was 27.1±7 Kg. It was 26.8±6.8 Kg for boys and 27.5±7.3 Kg for girls. Mean gender wise weight of children across age groups and across stages of adolescence are given in Table 4.4 and Table 4.5 respectively. Mean weight of the children in both the genders was seen to be increasing with increase in age. No difference was observed in the mean weight of boys and girls in age groups upto 11 years. In the age groups above 11 years, mean weight of the girls was reported to be higher compared to boys. The difference (34.2±5.6 Kg for girls vs 31.9±4.2 Kg for boys) was statistically significant ($p<0.01$) in 13-14 years age group as shown in Table 4.4. Mean weight across the stages of adolescence showed that there was no significant difference in weight of boys and girls in pre-adolescence and mid-adolescence, however girls had significantly higher mean weight (28.5±7 Kg) in early-adolescence phase compared to boys (27.4±6.8 Kg) (Table 4.5).

Gender wise mean height of the children across age groups and stages of adolescence is given in Table 4.6 and Table 4.7. Mean height of the enrolled children was 135.7±9.1 cm. It was seen to be higher in girls (136±9.6 cm) as compared to boys (135.4±8.7 cm). Age wise data revealed that mean height was higher among boys in 8 to 11 years age group than girls. However, mean

Table 4.2 Number of Subjects in Selected Schools (anthropometry)

School Name	Male		Female		Total
	n	%	n	%	
Angadh Prathmik Shala 1	120	56.6	92	43.4	212
Dodaka Prathmik Shala	105	52.5	95	47.5	200
Fajalpur Prathamik Shala No. 1	33	46.5	38	53.5	71
Indira Nagar Prathmik Shala, Koyali Charo	66	56.9	50	43.1	116
Navapura Prathmik Shala, Angadh	103	47.2	115	52.8	218
Undera Prathmik Shala	86	51.5	81	48.5	167

Figure 4.1 Age and gender wise distribution of children

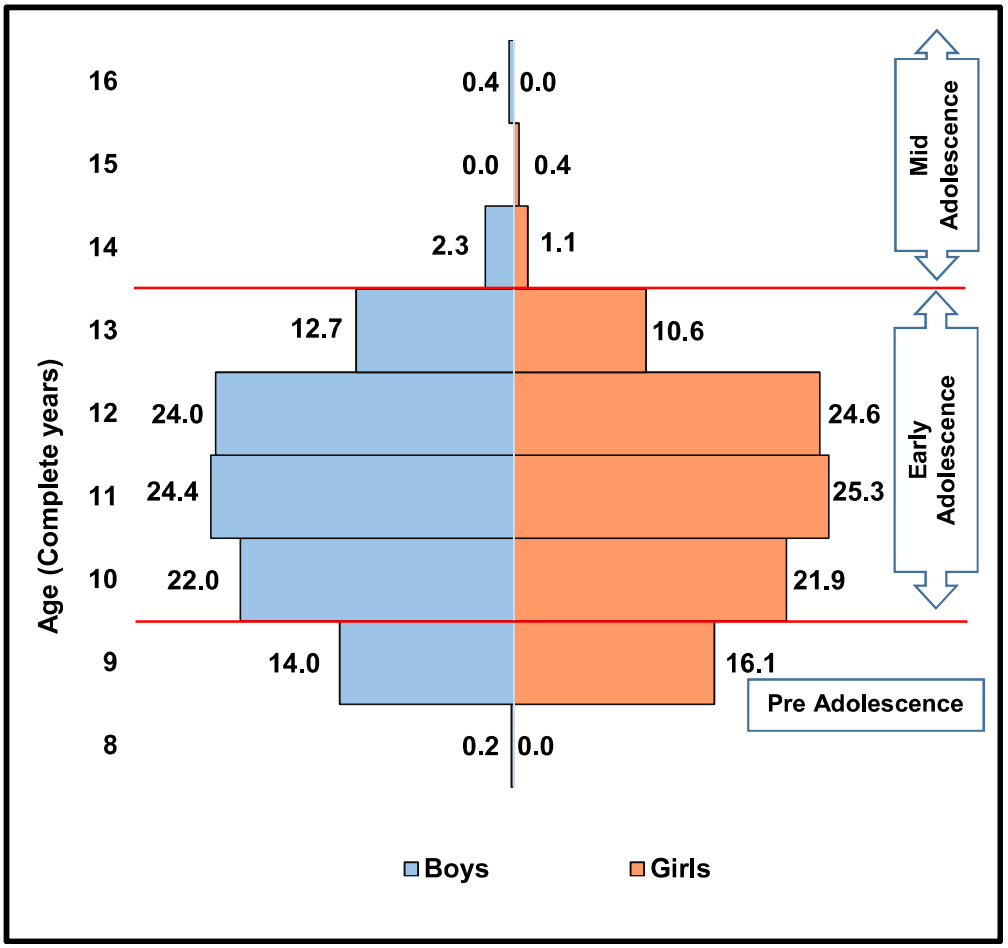


Table 4.3 Distribution of Children Cross-Tabulated by Age & Gender

Age (Years)	Male		Female		Total
	n	%	n	%	
8-9	1	100.0	0	0.0	1
9-10	72	48.6	76	51.4	148
10-11	113	52.3	103	47.7	216
11-12	125	51.2	119	48.8	244
12-13	123	51.5	116	48.5	239
13-14	65	56.5	50	43.5	115
14-15	12	70.6	5	29.4	17
15-16	0	0.0	2	100.0	2
16-17	2	100.0	0	0.0	2
Total	513	52.1	471	47.9	984

Table 4.4 Mean Weight (Kg) of the Children Cross Tabulated by Age & Gender

Age (Years)	N	Male		Female		Total		't' value	'p' value
		Mean	SD	Mean	SD	Mean	SD		
8-9	1	33.5	-	-	-	33.5	-	-	-
9-10	148	21.8	3.2	21.7	5.8	21.7	4.7	0.148	0.883
10-11	216	24.5	5.1	24.7	6.4	24.6	5.7	-0.357	0.721
11-12	244	26.7	7.3	27.6	7.0	27.2	7.2	-0.983	0.327
12-13	239	29.1	6.9	30.4	5.9	29.7	6.4	-1.503	0.134
13-14	115	30.7	6.0	34.2	5.6	32.2	6.0	-3.137	0.002
14-15	17	31.9	4.2	34.3	6.7	32.6	5.0	-0.895	0.385
15-16	2	-	-	32.0	1.4	32.0	1.4	-	-
16-17	2	43.0	5.7	-	-	43.0	5.7	-	-
Total	984	26.8	6.8	27.5	7.3	27.1	7.0	-1.516	0.130
ANOVA		19.346		29.173		37.444			
'p' value		0.000		0.000		0.000			

Table 4.5 Genderwise Mean Weight (Kg) of the Children across the Stages of Adolescence

Stages of Adolescence	N	Male		Female		Total		't' value	'p' value
		Mean	SD	Mean	SD	Mean	SD		
Pre Adolescence	149	21.9	3.5	21.7	5.8	21.8	4.8	0.351	0.726
Early Adolescence	814	27.4	6.8	28.5	7.0	28.0	6.9	-2.261	0.024
Mid Adolescence	21	33.5	5.8	33.6	5.6	33.5	5.6	-0.054	0.958
Total	984	26.8	6.8	27.5	7.3	27.1	7.0	-1.516	0.130
ANOVA		30.609		35.329		64.666			
'p' value		0.000		0.000		0.000			

Table 4.6 Mean Height (cm) of the Children Cross Tabulated by Age & Gender

Age (Years)	N	Male		Female		Total		't' value	'p' value
		Mean	SD	Mean	SD	Mean	SD		
8-9	1	150.0	-	-	-	150.0	-	-	-
9-10	148	126.4	5.4	124.8	6.5	125.6	6.0	1.591	0.114
10-11	216	131.6	6.6	130.9	6.8	131.3	6.7	0.789	0.431
11-12	244	134.6	6.5	136.7	7.5	135.6	7.1	-2.337	0.020
12-13	239	139.1	7.4	142.4	6.3	140.7	7.1	-3.671	0.000
13-14	115	143.6	7.8	145.4	5.5	144.4	6.9	-1.360	0.176
14-15	17	146.6	5.4	147.9	9.6	147.0	6.6	-0.363	0.721
15-16	2	-	-	144.4	6.2	144.4	6.2	-	-
16-17	2	152.5	3.5	-	-	152.5	3.5	-	-
Total	984	135.4	8.7	136.0	9.6	135.7	9.1	-1.016	0.310
ANOVA		49.694		81.664		99.845			
'p' value		0.000		0.000		0.000			

Table 4.7 Genderwise Mean Height (cm) of the Children across the Stages of Adolescence

Stages of Adolescence	N	Male		Female		Total		't' value	'p' value
		Mean	SD	Mean	SD	Mean	SD		
Pre Adolescence	149	126.7	6.0	124.8	6.5	125.8	6.3	1.839	0.068
Early Adolescence	814	136.5	8.1	138.0	8.5	137.2	8.3	-2.563	0.011
Mid Adolescence	21	147.5	5.5	146.9	8.4	147.3	6.4	0.184	0.856
Total	984	135.4	8.7	136.0	9.6	135.7	9.1	-1.016	0.310
ANOVA		65.979		88.008		150.522			
'p' value		0.000		0.000		0.000			

height of girls was higher than their male counterparts in age groups above 11 years. The difference was statistically significant in 11-12 years ($p<0.05$) and 12-13 years ($p<0.001$) age groups. Data on mean height across the stages of adolescence showed that average height of boys was higher than girls during pre-adolescence, but girls had higher mean height in early-adolescence and mid-adolescence as compared to boys. The difference was statistically significant ($p<0.05$) in early-adolescence.

Gender wise body mass index (BMI) of children across age groups is tabulated in Table 4.8. Mean BMI of children was 14.6±2.4 Kg/m^2. Girls had a higher BMI (14.7±2.5 Kg/m^2) than boys (14.5±2.4 Kg/m^2). Age-wise data showed that BMI increased with age in both the genders with increase in weight and height. No gender wise difference in BMI of children was observed except for 13-14 years and 14-15 years age groups; where girls had higher BMI than boys. Girls showed a significantly ($p<0.01$) higher BMI (16.1±2.2 Kg/m^2) than boys (14.8±2.0 Kg/m^2) in 13-14 years age group. With respect to stages of adolescence, no significant difference was observed between BMI of both the genders (Table 4.9).

Prevalence of Malnutrition among Children

Anthropometric measurements of the children, i.e. weight and height, along with age were used to assess their nutritional status using Weight for age (WAZ), Height for age (HAZ) and BMI for age (BAZ) indices. Nutritional status assessment was done using WHO Anthro Plus software which uses WHO 2007 Growth Standards for 5-19 years of age as reference standards.

Weight for age is used as an indicator of nutritional status for children below 10 years of age. A total of 365 children of 8-10 year of age were enrolled in the study. Mean WAZ of children was -2.3±1.1. Boys had a higher mean WAZ than girls (Table 4.10).

Low weight for age is termed as underweight. WAZ <-2SD is considered as underweight and WAZ <-3SD is considered as severe underweight, as per the WHO standards. Prevalence of underweight is given in Table 4.12. The data revealed that overall prevalence of underweight was 66.1% with 31.1% severe underweight. Girls had a higher prevalence of underweight (WAZ<-2

Table 4.8 Mean BMI (Kg/m2) of the Children Cross Tabulated by Age & Gender

Age (Years)	N	Male		Female		Total		't' value	'p' value
		Mean	SD	Mean	SD	Mean	SD		
8-9	1	14.9	-	-	-	14.9	-	-	-
9-10	148	13.6	1.5	13.7	2.1	13.7	1.8	-0.472	0.637
10-11	216	14.0	1.9	14.3	2.6	14.2	2.3	-0.924	0.356
11-12	244	14.6	3.0	14.6	2.7	14.6	2.9	-0.095	0.925
12-13	239	14.9	2.5	14.9	2.1	14.9	2.4	0.022	0.982
13-14	115	14.8	2.0	16.1	2.2	15.4	2.2	-3.340	0.001
14-15	17	14.8	1.6	15.6	2.5	15.1	1.9	-0.769	0.454
15-16	2	-	-	15.4	0.6	15.4	0.6	-	-
16-17	2	18.4	1.6	-	-	18.4	1.6	-	-
Total	984	14.5	2.4	14.7	2.5	14.6	2.4	-1.308	0.191
ANOVA		3.744		6.651		6.498			
'p' value		0.001		0.000		0.000			

Table 4.9 Genderwise Mean BMI (Kg/m2) of the Children across the Stages of Adolescence

Stages of Adolescence	N	Male		Female		Total		't' value	'p' value
		Mean	SD	Mean	SD	Mean	SD		
Pre Adolescence	149	13.6	1.5	13.7	2.1	13.7	1.8	-0.415	0.679
Early Adolescence	814	14.6	2.5	14.8	2.5	14.7	2.5	-1.437	0.151
Mid Adolescence	21	15.4	2.0	15.5	2.0	15.4	2.0	-0.200	0.843
Total	984	14.5	2.4	14.7	2.5	14.6	2.4	-1.308	0.191
ANOVA		6.118		6.709		12.564			
'p' value		0.002		0.001		0.000			

Table 4.10 Genderwise Mean Anthropometric Indices

Age (complete years)	N	Male		Female		Total		't' value	'p' value
		Mean	SD	Mean	SD	Mean	SD		
WAZ	365	-2.2	1.1	-2.4	1.2	-2.3	1.1	1.190	0.236
HAZ	984	-1.6	1.0	-1.7	1.0	-1.7	1.0	1.092	0.275
BAZ	984	-2.2	1.5	-1.9	1.4	-2.0	1.4	-3.123	0.002

Table 4.11 Mean WAZ of the Children Cross Tabulated by Age & Gender

Age (complete years)	N	Male		Female		Total		't' value	'p' value
		Mean	SD	Mean	SD	Mean	SD		
8	1	1.3	-	-	-	1.3	-	-	-
9	148	-2.3	1.0	-2.4	1.3	-2.3	1.1	0.340	0.734
10	216	-1.9	1.0	-2.5	0.8	-2.2	1.0	1.873	0.071
Total	365	-2.2	1.1	-2.4	1.2	-2.3	1.1	1.190	0.236

Table 4.12 Genderwise Prevalence of Underweight among Children (<10 years of age) (n, %)

	Total (n=180)		Male (n=88)		Female (n=92)		Chi-square	p
	n	%	n	%	n	%		
Normal	61	33.9	34	38.6	27	29.3	3.450	0.327
Underweight	63	35	31	35.2	32	34.8		
Severe underweight	56	31.1	23	26.2	33	35.9		

SD) and severe underweight (WAZ<-3SD) as compared to boys. This difference was not statistically significant.

Height for age is an indicator that reflects long term nutritional status of children. Mean HAZ of children was -1.7±1.1. It was higher for boys (-1.6±1.0) in comparison to girls (-1.7±0.8) (Table 4.10). Age wise data revealed that boys had a higher mean HAZ than girls up to 12 years. Girls showed a higher mean HAZ in age groups above 12 years. However, the difference in mean gender wise HAZ was statistically significant only in age groups of 9-10 years (-1.5±0.9 in boys vs -1.8±1.0 in girls, p<0.0.5) and 10-11 years (-1.3±1.0 in boys vs -1.7±1.0 in girls, p<0.05) (Table 4.13). Further, it was noticed that mean HAZ decreased with increasing age in adolescents i.e.- age groups above 10 years. Similar trend of decrease in HAZ was observed across the stages of adolescence (Table 4.14).

Genderwise prevalence of stunting presented in Table 4.15, revealed that 38.4% of the children were stunted with 7.4% children being severely stunted. Severe stunting was higher among girls (8.1%) than boys (6.8%). According to the age wise data, prevalence of stunting among children increased with increase in age (Table 4.16).

BMI for age (BAZ) is used as an indicator of short term nutritional status in 5-19 years old children. Mean BAZ was higher among girls (-1.9±1.4) than boys (-2.2±1.5). This difference was also reflected in the age wise data but the difference was not statistically significant except for 13 years age group (p<0.001). There was no age wise difference in mean BAZ upto 11 years, but it started decreasing with age from 11 years age groups (Table 4.18). Mean BAZ of the children across the stages of adolescence also showed similar gender wise difference (Table 4.19). Prevalence of stunting was comparable in pre and early adolescence. (Table 4.17)

More than half (55.7%) of the children were found to be thin (BAZ<-2SD) out of which 25.9 were severely thin. Prevalence of thinness was higher among boys as compared to girls. With respect to over nutrition, 3.2% and 1% children were found to be overweight and obese, respectively (Table 4.20). Data across the age groups (Table 4.21) showed that prevalence of severe

Table 4.13 Mean HAZ of the Children Cross-Tabulated by Age & Gender

Age (complete years)	N	Male		Female		Total		't' value	'p' value
		Mean	SD	Mean	SD	Mean	SD		
8	1	3.2	-	-	-	3.2	-	-	-
9	148	-1.5	0.9	-1.8	1.0	-1.6	1.0	2.054	0.042
10	216	-1.3	1.0	-1.7	1.0	-1.5	1.0	2.375	0.018
11	244	-1.6	0.9	-1.7	1.1	-1.6	1.0	0.720	0.472
12	239	-1.8	1.0	-1.7	0.9	-1.8	0.9	-1.399	0.163
13	115	-2.0	1.0	-1.8	0.8	-1.9	0.9	-1.057	0.293
14	17	-2.4	0.7	-1.8	1.3	-2.2	0.9	-1.087	0.294
15	2	-	-	-2.6	0.8	-2.6	0.8	-	-
16	2	-2.8	0.3	-	-	-2.8	0.3	-	-
Total	984	-1.6	1.0	-1.7	1.0	-1.7	1.0	1.092	0.275

Table 4.14 Genderwise Mean HAZ of the Children across the Stages of Adolescence

Stages of Adolescence	N	Male		Female		Total		't' value	'p' value
		Mean	SD	Mean	SD	Mean	SD		
Pre Adolescence	149	-1.4	1.0	-1.8	1.0	-1.6	1.0	2.301	0.023
Early Adolescence	814	-1.7	1.0	-1.7	0.9	-1.7	1.0	0.474	0.636
Mid Adolescence	21	-2.4	0.7	-2.1	1.2	-2.3	0.9	-0.935	0.362
Total	984	-1.6	1.0	-1.7	1.0	-1.7	1.0	1.092	0.275

Table 4.15 Genderwise Prevalence of Stunting among Children (n, %)

	Male (n=513)		Female (n=471)		Total (n=984)		Chi-square	p
	n	%	n	%	n	%		
Normal	318	62.0	288	61.1	606	61.6	0.554	0.758
Stunting	160	31.2	145	30.8	73	7.4		
Severe stunting	35	6.8	38	8.1	305	31.0		

Table 4.16 Prevalence of Stunting among Children across Age Groups (n, %)

Age (complete years)	N	Severe Stunting		Stunting		Normal		Chi-square	p
		n	%	n	%	n	%		
8	1	0	0.0	0	0.0	1	100	31.533	0.011
9	148	9	6.1	45	30.4	94	63.5		
10	216	10	4.6	58	26.9	148	68.5		
11	244	19	7.8	71	29.1	154	63.1		
12	239	22	9.2	74	31.0	143	59.8		
13	115	8	7.0	47	40.9	60	52.2		
14	17	3	17.6	8	47.1	6	35.3		
15	2	1	50.0	1	50.0	0	0.0		
16	2	1	50.0	1	50.0	0	0.0		
Total	984	73	7.4	305	31.0	606	61.6		

Table 4.17 Prevalence of Stunting among Children across the Stages of Adolescence (n, %)

Age (complete years)	N	Severe Stunting		Stunting		Normal		Chi-square	p
		n	%	n	%	n	%		
Pre Adolescence	149	9	6.0	45	30.2	95	63.8	13.800	0.008
Early Adolescence	814	59	7.2	250	30.7	505	62.0		
Mid Adolescence	21	5	23.8	10	47.6	6	28.6		
Total	984	73	7.4	305	31.0	606	61.6		

Table 4.18 Mean BAZ of the Children Cross Tabulated by Age & Gender

Age (complete years)	N	Male		Female		Total		't' value	'p' value
		Mean	SD	Mean	SD	Mean	SD		
8	1	-0.7	-	-	-	-0.7	-	-	-
9	148	-2.2	1.2	-1.9	1.2	-2.0	1.2	-1.512	0.133
10	216	-2.1	1.3	-1.8	1.4	-2.0	1.4	-1.596	0.112
11	244	-2.1	1.6	-1.9	1.6	-2.0	1.6	-0.751	0.453
12	239	-2.1	1.7	-2.0	1.2	-2.1	1.5	-0.627	0.531
13	115	-2.4	1.3	-1.6	1.2	-2.1	1.3	-3.601	0.000
14	17	-2.7	1.2	-2.2	1.4	-2.5	1.2	-0.773	0.452
15	2	-	-	-2.4	0.5	-2.4	0.5	-	-
16	2	-1.1	0.7	-	-	-1.1	0.7	-	-
Total	984	-2.2	1.5	-1.9	1.4	-2.0	1.4	-3.123	0.002

Table 4.19 Genderwise Mean BAZ of the Children across the Stages of Adolescence

Stages of Adolescence	N	Male		Female		Total		't' value	'p' value
		Mean	SD	Mean	SD	Mean	SD		
Pre Adolescence	149	-2.2	1.2	-1.9	1.2	-2.0	1.2	-1.417	0.159
Early Adolescence	814	-2.2	1.5	-1.9	1.4	-2.0	1.5	-2.728	0.007
Mid Adolescence	21	-2.5	1.3	-2.2	1.2	-2.4	1.2	-0.391	0.700
Total	984	-2.2	1.5	-1.9	1.4	-2.0	1.4	-3.123	0.002

Table 4.20 Genderwise Prevalence of Thinness, Overweight and Obesity among Children (n, %)

	Male (n=513)		Female (n=471)		Total (n=984)		Chi-square	p
	n	%	n	%	n	%		
Severe Thinness	154	30	101	24.2	255	25.9	20.201	0.000
Thinness	163	31.8	130	27.6	293	29.8		
Normal	174	33.9	221	46.9	395	40.1		
Obesity	7	1.4	3	0.6	10	1		
Overweight	15	2.9	16	3.4	31	3.2		

Table 4.21 Prevalence of Thinness, Overweight and Obesity among Children Across age groups (n, %)

Age (complete years)	N	Severe Thinness		Thinness		Normal		Overweight		Obesity		Chi-square	p
		n	%	n	%	n	%	n	%	n	%		
8	1	0	0.0	0	0.0	1	100.0	0	0.0	0	0.0		
9	148	27	18.2	55	37.2	62	41.9	3	2.0	1	0.7		
10	216	52	24.1	68	31.5	87	40.3	6	2.8	3	1.4		
11	244	74	30.3	66	27.0	86	35.2	13	5.3	5	2.0		
12	239	65	27.2	61	25.5	105	43.9	7	2.9	1	0.4	37.404	0.235
13	115	29	25.2	38	33.0	46	40.0	2	1.7	0	0.0		
14	17	8	47.1	3	17.6	6	35.3	0	0.0	0	0.0		
15	2	0	0.0	2	100.0	0	0.0	0	0.0	0	0.0		
16	2	0	0.0	0	0.0	2	100.0	0	0.0	0	0.0		
Total	984	255	25.9	293	29.8	395	40.1	31	3.2	10	1.0		

thinness increased with age upto 11 years age group, after which it started decreasing with age. Thinness (BAZ: -3SD to -2SD) was highest in 9 years age group. It was seen to be decreasing with increase in age. Data across the phases of adolescence revealed that overall prevalence of thinness did not differ between pre adolescence and early adolescence. However, severe thinness was higher among children in pre adolescence as compared to early adolescence (Table 4.22).

Socio Economic Background of Children

Data on socio demographic background of children is given in Table 4.23. The data showed that majority of the children were Hindu (97.3%) and only 2.7% were Muslim. Amongst the children, majority (61.6%) were from general category, followed by OBC (20.5%) and SC (13.3%). Only 4.6% of the children belonged to ST category.

With respect to family structure, majority of the children (43.9%) were from nuclear family followed by joint (29.1%) and extended nuclear family (26.8%). Most of the children had families with <6 (46.2%) and 6-10 (45.7%) members. Only 7.7% families reported to be a size of 11-18 members (Table 4.23).

The rate of illiteracy in parents was not reported to be very high, wherein only 2% of the fathers were illiterate vs. 9.6% of mothers. Thus, the illiteracy levels were higher among mothers than fathers. Around one third (34.9%) of the fathers had studied up to 10th standard followed by 30.3% who had studied till primary section (1st to 7th standard) and around one fourth (23.5%) had studied up to secondary section (8th to 9th standard). In contrast to this, majority of the mothers left studies while or after primary schooling (1st to 7th standard). Only 14.9% mothers had studied up to secondary and 9.2% up to 10th standard. Thus, fathers of the children had a better educational background as compared to mothers (Table 4.24).

Data on occupation of the parents, shown in Table 4.25, revealed that majority of the fathers were working as salaried employees. This included service in industries and other sectors as well as salaried drivers. Some fathers were working as daily wage labourers (16.9%) and 13.2% were into farming or animal husbandry. Majority of the mothers were reported to be

Table 4.22 Prevalence of Thinness, Overweight and Obesity among Children across the Stages of Adolescence (n, %)

Age (complete years)	N	Severe Thinness		Thinness		Normal		Overweight		Obesity		Chi-square	p
		n	%	n	%	n	%	n	%	n	%		
Pre Adolescence	149	27	18.1	55	36.9	63	42.3	3	2.0	1	0.7	10.403	0.238
Early Adolescence	814	220	27.0	233	28.6	324	39.8	28	3.4	9	1.1		
Mid Adolescence	21	8	38.1	5	23.8	8	38.1	0	0.0	0	0.0		
Total	984	255	25.9	293	29.8	395	40.1	31	3.2	10	1.0		

Table 4.23 Socio Demographic Background of the Subjects

	Male (N=462)		Female (N=437)		Total (N=899)	
	N	%	N	%	N	%
Religion						
Hindu	446	96.5	429	98.2	875	97.3
Muslim	16	3.5	8	1.8	24	2.7
Caste						
General	276	59.7	278	63.6	554	61.6
OBC	96	20.8	88	20.1	184	20.5
SC	64	13.9	56	12.8	120	13.3
ST	26	5.6	15	3.4	41	4.6
Type of Family						
Nuclear	213	46.1	182	41.6	395	43.9
Extended Nuclear	121	26.2	120	27.5	241	26.8
Joint	128	27.7	134	30.7	262	29.1
No answer	0	0.0	1	0.2	1	0.1
Number of Family Members						
<6	233	50.4	182	41.6	415	46.2
6-10	198	42.9	213	48.7	411	45.7
11-15	27	5.8	39	8.9	66	7.3
15-18	2	0.4	2	0.5	4	0.4
No Answer	2	0.4	1	0.2	3	0.3

Table 4.24 Education of Parents of the Subjects

	Male (N=462)		Female (N=437)		Total (N=899)	
	N	%	N	%	N	%
Father's Education						
Illiterate	5	1.1	13	3.0	18	2.0
Primary	150	32.5	122	27.9	272	30.3
Secondary	109	23.6	102	23.3	211	23.5
SSC	162	35.1	152	34.8	314	34.9
HSC	28	6.1	35	8.0	63	7.0
Graduate and above	2	0.4	7	1.6	9	1.0
Father no more	1	0.2	2	0.5	3	0.3
No answer	5	1.1	4	0.9	9	1.0
Mother's Education						
Illiterate	43	9.3	43	9.8	86	9.6
Primary	291	63.0	279	63.8	570	63.4
Secondary	67	14.5	67	15.3	134	14.9
SSC	46	10.0	37	8.5	83	9.2
HSC	9	1.9	6	1.4	15	1.7
Graduate and above	1	0.2	0	0.0	1	0.1
Father no more	0	0.0	2	0.5	2	0.2
No answer	5	1.1	3	0.7	8	0.9

Table 4.25 Occupation of Parents of the Subjects

	Male (N=462)		Female (N=437)		Total (N=899)	
	N	%	N	%	N	%
Father's Occupation						
Salaried employee	284	61.5	235	53.8	519	57.7
Daily wage labourers	78	16.9	74	16.9	152	16.9
Farming/ Animal Husbandry	48	10.4	71	16.2	119	13.2
Self employed	34	7.4	34	7.8	68	7.6
Unemployed	3	0.6	10	2.3	13	1.4
Father passed away	12	2.6	12	2.7	24	2.7
No answer	3	0.6	1	0.2	4	0.4
Mother's Occupation						
Housewife	382	82.7	362	82.8	744	82.8
Daily wage labourers	33	7.1	35	8.0	68	7.6
Domestic workers	24	5.2	19	4.3	43	4.8
Salaried employee	14	3.0	8	1.8	22	2.4
Self employed	0	0.0	3	0.7	3	0.3
Mother Passed away	3	0.6	5	1.1	8	0.9
No answer	6	1.3	5	1.1	11	1.2

home makers (82.8%), while others were working as daily wage labourers (7.6%), domestic help (4.8%) and salaried employees (0.3%).

Revised Kuppuswamy classification for the year 2019 (Dalvi et al. 2020) was used as a reference for categorising the total family income of children. Majority (37.2%) of the families had monthly family income of rupees 2555-7587 followed by families having family income of 7588-12646 rupees per month (Table 4.26).

Further, monthly per capita income of the families was calculated. It was categorised using Revised B G Prasad's classification of SES for 2019 (Dalvi et al. 2020). Majority (42.3%) of the families lied under lower middle class (1123- 2245 INR) category followed by lower class (<1122 INR).

Practices and Perceptions regarding Mid Day Meal

Mid Day Meal programme guarantees provision of hot cooked meals to all the children studying in Government primary schools on all working days. Most (93%) of the children in the study reported to be consuming MDM served in the schools (Figure 4.2). Frequency of consumption of MDM as reported by children was 5-6 days a week in 70.1% of children. Only 16% of the children reported to be consuming MDM 3-4 days a week and 5.5% consumed MDM 1-2 days a week (Table 4.27). Children, who did not consume MDM at school (7%) were asked the main reason for non-consumption. Majority of them reported that they did not like the taste of food served under MDM (44.2%) followed by 17.3% who reported that they prefer going home during lunch break for eating. Peer influence (3.9%) and not bringing plates from home (1.9%) were also stated as reasons for not consuming MDM by some children. However, almost one fifth (19.2%) of the children did not give any reason for not consuming MDM at the school (Table 4.28).

Majority of the children (91.5%) reported that they liked the food served under MDM in the school (Table 4.29). Khichadi was the most liked item (28.7%) followed by Dal dhokali (25.4%) and Mix dal (21.8%) (Table 4.30). Aloo subji (24.6%) was the most disliked item served under MDM, among children. (Table 4.31) Although one fourth of the children reported that they liked Dal Dhokali the most almost equal number (23.7%) of children said that they did

Table 4.26 Monthly Family Income of the Enrolled Children

	Male (N=462)		Female (N=437)		Total (N=899)	
	N	%	N	%	N	%
Total Family Income (INR)						
<2554	10	2.2	12	2.7	22	2.4
2555-7587	170	36.8	164	37.5	334	37.2
7588-12646	146	31.6	125	28.6	271	30.1
12647-18969	63	13.6	57	13.0	120	13.3
18970 –24293	15	3.2	13	3.0	28	3.1
24294–49586	16	3.5	24	5.5	40	4.4
>49584	5	1.1	4	0.9	9	1.0
Don't Know	37	8.0	38	8.7	75	8.3
Monthly Per Capita Income*						
Lower class (<1122)	123	26.6	152	34.8	275	30.6
Lower Middle Class (1123–2245)	207	44.8	173	39.6	380	42.3
Middle Class (2246–3742)	63	13.6	50	11.4	113	12.6
Upper Class (>7486)	6	1.3	9	2.1	15	1.7
Upper Middle Class (3743–7486)	26	5.6	15	3.4	41	4.6
Don't Know	37	8.0	38	8.7	75	8.3

* According to Revised B G Prasad's classification of SES for 2019 (Dalvi et al. 2020)

Figure 4.2 Proportion of children consuming MDM at school

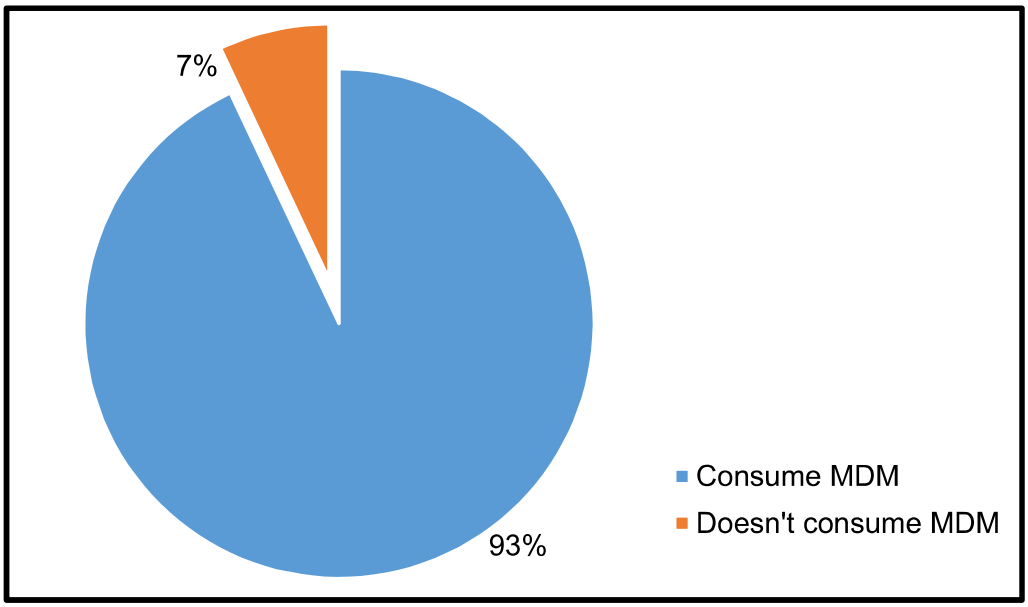


Table 4.27 Reported Frequency of Consumption of MDM among Children

	Male (N=398)		Female (N=371)		Total (N=769)	
	n	%	n	%	n	%
1-2 days a week	23	5.8	19	5.1	42	5.5
3-4 days a week	64	16.1	59	15.9	123	16.0
5-6 days a week	277	69.6	262	70.6	539	70.1
Sometimes	4	1.0	8	2.2	12	1.6
Never	30	7.5	23	6.2	53	6.9

Table 4.28 Reasons for not consuming MDM at school

	Male (N=28)		Female (N=24)		Total (N=52)	
	n	%	n	%	n	%
Do not like the taste	9	32.1	14	58.3	23	44.2
Go home for lunch	6	21.4	3	12.5	9	17.3
No reason	4	14.3	6	25	10	19.2
Had fallen ill after eating MDM	2	7.1	0	0.0	2	3.9
Peer influence	2	7.1	0	0.0	2	3.9
Stomach ache after eating MDM	2	7.1	0	0.0	2	3.9
Not hungry in school	1	3.6	0	0.0	1	1.9
Don't bring plate	1	3.6	0	0.0	1	1.9
No answer	1	3.6	1	4.2	2	3.9

Table 4.29 Preference for MDM among Children

	Male (N=398)		Female (N=371)		Total (N=769)	
	n	%	n	%	n	%
Like MDM	362	91.0	342	92.2	704	91.5
Don't like MDM	2	0.5	4	1.1	6	0.8
Sometimes	3	0.8	1	0.3	4	0.5
No answer	31	7.8	24	6.5	55	7.2

Table 4.30 Food Items Served under MDM liked the Most by Children

Items liked the most	Male (N=398)		Female (N=371)		Total (N=769)	
	n	%	n	%	n	%
Dal dhokali	120	30.2	75	20.2	195	25.4
Sukhadi	10	2.5	11	3.0	21	2.7
Plain Roti	21	5.3	17	4.6	38	4.9
Thepla	26	6.5	28	7.5	54	7.0
Aloo Subji	18	4.5	21	5.7	39	5.1
Dudhi Subji	7	1.8	10	2.7	17	2.2
Mix Subji	30	7.5	49	13.2	79	10.3
Chana Dal	24	6.0	31	8.4	55	7.2
Mix Dal	85	21.4	83	22.4	168	21.8
Jeera Rice	33	8.3	48	12.9	81	10.5
Veg Pulao	45	11.3	56	15.1	101	13.1
Peas Pulao	55	13.8	57	15.4	112	14.6
Chana Rice	18	4.5	9	2.4	27	3.5
Khichadi	108	27.1	113	30.5	221	28.7
Idli	5	1.3	3	0.8	8	1.0
Shingdana	19	4.8	12	3.2	31	4.0
Bataka Poha	0	0.0	1	0.3	1	0.1
NA	32	8.0	28	7.5	60	7.8

Table 4.31 Food Items served Under MDM disliked by Chlidren

	Male (N=398)		Female (N=371)		Total (N=769)	
	n	%	n	%	n	%
Like Everything	108	27.1	71	19.1	179	23.3
Dal dhokali	77	19.3	105	28.3	182	23.7
Sukhadi	26	6.5	22	5.9	48	6.2
Plain Roti	19	4.8	22	5.9	41	5.3
Masala Roti	10	2.5	20	5.4	30	3.9
Aloo Subji	93	23.4	96	25.9	189	24.6
Dudhi Subji	13	3.3	14	3.8	27	3.5
Mix Subji	22	5.5	19	5.1	41	5.3
Chana Dal	30	7.5	29	7.8	59	7.7
Mix Dal	43	10.8	22	5.9	65	8.5
Plain Rice	6	1.5	14	3.8	20	2.6
Jeera Rice	37	9.3	46	12.4	83	10.8
Veg Pulao	35	8.8	23	6.2	58	7.5
Peas Pulao	42	10.6	30	8.1	72	9.4
Chana Rice	19	4.8	18	4.9	37	4.8
Peas in Pulao	0	0.0	1	0.3	1	0.1
Vegetables/ corriander in any dish	10	2.6	1	0.3	11	1.4
Khichadi	38	9.5	29	7.8	67	8.7
Idli	2	0.5	1	0.3	3	0.4
Shingdana	12	3.0	11	3.0	23	3.0
Bataka Poha	2	0.5	0	0.0	2	0.3
NA	32	8.0	28	7.5	60	7.8

not like Dal Dhokali served in the school. Nearly one fourth of the children (23.3%) reported to be liking all the food items that they receive in school (Table 4.31) Thus, taking into consideration the likes and dislikes of the children, Khichadi was the most preferred item among the food items served to children in school.

Data on perceptions of children about benefits of MDM, presented in Table 4.32, showed that three fourth of the children (74.9%) opined that MDM is beneficial for them. The main perceived benefit of MDM as reported by the children, was improvement in health (28.7%). MDM's role in providing nutritious food was also one of the benefits identified by 13.3% respondents. Some responses also suggested that MDM contributes to food security (6.4%), better growth (6.1) and educational outcomes (3.8%) as per their opinions. It is noteworthy that almost one fourth of the children were not able to state any benefits of MDM. Among respondents who said that they do not perceive MDM to be beneficial for them, most could not state the reason for their response. (Table 4.32)

Practices and Perceptions regarding Sanitation and Hygiene

Understanding the importance of personal hygiene and following proper hygiene practices is important for children and adolescents not only to reduce the chances of infectious diseases but also for better educational outcomes. Ensuring hand hygiene can help prevent infectious diseases such as diarrhoeal diseases and respiratory diseases.

Children were asked questions related to their perception about personal hygiene as well as practices. Almost all the children (99.7%) opined that hand washing is an important practice and majority (96.1%) said that it can prevent illnesses (Table 4.33). All the children reported to be washing their hands before handling or consuming food, after eating and after using toilet. Other responses suggested that 43.2% children were washing hands after going home from outside followed by 31.5% washing their hands after doing household chores. (Table 4.33). Washing hands with soap and water is necessary for maintaining hand hygiene. Although, almost all the children reported that they used soap for hand washing when at home, only 67.2% of

Table 4.32 Perceptions about benefits of Mid Day Meal

	Male (N=398)		Female (N=371)		Total (N=769)	
	n	%	n	%	n	%
Do you think that MDM is beneficial?						
Yes	292	73.4	284	76.5	576	74.9
No	39	9.8	23	6.2	62	8.1
No answer	36	9.0	39	10.5	75	9.8
NA	31	7.8	25	6.7	56	7.3
If yes, Perceived Benefits of MDM						
Improved health	108	27.1	113	30.5	221	28.7
Provides Nutrition	60	15.1	42	11.3	102	13.3
Contributes to food availability	28	7.0	21	5.7	49	6.4
Improved in growth	25	6.3	22	5.9	47	6.1
Improved educational outcomes	20	5.0	9	2.4	29	3.8
Like the food served under MDM	5	1.3	3	0.8	8	1.0
Replacement of home meals	5	1.3	4	1.1	9	1.2
General Good Feeling	2	0.5	0	0.0	2	0.3
Other	2	0.5	1	0.3	3	0.4
No answer	79	19.8	107	28.8	186	24.2
NA	98	24.6	82	22.1	180	23.4
If no, why?						
No answer	30	7.5	19	5.1	49	6.4
Nausea/ vomiting after eating	1	0.3	3	0.8	4	0.5
Don't like	0	0.0	1	0.3	1	0.1
No reason	2	0.5	1	0.3	3	0.4
Haven't experienced any benefit	1	0.3	2	0.5	3	0.4
Monotonous menu	1	0.3	0	0.0	1	0.1
NA	363	91.2	345	93.0	708	92.1

Table 4.33 Practices and Perceptions Related to Handwashing

	Male (N=398)		Female (N=371)		Total (N=769)	
	n	%	n	%	n	%
Handwashing considered to be an important hygiene practice	397	99.8	370	99.7	767	99.7
Perceived reasons for handwashing						
Prevent illness	382	96	357	96.2	739	96.1
Hygiene/cleanliness	37	9.3	29	7.8	66	8.6
No answer	3	0.8	5	1.3	8	1.0
Other	1	0.3	1	0.3	2	0.3
NA	1	0.3	1	0.3	2	0.3
When do you wash your hands?						
Before handling or consuming food	396	99.5	371	100	767	99.7
After eating	396	99.5	371	100	767	99.7
After using toilet	394	99.0	371	100	765	99.5
After going home from outside	200	50.3	132	35.6	332	43.2
After doing household chores	72	18.1	170	45.8	242	31.5
When hands get dirty	62	15.6	45	12.1	107	13.9
At bedtime	16	4.0	8	2.2	24	3.1
Other	22	5.5	22	5.9	44	5.7

the chlidren reported washing hands with soap in schools. More girls (71.4%) were washing hands with soap in schools as compared to boys (63.31%). (Table 4.34) Usage of soap in schools was mainly confined to pre meals in lunch breaks.

Properly trimming and cleaning finger nails is crucial for maintaining hand hygiene, as untrimmed and dirty nails can harbour dirt, pathogens as well as worms. It will expose the children to infectious diseases and worm infestations. In India, traditionally large part of the population consumes food with their hands without using cutlery. Children in schools also eat MDM with hands. Hence, it is even more important for them to keep their nails trimmed and clean. All the children in study considered nail hygiene as an important practice. Variety of responses were recorded when the children were asked why it is important to keep nails clean and trimmed according to them. The responses were clubbed into broader responses. Majority (82.4%) of the children stated that trimmed and clean nails help in preventing illnesses and being healthy. Around half (51.1%) of the children said that it is important to keep nails clean help in ensuring hygiene. (Table 4.35). Most of the children (96.9%) said that they keep their nails cut and trimmed with 61.1% cutting their nails once a week. Nearly one fourth of the respondents (22.2%) stated that they cut their nails whenever they think that their nails have grown long. Although, majority of the children reported that they maintained good nail hygiene, it was observed that only one third (32.8%) of the children had clean and trimmed nails. (Table 4.36)

Bathing was regarded as an important hygienic practice by all of the children. They all claimed to bathe every day. (Table 4.37)

Dietary Intake among Children

Children are provided meals under the MDMP with an aim to bridge the gap between their nutrient requirements and dietary intake.

Dietary intakes were assessed using 3 days, 24 hours diet recall data collected on a sub sample from 3 schools. The data also helped in understanding the contribution of food served under MDM to the daily nutrient

Table 4.34 Reported use of soap for handwashing

Reported use of soap for handwashing		Male (N=398)		Female (N=371)		Total (N=769)	
		n	%	n	%	n	%
At school	Only water	141	35.4	105	28.3	246	32.0
	Water and soap	252	63.3	265	71.4	517	67.2
At home	Only water	13	3.3	8	2.2	21	2.7
	Water and soap	387	97.2	363	97.8	750	97.5

Table 4.35 Perceived reasons for keeping nail trimmed and clean

	Male (N=398)		Female (N=371)		Total (N=769)	
	n	%	n	%	n	%
Health reasons	324	81.4	310	83.6	634	82.4
Hygiene Reasons	229	57.5	164	44.2	393	51.1
Discomfort	11	2.8	5	1.3	16	2.1
Aesthetic reasons	4	1.0	2	0.5	6	0.8
Personal preference	2	0.5	0	0.0	2	0.3
Nails checked at school	0	0.0	2	0.5	2	0.3
No answer	10	2.5	20	5.4	30	3.9

Table 4.36 Practices Related to Nail Hygiene among Children

	Male (N=398)		Female (N=371)		Total (N=769)	
	n	%	n	%	n	%
Do you keep nails trimmed and clean?						
Yes	386	97	359	96.8	745	96.9
No	10	2.5	9	2.4	19	2.5
Sometimes	2	0.5	3	0.8	5	0.7
Frequency of trimming nails						
Once a week	229	57.5	241	65.0	470	61.1
When Nails grow Long	102	25.6	69	18.6	171	22.2
2-3 times a week	29	7.3	30	8.1	59	7.7
Once a month	11	2.8	5	1.3	16	2.1
Daily	6	1.5	8	2.2	14	1.8
Sometimes	6	1.5	5	1.3	11	1.4
No answer	5	1.3	3	0.8	8	1.0
Once in 10-15 days	4	1.0	4	1.1	8	1.0
Other	3	0.8	3	0.8	6	0.8
When someone asks to cut	1	0.3	3	0.8	4	0.5
Never	2	0.5	0	0.0	2	0.3
Observations regarding cleanliness of nails						
Trimmed and clean	116	31.3	136	34.2	252	32.8
Untrimmed and not clean	158	42.6	164	41.2	322	41.9
Trimmed but not clean	80	21.6	80	20.1	160	20.8
Untrimmed and clean	17	4.6	18	4.5	35	4.6

Table 4.37 Practices and Perceptions related to Bathing among Children

	Male (N=398)		Female (N=371)		Total (N=769)	
	n	%	n	%	n	%
Bathing considered to be an important hygiene practice	363	99.5	389	99.7	752	99.6
Opinions regarding benefits of bathing						
Health/Prevent illness	161	40.5	160	43.1	321	41.7
Hygiene	141	35.4	88	23.7	229	29.8
Social acceptability	94	23.6	63	17.0	157	20.4
Other	27	6.8	14	3.8	41	5.3
No answer	52	13.1	93	25.1	145	18.9
Reported frequency of bathing						
Daily	392	98.5	365	98.4	757	98.4
6 days a week	3	0.8	2	0.5	5	0.7
3-4 days a week (Alternate days)	0	0.0	1	0.3	1	0.1
Once a week	1	0.3	1	0.3	2	0.3
No Answer	2	0.5	2	0.5	4	0.5

intake of the children. Food items served under MDMP were analysed for their nutrient content in the Phace 1 C of the study. These values were used for calculation of nutrient intake.

The children selected for 24 hour diet recall were 9-14 years old, with a mean age of 11±1.2 years. Mean anthropometric measurements of the children are presented in Table 4.38. There was no statistical significance in the difference between mean anthropometric measurements of girls and boys. Around one third of these children were stunted with more girls being stunted as compared to boys. Thinness was seen in almost half of these children. More boys in the selected sub sample were found to be thin as compared to their female counterparts.

Data on mean intake of macronutrients showed that the children were consuming 1264±452 Kcal energy, 163±57 gm carbohydrates, 35.7±15.3 gm protein and 48.6±19.2 gm total fat. With respect to iron (6.3±3.7 mg) and calcium (233±135 mg), the average intake among children was low. Boys had higher mean nutrient intake as compared to their female counterparts. This difference was found to be statistically significant ($p<0.05$) for energy (1418±483 vs 1150±397 Kcal), carbohydrates (183±58 vs 149±52 gm), protein (40.9±15.7 vs 31.8±13.9 gm) and fat (54.2±20.9 vs 44.5±17.1 gm). (Table 4.39)

Dietary intake of children was compared with recommended nutritional requirements for Indians, given in the year 2010 (ICMR) as well as 2020 (ICMR-NIN). The guidelines given by ICMR in the year 2010 gave Recommended Dietary Allowances (RDA) for Indians of various age groups. The expert group, in the newer guidelines, gave both Recommended Dietary Allowances (RDA) as well as Estimated Average Requirement (EAR) for different age groups. According to the definition used in the technical report, the average levels of daily nutritional intake estimated to meet the needs of half of the healthy population in a given gender and age group is referred to as the EAR. RDAs are the amounts of nutrients needed to meet requirements of almost all (97-98%) the healthy individuals in the population. The EAR is a nutrient requirement used in public health nutrition to assess a population's nutrient intake whereas RDAs are used mainly for assessing nutrient intake of

Table 4.38 Mean Anthropometric Measurements of Subjects Selected in the Sub-sample

	Male (N=26)		Female (N=35)		Total (N=61)	
	Mean	SD	Mean	SD	Mean	SD
Age (Y)	11	1.3	11	1.2	11	1.2
Weight (kg)	27	6.5	28	8.4	28	7.6
Height (cm)	135	8.7	136	11.1	135	10.1
BMI	14	2.2	15	2.9	15	2.6

Figure 4.3 Stunting among Children Selected for Dietary Assessment

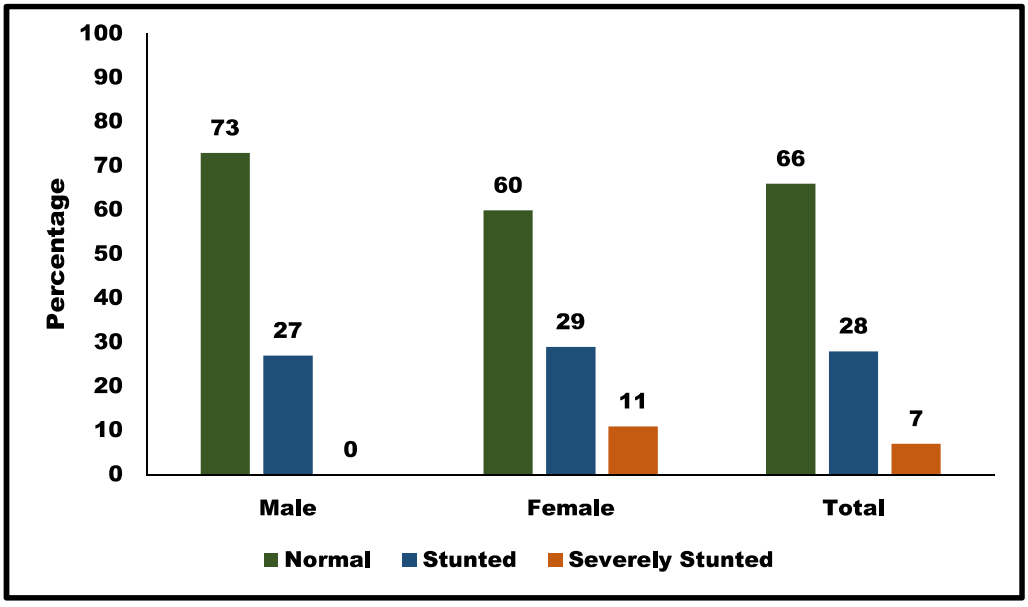


Figure 4.4 Thinness among Children Selected for Dietary Assessment

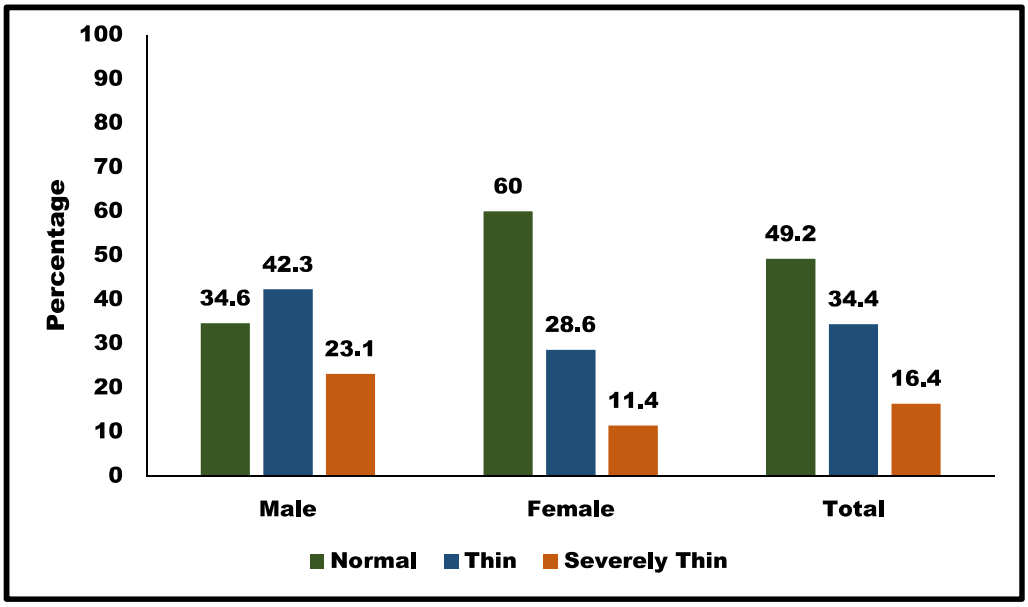


Table 4.39 Mean Daily Dietary Intake among Children

	Male (N=26)		Female (N=35)		Total (N=61)		't' value	Significance p
	Mean	SD	Mean	SD	Mean	SD		
Energy (Kcal)	1418	483	1150	397	1264	452	2.377	0.021*
Carbohydrates (gm)	183	58	149	52	163	57	2.438	0.018*
Protein (gm)	40.9	15.7	31.8	13.9	35.7	15.3	2.411	0.019*
Fat (gm)	54.2	20.9	44.5	17.1	48.6	19.2	2.013	0.049*
Calcium (mg)	247	138	223	134	233	135	0.676	0.501
Iron (mg)	6.9	3.9	5.9	3.5	6.3	3.7	1.036	0.304

individuals. (ICMR-NIN, 2020) In view of this, the nutrient intake of subjects in this study were compared to RDA (2010) as well as EAR (2020). Mean dietary intake of children in terms of percent RDA (2010) is presented in Table 4.40. The mean intake of energy and protein met 2/3rd (62.4±22.1%) and 93.4±41.5% of the RDA (2010) respectively. The diets were meeting less than one third of the RDA of calcium (31.0±18.5% RDA) and iron (28.6±18.2% RDA). Thus, the mean diets were inadequate in energy, iron and calcium when compared with RDA 2010. Gender wise comparison revealed that mean dietary intake in terms of percent RDA (2010) was higher in boys as compared to girls. The difference was statistically significant for protein. ($p<0.05$)

With respect to EARs 2020, diets met 61.5±22 % EAR for energy (Table 4.41). Mean protein intake was higher among children in terms of percent EAR (2020) for both boys (160.7±66.4) and girls (125.6±57.4). The diets met almost half of the EAR for iron (48.6±30.7) and one fifth of the EAR for calcium (37.2±21.5). Boys' diets met higher percent of their age appropriate EAR (2020) than that of girls. Mean percent EAR for protein and iron were significantly higher in case of boys than girls.

The requirement of energy for adolescents is almost the same as per both RDA 2010 and EAR 2020. Hence, no difference was there in percent RDA (2010) and percent EAR (2020) of energy met by children's diet. Requirements (EAR) of protein and iron are lower as per the revised recommendations than the previous RDAs. Children's diets were found to be sufficient in protein with reference to RDA (2010). However, when compared with newer requirements, mean percent EAR (2020) met by diet was very high. Iron intake of children could meet only 28.6±18.2% of RDA 2010 however due to the lower revised requirement almost half (48.6±30.7%) of the EAR of iron was met. Calcium requirements for adolescents were previously (RDA 2010) the same for all the adolescents but revised requirements are more age specific. Majority of the children in the sub sample were from 9-12 years of age, for whom the new EAR for calcium is lower than RDA 2010. Hence, the diets met higher percent requirements when compared to the new EAR (2020) as given in Table 4.42.

Table 4.40 Gender-wise Percent RDA (2010) met by daily diet

	Male (N=26)		Female (N=35)		Total (N=61)		't' value	Significance p
	Mean	SD	Mean	SD	Mean	SD		
Energy (Kcal)	66.9	59.0	59.0	21.1	62.4	22.1	1.387	0.171
Protein (gm)	107.2	83.2	83.2	37.5	93.4	41.5	2.313	0.024*
Calcium (mg)	32.4	29.9	29.9	19.7	31.0	18.5	0.501	0.618
Iron (mg)	33.7	24.9	24.9	16.4	28.6	18.2	1.894	0.063

Table 4.41 Gender-wise Percent EAR (2020) met by daily diet

	Male (N=26)		Female (N=35)		Total (N=61)		't' value	Significance p
	Mean	SD	Mean	SD	Mean	SD		
Energy (Kcal)	66.4	22.9	57.8	20.8	61.5	22.0	1.526	0.132
Protein (gm)	160.7	66.4	125.6	57.4	140.6	63.3	2.205	0.031*
Calcium (mg)	38.5	18.2	36.3	23.8	37.2	21.5	0.397	0.693
Iron (mg)	58.5	33.4	41.3	26.7	48.6	30.7	2.165	0.036*

Table 4.42 Gender-wise Percent Nutrient Requirements Met by Daily Diets: RDA (2010) Vs EAR (2020)

	Dietary Allowances	Female		Male		Total	
		Mean	SD	Mean	SD	Mean	SD
Energy	RDA 2010	59.0	21.1	66.9	23.0	62.4	22.1
	EER 2020	57.8	20.8	66.4	22.9	61.5	22.0
Protein	RDA 2010	83.2	37.5	107.2	43.4	93.4	41.5
	EAR 2020	125.6	57.4	160.7	66.4	140.6	63.3
Calcium	RDA 2010	29.9	19.7	32.4	17.0	31.0	18.5
	EAR 2020	36.3	23.8	38.5	18.2	37.2	21.5
Iron	RDA 2010	24.9	16.4	33.7	19.6	28.6	18.2
	EAR 2020	41.3	26.7	58.5	33.4	48.6	30.7

ranges is related with a lower risk of chronic diseases. It also ensures healthy adequate diet among which reduces the risk of undernutrition. (ICMR-NIN 2020)

The 24 hour diet recall gave data on intake of carbohydrate, protein and total fat. AMDR for Indian children between 3-18 years of age is 5-15 PE Ratio, 25-35 total fat and 45-65 carbohydrates in terms of percent energy. (ICMR-NIN 2020) Mean Protein Energy Ratio (PE Ratio), carbohydrates and fat expressed as percent energy were 11.2±2.6, 34.4±4.4 and 52.2±4.4 respectively (Table 4.44). Most of the children met AMDR of protein (95.1%) and carbohydrates (93.4%). Diets of 54.1% children met AMDR for total fat whereas 45.9% of the children consumed more fat than recommended AMDR. (Table 4.45)

Nutrient Intake through MDM

Children were consuming 515±204 Kcal energy and 18±7.5 gm protein through MDM. Mean fat intake through MDM among children was 28.6±11.8 gm. MDM contributed to only 47±21 mg calcium and 0.9±0.6 mg iron on an average to the children's daily diets. Mean intake of protein (20.3.6±7.0 gm vs 16.0±7.3 gm), fat (33.0±10.9 gm vs 25.3±11.5 gm) and iron (1.2±0.5 vs 0.8±0.6) through MDM were found to be significantly ($p<0.05$) higher among boys as compared to boys. (Table 4.46)

MDM was split into two meals: breakfast and lunch in Gujarat state at the time of data collection. Mean nutrient intake through the MDM breakfast and MDM meal are presented in Table 4.47 and Table 4.48. Children consumed higher average energy, protein and fat from food served in MDM breakfast as compared to MDM lunch. Mean carbohydrates and calcium intake was higher from the meal than MDM breakfast. Gender wise comparison showed that boys consumed higher mean nutrients through MDM, mainly breakfast as compared to girls. The difference was statistically significant for energy (399±187 vs 281±172 Kcal, $p<0.05$), protein (14.2±5.0 vs 9.5±6.6 gm, $p<0.01$), fat (28.5±12.2 vs 19.1±12.4 gm, $p<0.01$), calcium (27.5±15.1 vs 18.9±12.2 mg, $p<0.05$) and iron (1.3±0.8 vs 0.8±0.6 mg, $p<0.05$).

Table 4.43 Nutrient Adequacy of Daily Diets of Children

Nutrient Adequacy Ratio (NAR)		
	RDA (2010)	**EAR (2020)**
Energy	0.62±0.21	0.61±0.21
Protein	0.80±0.24	0.91±0.17
Calcium	0.31±0.18	0.37±0.19
Iron	0.29±0.18	0.46±0.24
Mean Adequacy Ratio (MAR)		
Boys	0.54±0.16	0.64±0.15
Girls	0.47±0.17	0.56±0.18

Table 4.44 Gender-wise Mean AMDR as Percent Energy

	Male (N=26)		Female (N=35)		Total (N=61)		't' value	Significance p
	Mean	SD	Mean	SD	Mean	SD		
PE ratio	11.5	2.3	10.9	2.9	11.2	2.6	1.526	0.132
Fat	34.1	4.4	34.6	4.4	34.4	4.4	2.205	0.031*
Carbohydrate	52.3	4.0	52.0	4.7	52.2	4.4	0.397	0.693

Table 4.45 Percent of Children consuming Diets Meeting AMDR

	Male (N=26)		Female (N=35)		Total (N=61)	
	n	%	n	%	n	%
PE ratio	25.0	96.2	33.0	94.3	58.0	95.1
Fat	14.0	53.8	19.0	54.3	33.0	54.1
Carbohydrate	25.0	96.2	32.0	91.4	57.0	93.4

Table 4.46 Mean Daily Nutrient Intake through MDM

	Male (N=23)		Female (N=31)		Total (N=54)		't' value	Significance p
	Mean	SD	Mean	SD	Mean	SD		
Energy (Kcal)	569	203	475	198	515	204	1.706	0.094
Carbohydrates (gm)	47.5	22.8	44.8	21.7	45.9	22.0	0.440	0.662
Protein (gm)	20.6	7.0	16.0	7.3	18.0	7.5	2.364*	0.022
Fat (gm)	33.0	10.9	25.3	11.5	28.6	11.8	2.505*	0.015
Calcium (mg)	49.7	21.4	45.7	22.1	47	21	0.666	0.508
Iron (mg)	1.2	0.5	0.8	0.6	0.9	0.6	2.569*	0.013

Table 4.47 Mean Nutrient Intake through Mid Day Meal Breakfast

	Male (N=23)		Female (N=31)		Total (N=54)		't' value	Significance p
	Mean	SD	Mean	SD	Mean	SD		
Energy (Kcal)	399	187	281	172	331	186	2.397*	0.020
Carbohydrates (gm)	21.6	16.2	16.7	10.6	18.8	13.3	1.333	0.188
Protein (gm)	14.2	5.0	9.5	6.6	11.5	6.4	2.798**	0.007
Fat (gm)	28.5	12.2	19.1	12.4	23.1	13.1	2.779**	0.008
Calcium (mg)	27.5	15.1	18.9	12.2	22.6	14.1	2.310*	0.025
Iron (mg)	1.3	0.8	0.8	0.6	1.0	0.7	2.613*	0.012

Table 4.48 Mean Daily Nutrient Intake through Mid Day Meal Lunch

	Male (N=23)		Female (N=31)		Total (N=54)		't' value	Significance p
	Mean	SD	Mean	SD	Mean	SD		
Energy (Kcal)	264	169	250	139	256	151	0.336	0.738
Carbohydrates (gm)	34.0	22.2	32.8	18.8	33.4	20.1	0.214	0.832
Protein (gm)	9.8	6.3	8.6	4.9	9.1	5.5	0.767	0.447
Fat (gm)	9.9	7.2	9.8	6.0	9.9	6.5	0.043	0.966
Calcium (mg)	32.0	22.8	33.3	21.9	32.7	22.1	-0.219	0.827
Iron (mg)	0.0	0.0	0.0	0.1	0.0	0.1	-0.850	0.399

Providing supplementary nutrition to children in Government run primary schools is the main component of MDMP, in order to improve their nutritional status. Present data showed that MDM contributed considerably to the mean daily nutrient intake of children. More than half of the total daily fat intake (54.6±.9.9%) among children was because of MDM consumption. It was higher in boys than girls but the difference was not statistically significant. MDM contributed to almost half (48.1±16.5%) of the protein, 41.9±18.3% energy and 29.1±14.55% carbohydrate intake among children. With respect to calcium and iron, around one fourth (26.8±15.3%) and one fifth (21.0±16.2%) of the total intake was met by MDM. Gender wise data did not show much difference in the percent daily intake of energy and calcium. Mean percent daily intake through MDM was slightly higher for carbohydrates, protein and iron in boys as compared to girls, but there was no statistical significance in the difference. (Table 4.49)

Nutrient intake thought MDM was further compared with dietary requirements (RDA 2010 and EAR 2020). The data reflected that MDM contributed around one fourth of the daily energy requirements (25.7±10.5% RDA 2010, 22.4±12.8% EER 2020) of the children. As regards protein, around half of the RDA 2010 and two third of the EAR 2020 was met by MDM. (Table 4.50 and Table 4.51)

According to the nutrient norms of MDMP, children should be meeting 450 Kcal and 12 gm protein in primary section; and 700 Kcal energy and 20 gm protein in upper primary section. Only 38.9% and 48.2% of the children met the nutrient norms of energy and protein. More boys consumed amount of MDM that met nutrient norms as compared to girls. (Figure 4.5)

Spot Observations

Execution of MDM at school was observed by carrying out direct observations, every month in all the selected schools for a period of six months. A total of 36 visits were done to carry out spot observations. Observations related to WASH, sitting arrangement and serving of MDM, role of teachers as well as management of plate waste and left-over foods were recorded using an observation check-list.

Table 4.49 Mean Percent Contribution of MDM to the Daily Nutrient Intake

	Male (N=23)		Female (N=31)		Total (N=54)		't' value	Significance p
	Mean	SD	Mean	SD	Mean	SD		
Energy (Kcal)	42.4	20.3	41.5	17.0	41.9	18.3	0.186	0.853
Carbohydrates (gm)	27.4	12.7	30.4	15.8	29.1	14.5	0.737	0.464
Protein (gm)	50.1	13.1	46.6	18.7	48.1	16.5	0.755	0.454
Fat (gm)	60.3	15.3	50.4	21.9	54.6	19.9	1.864	0.068
Calcium (mg)	27.9	11.2	26.0	17.9	26.8	15.3	0.445	0.658
Iron (mg)	23.4	13.1	19.1	18.1	21.0	16.2	0.965	0.339

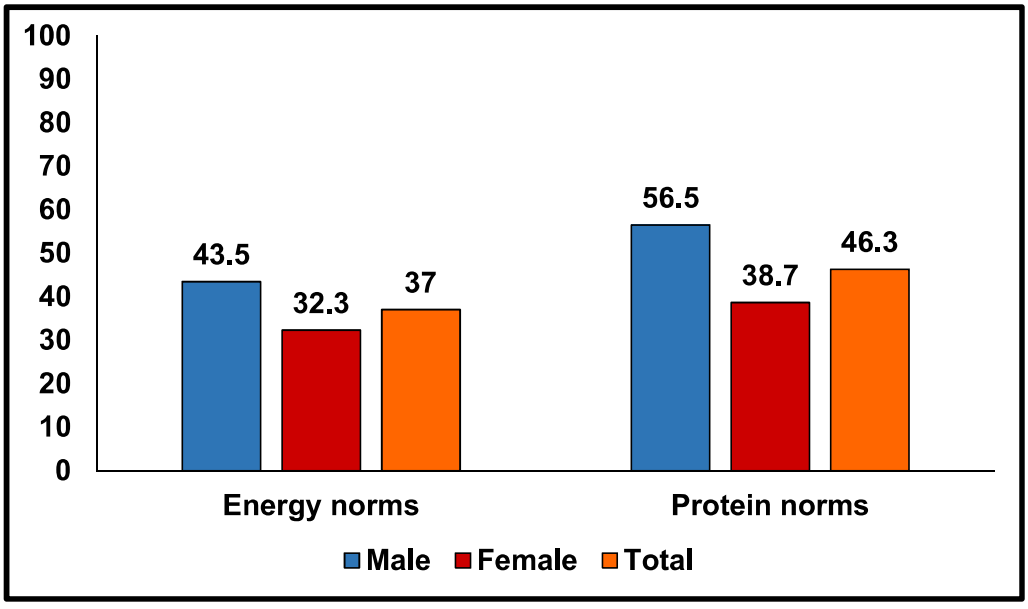
Table 4.50 Gender-wise Percent RDA (2010) met by MDM

	Male (N=26)		Female (N=35)		Total (N=61)		't' value	Significance p
	Mean	SD	Mean	SD	Mean	SD		
Energy (Kcal)	27.4	10.4	24.4	10.6	25.7	10.5	1.016	0.314
Protein (gm)	55.2	22.3	42.1	20.2	47.7	21.9	2.245	0.029*
Calcium (mg)	6.6	2.9	6.2	3.2	6.4	3.0	0.560	0.583
Iron (mg)	5.7	2.6	3.3	2.8	4.4	2.9	3.226	0.002**

Table 4.51 Gender-wise Percent EAR (2020) met by MDM

	Male (N=26)		Female (N=35)		Total (N=61)		't' value	Significance p
	Mean	SD	Mean	SD	Mean	SD		
Energy (Kcal)	24.0	13.2	21.2	12.5	22.4	12.8	0.863	0.392
Protein (gm)	73.2	42.3	56.4	35.6	63.6	39.2	1.682	0.098
Calcium (mg)	7.1	4.2	6.5	4.3	6.8	4.2	0.507	0.614
Iron (mg)	8.8	5.3	4.9	4.6	6.5	5.2	3.060	0.003*

Figure 4.5 Percentage of Children Meeting Nutrient Norms of MDMP



Major findings of the observations are as follows:

Water, sanitation and hygiene

a) Availability of safe drinking water in schools is an important contributor to a safe learning environment for all the children. Regular supply of safe drinking water in the schools was recorded in majority of the (83.3%) observations. (Table 4.52). The drinking water facility was vandalised in one of the schools selected in the study resulting in unavailability of drinking water in the school. It is noteworthy that reconstruction of the drinking water facility had started towards the end of the study.

b) MHRD (2012) has given guidelines related to hand-washing in schools. The guidelines suggest that hand-washing soap should be available in schools for children. The results showed that soap was available at the time of 66.7% visits and children were observed to be washing their hands with soap before meals. However, only 33.3% observations reported that the majority of the children were washing their hands with soap before consuming MDM in school. (Table 4.52)

c) The guidelines further suggest that teachers should monitor hand-washing before serving MDM, which was not observed in any of the observations. However, 16.7% observations reported that hand-washing was supervised by children. In one of the schools, *'Bal Sansad'* members along with class representatives, were given the duty of supervising hand washing by children. (Table 4.52). They were supposed to make sure that all the children wash their hands and maintain discipline. This practice was seen to be effective in ensuring that children wash their hands with soap before meals.

d) Allocating a dedicated time within the daily time-table for hand-washing can contribute to effective hand-washing practices in schools. (MHRD 2012) It was observed in the study, that though children were asked to wash their hands when the bell rang for break, there was no dedicated time for hand-washing. This lead to children running and rushing to the hand-washing station or directly to the dining area. This rush could be largely avoided where student members of *'Bal Sansad'* were involved in supervision of hand-washing and ensuring discipline among children while hand-washing.

Table 4.52 Water, Sanitation and Hygiene

Observations	N	%
Regular Supply of Drinking Water	30	83.3
Handwashing with soap and water	24	66.7
Majority of the children washing hands with soap	12	33.3
Supervision of handwashing	6	16.7
Dedicated time for handwashing	0	0
Person responsible for supervision of hand washing		
• Teachers	0	0
• Students	6	16.7

Hand-washing with soap

However, allocating dedicated time for handwashing could have been extremely beneficial in guaranteeing effective handwashing with soap among children.

Sitting Arrangement for MDM

- In 27.8% of observations, a designated dining area was observed to be utilized for serving MDM to the children. (Table 4.53)
- Around one fourth of the observations reported that children consumed MDM in an open space/ playground. Children were sitting in a dining area with shade and tiled floor as per 30.6% observations. In more than half visits children were observed to be sitting in corridors for consuming MDM (Table 4.53)

Cleanliness of Dining Area

- Children were sitting on the floor while eating MDM in all the schools. Hence, it is crucial to clean the floor properly before and after serving MDM. Floor was swept as observed in all the visits post MDM. However, in only one fourth observations, cleaning of floor before serving MDM to children was observed. (Table 4.53)
- Mopping the floor before serving MDM was not a common practice as reported in the observations.
- Due to suboptimal cleaning practices, majority of the observations reported presence of dust in the dining area at the time of serving MDM. (Table 4.53)
- Dining area was well lit in all the school as MDM was served in open areas. However, open dining areas were also a reason for present of flies in half (52.8%) of the observations. (Table 4.53)

Serving of MDM

- Responsibility of serving MDM was of MDM helpers in all the schools. In 69.5% of the observations, students were observed to be also involved in serving the meals. (Table 4.54)
- Serving utensils were available in all the schools. One-third observations reported that the helpers took the serving ladles to their home for cleaning. (Table 4.54)

Table 4.53 Observations related to sitting arrangement for MDM

Observation	N	%
Separate dedicated dining area for MDM	10	27.8
Sitting Arrangement:		
• Open space/ Playground	26	72.2
• Shaded sitting area with tiled floor	11	30.6
• Corridor	20	55.6
Cleaning of floor:		
• Before serving MDM	9	25
• After MDM	36	100
Well lit dining area	36	100
Presence of Dust in the dining area	30	83.3
Presence of Files in the dining area	19	52.8

Children consuming Mid Day Meals

Table 4.54 Observation related to serving of MDM

Observation	N	%
Responsibility of Serving MDM		
• MDM Helpers	36	100
• School children	25	69.5
Serving utensils (spoons/ Ladles)		
• School	36	100
• Helper's home	12	33.3
Meals taken out in other vessels for serving	18	50
Meals served to the children are hot	36	100
On demand serving	36	100
Plates		
• Provided from School	12	33.3
• Children bring from home	24	66.7

Serving of MDM by Helpers and Students

- Serving spoons were observed to be of different size in schools. Vessels such as steel jugs were also used in some schools for serving food. Lack of uniformity in size of serving utensils affects serving size being offered to children.
- Food was taken out in other utensils from the tiffins for serving to the children as reported in half of the observations (50%). (Table 4.54) This practice increases the chances of food contamination.
- The meals were hot at the time of serving in all the observations. On demand serving was observed in all the schools. (Table 4.54)

Plates for MDM consumption

- Plates were provided to the children from schools as reported in 33.3% observations. While, in 66.7% observations, children were seen to be bringing plates from home to eat. Providing plates from the school helps spread sense of equality as all the children have same shape and size of plates to eat. It also ensures that all the children have equal opportunity to have meals at the school. Serving size of food doesn't get compromised depending on the size of the plate when all the children get plates from school. However, there is a possibility of compromised cleanliness of the plates as usually children themselves are supposed to wash the plates. Due to irregularity in availability of soap and rush at the washing stations, children may not clean the plates properly. (Table 4.54)

Role of Teachers in execution of MDM at schools

- Presence of teachers at the time of serving MDM was observed in most (97.2%) of the visits. More than two teachers were present at the time of MDM serving in 44.5% observations followed by 30.6% observations where one teacher was present. All the class teachers were present in one-fifth (19.5%) observations. Presence of principal was observed at the time of serving in 38.9% visits. (Table 4.55)

Table 4.55 Role of Teachers in execution of MDM at schools

Observation	N	%
Presence of teachers		
• All Class Teachers	7	19.5
• <2 teachers	16	44.5
• 1 Teacher	11	30.6
• No One	1	2.8
Principal present at the time of serving	14	38.9
Teachers present throughout MDM serving	7	19.5
Motivation of teachers	7	19.5
Tasting of food by teachers	6	16.7
Attendance taken at the time of serving	0	0

Supervision by teachers at the time of serving

- While, teachers were present at the time of serving in majority of the observations, they would leave half-way. Teachers were seen to be present throughout MDM consumption in only 7% observations. It was noted that teachers were seen to be motivating children for consuming the food properly when they were present throughout MDM. (Table 4.55)
- Meals should be tasted by at least one teacher before serving it to the children. It was observed that while the teachers did taste meal in the schools, it was mostly done when the teachers had their lunch; i.e.- after MDM were served. In only 6 (16.7%) observations, tasting was done by teachers before serving MDM to the children. (Table 4.55)
- Attendance of beneficiary at the time of serving MDM was not observed in any of the visits. (Table 4.55)

Management of leftover foods

- Waste-bins for collecting plate waste, were present in all the schools as observed in all the visits. Children were using these bins as recorded in all the observations. However, some of the children were observed to be discarding plate waste in open area near schools in 16.7% visits. (Table 4.56)
- In majority (80.6%) of the observations, left-over foods were seen to be given away to shepherds for cattle feeding. Left-over food that was fit for consumption was also given to village proper as reported in one fifth observations. The left-overs were seen to be discarded in 19.5% observations. (Table 4.56)

PHASE 1 B: EVALUATION OF MDM AT CENTRALISED KITCHEN

The primary function of the Mid Day Meal Program is to provide school children with food supplements in the form of hot cooked meals. The meals are prepared at school in a dedicated kitchen. However, the guidelines of the programme have a provision of involving voluntary (non-Government) organisations for functioning of centralised kitchens in urban areas, where the schools have space constraint. Schools of rural areas with

Table 4.56 Management of leftover foods

Observation	N	%
Plate-waste disposal		
• Disposal bins	36	100
• Open space	6	16.7
Leftover food management		
• Given to village people/ helpers/ children	7	19.5
• Given to shepherds	29	80.6
• Discarded	7	19.5

Disposal of Plate-waste in a bin

good road connectivity can also be covered under these centralised kitchens run by NGO.

Government primary schools in urban Vadodara as well as selected rural areas of Vadodara are provided Mid Day Meal through a centralised kitchen since November 2009. This kitchen is run by The Akshay Patra Foundation (TAPF) under Public Private Partnership. This kitchen is an (ISO 22000:2005) certified kitchen working with six sigma methodology. TAPF kitchen was providing meals to beneficiaries of ICDS programme, patients admitted at a Government hospital and for Shramik Annapurna Yojana in addition to providing meals to MDM beneficiaries in the duration of data collection. Infrastructure and workflow at the centralised kitchen related to the Mid Day Meal Programme are discussed in this section.

The kitchen was divided into different sections dedicated to specific functions such as storage, cold storage room, vegetable processing section, cooking area, vessel washing area, vessel store, dispatch/ loading area, vessel unloading area, boiler section, etc. A vehicle washing area was being used for cleaning the mobile units/ vans. Apart from these, a canteen area, locker rooms (separate for men and women), washrooms as well as leg washing area and hand washing station were available for the staff members. Hand-washing station had paddle operated taps as well as hand driers.

Machines and Equipment

Various machinery and equipment were being used in the centralised kitchen that aid efficient food production with reduced human handling to ensure food safety. (Table 4.57 and Table 4.58)

A rice-cleaning machine was used to clean the rice. This machine had various sorting and cleaning mechanisms, such as sieving mechanism, magnetic rollers, and vibrating trays. This cleaning system removed impurities such as stones, metal particles, insects, dust etc. Two rice silos were available for storage of cleaned rice to preserve the quality of stored grains. In order to sieve wheat flour for making roti and thepla, an electronic sifting machine was used. Electronic dough kneading machines were available for preparing dough for rotis and thepla. These machines had rotating mechanisms, which

Table 4.57 Electronic Machines used in Centralised Kitchen of The Akshay Patra Foundation for Pre-preparation of Meals

Machine	Number
Rice cleaning machine	1
Rice silos	2
Flour sieving machine	1
Dough kneading machines	3
Vegetable cutter	3
Potato peeling machine	2
Wet grinder	1

Table 4.58 Electronic Machines used in Centralised Kitchen of The Akshay Patra Foundation for Cooking Meals

Machine	Number	Fuel used
Roti making machines	2	LPG
Rice cauldrons	7	Steam
Dal cauldrons	5	Steam
Idly making machine	1	Steam
Flour Fryer Machines	2	LPG & Biogas

Rice Cleaning Machine

Rice Inlet of Rice Cleaning Machine

Rice Silo

Flour Sifting Machine

Dough Kneading Machine

Vegetable Cutting Machines

Potato Peeling Machine

Wet Grinder (Batter Machine)

Roti Making Machine

Rice Cauldrons

Dal Cauldrons

Idli Making Machine

Flour Fryer Machine
(Sukhadi, groundnuts and poha)

helped in kneading dough in large quantities in less time. Three dough kneading machines were being used. Potato peeling machines and vegetable cutters were used for preparing vegetables for cooking. One wet grinding machine was being used for preparing batter for idlis.

Roti and thepla were made in a fully automated electronic roti making machine. Two roti making machines were present in the kitchen. One machine had a capacity of preparing 25,000 rotis per hour and the other had a capacity of preparing 40,000 rotis per hour. Rice items and curry based items i.e.- subji, dal and dal dhokali were made in stainless steel cauldrons. An idli-making machine with a capacity of 1200 idlis per hour was being used for cooking idlis. It had conveyer belt like rotating mechanisms, with idli moulds. Steam was used as cooking medium in this machine. Two flour fryer machines were used for preparing breakfast/ snack items. Rotating stirring mechanisms were attached to big vessel for automatic stirring of the contents in the vessel to ensure uniform cooking.

Reverse Osmosis (RO) Plant was available in the kitchen to ensure usage of clean water for preparation of the meals. Steam was used as a main cooking medium in the kitchen. Steam Boilers were available at the centralised kitchen for producing steam. Wood fire was used as fuel in steam boiler. Water softeners were also present in the kitchen. Various other equipment were being used in the kitchen to aid the functioning such as electronic weighing balances, sealing machine for gunny sacks, steam jet sterilisers, food thermometers, etc. Fire extinguishers were also available in the kitchen as a safety measure.

Fuels used for cooking

Steam, LPG and biogas were being used as fuels in the centralised kitchen (Table 4.58). Steam was used for cooking rice, dal, subji and idli. LPG gas was used in the stoves used for tempering as well as roti making machine and flour fryer machine for preparation of snacks. Biogas was used for preparation of snacks.

Steam Boiler

LPG cylinders

Biogas Plant

RO Water purifier

Fire Extinguisher

Sealing Machine

Personal hygiene of staff members

All the staff members were given uniforms. Separate cloak rooms were provided for males and females. All the workers were provided with disposable headgear, gloves and masks. Protective rubber boots along with plastic shoe liners were given to all the staff members working in the cooking area. Workers working in the washing area were provided with plastic aprons. All the staff members were supposed to wash their boots/feet at the leg washing area before entering the kitchen. They were also supposed to wash or sanitize their hands to ensure safe food handling. Posters related to personal hygiene were displayed in the kitchen.

Storage

Separate storage area was available for raw food items. All the cereal grains and pulses were stored in one storage room in different stacks. Raised metal platforms were being used to store the food grains. The grains were stored in their original packaging in which they were procured. Raised metal platforms were placed at least 1.5 feet away from walls. Wheat flour, whole groundnuts, pulses and split pulses (dals) were stored in plastic sacks. Rice was stored in gunnysacks. Oil was stored on the raised platform in metal tins. Salt (in sealed plastic packaging) was stored in a plastic sack. Spices were stored in a separate storage room. Metal racks and raised platforms were used to store spices packed in plastic boxes and packages. Perishable food items i.e.- vegetables were purchased on previous day of cooking. Most of the purchased vegetables were utilised in cooking. If extra vegetables were available, they were stored in a walk-in freezer storage. Potatoes were stored in sacks on raised platforms at room temperature.

Procurement of Raw food items

Cereal grains under Mid Day Meal programme were provided through the nearest FCI godowns in both centralised as well as school level kitchens. All the other food items were purchased by the NGO from local vendors. Perishable items, i.e. vegetables were purchased on a daily basis. Double fortified salt was procured with iron 85 mg per 100 grams and Iodine 15 PPM.

Staff wearing uniforms, headgears, gloves, mask and aprons

Boot Stand

Leg Washing Area

Hand Washing Station

Hand driers

Storage of Grains

Storage of Potatoes

Cold Storage for Vegetables

Storage of oils

Storage of Spices

Preparation

A set flow of work was followed in order to prepare sufficient food to provide meals to all the allotted schools. Raw food items from the storage were issued on the previous day. Cleaning of ingredients and preparation for the meals started around 10:00 AM in the morning on previous day.

Rice was cleaned using a rice cleaning machine. Clean rice was further sent to the rice silos through automatic channels where they were stored at controlled temperature till further use. Whole pulses and dals were cleaned manually by workers. They were sieved and cleaned by hands. Groundnuts, poha and whole spices were also manually cleaned. Pulses, poha and groundnuts were stored in their original packets after cleaning. These packets were resealed to avoid food contamination.

Vegetables were cut on the previous evening from around 7:00 to 7:30 p.m. They were first hand sorted to remove any pieces of vegetables with blemishes or a sign of spoilage. Inedible parts of the vegetables such as stems were removed. The vegetables were then washed using running water followed by cleaning with chlorinated water. Cleaned vegetables were kept in stainless steel containers. Vegetable cutting started on the previous evening around 7:00 to 7:30 p.m. Electronic vegetable cutter/ choppers were cleaned before using. The vegetables were first cut into bigger pieces, which were further put into the cutting machines for cutting smaller pieces. Cut vegetables were kept in closed stainless steel utensils or plastic crates. Potatoes were first washed and peeled in an electronic peeling machine followed by cutting. These potatoes were further cleaned with chlorinated water and then soaked in water in stainless steel containers until further use.

Cleaning of dals

Washing Dal with hot water

Washing of Rice

Cleaning of Groundnuts

Cleaning of dry spices

Sorting and cleaning of chillies

Cleaning of Ginger

Peeling of Potatoes

Cutting Potatoes

Chlorinated water for cleaning vegetables

Washing with Chlorinated water

Storing cut potatoes till further use

Vegetable cutting

Cooking session started around 11:00 to 11:30 p.m. the previous night. All the cauldrons were first sterilized using hot steam. Rice and pulses were washed with running water. Dals were washed with hot water. Pulses were not soaked but used directly for cooking after washing.

Flour was sieved using flour sifting machine. Dough for Roti and Thepla was kneaded in an electric dough making machine. The weight of ingredients for each batch of dough was displayed near the instrument.

Cooking: Actual cooking began after the grains were washed and the dough was prepared. Tempering was the first step of cooking. Tempering for curry based items (dal or subji) as well as rice were prepared first in a big utensil on a stove run with LPG. All the spices were added to oil (or ghee) as per the recipe. The prepared tempering was separated into smaller containers, for each batch of sabji, dal or rice. This was followed by cooking of food items according to the menu.

Rice based items:

- **Pulao:** Whole pulses for pulao were cooked separately and set away before being used in the dish. Washed rice along with vegetables and salt were added to boiling water in cauldrons followed by tempering and pre-cooked pulses.
- **Jeera Rice:** Washed rice, salt and tempering were added to hot water in cauldrons for preparing jeera rice.
- **Khichadi:** In cauldrons, washed rice, dal, salt, and tempering were added to hot water to make khichadi.
- **Chana Rice:** Washed rice, pre boiled chana (whole bengal gram), salt and tempering were added to hot water in cauldrons for preparing chana rice.

Cooked rice was taken out in a food trolley and transferred to the rice tank.

Dal and subji:

- Washed Dal was added to boiling water in the cauldrons with tempering, vegetables and salt. If the recipe called for whole pulses,

they were first separately cooked. Precooked whole pulses were then added to the cauldrons along with other ingredients for cooking.

- Once cooked, the prepared dal or sabji was directly transferred to the daal tank through piped channels.

Roti and thepla:

- Rotis and Thepla were made in roti-making machines. Dough was manually fed into the machine, where it was rolled into dough-sheets of a specific thickness by rollers. These sheets were then passing through cutting rollers, which cut them into rotis. These rotis further went through flames on a conveyor belt and were roasted on both the sides. Fully cooked rotis passed through an oil spray and were collected in a pan. Any rotis with visible defect such as burnt or half cooked rotis were removed by the workers. The prepared rotis, collected in the pans were packed in tiffins.

Dal Dhokali:

- Dough for dhokali was kneaded in the dough-kneading machine.
- It was rolled in the electronic roti machine.
- These sheets were taken to the cutting area where a group of ladies manually cut pieces of dhokali.
- These pieces were then added to the cauldrons along with dal and tempering for cooking.
- The prepared dal dhokali was directly transferred to the daal tank through piped channels.

Breakfast items/snacks: Breakfast/ snacks items were prepared in a designated area in the kitchen. Idli and poha were cooked on the same day of serving. Sukhadi and fried groundnuts were prepared on previous day.

Idli:

- Rice and blackgram dal were soaked for at least 8 hours on the previous day. They were grinded using a wet grinder and the batter was kept for fermentation.

Tempering for dal and rice items

Whole Pulses Cooked Separately

Spices for Thepla/ Dhokali

Dough preared in dough kneading machine

Preparation of Dhokali for Dal Dhokali

- Fermented batter was used for preparing Idli in an electronic Idli making machine in the morning.
- Idlis were sent to the schools on a rotation basis, since the machine was not big enough to produce idlis to provide to all the schools on the same day.

Poha:

- Poha was prepared in the flour fryer machine.
- Tempering was prepared in the flour fryer.
- Cut potatoes and washed poha (flattened rice) were added to the tempering and cooked. Groundnuts were also added to the poha. Prepared poha was packed in stainless steel tiffins.

Sukhadi:

- Ghee and jaggery were heated in the flour fryer machine.
- Wheat flour was added to the flour fryer machine once the jaggery was melted. This mixture was roasted.
- Prepared sukhadi was transferred into big flat pans for setting.
- These pans were kept on metal racks for cooling.
- Sukhadi was cut into pieces once it was cool and set. Prepared sukhadi was weighed and packed in food grade plastic packets.
- These packets were sealed, labelled and stored on metal racks.

Fried Groundnuts:

- Two varieties of fried groundnuts were prepared: whole and split.
- The groundnuts were fried in the flour fryer machine.
- A mix of spices along with sendha Namak (rock salt) was used for seasoning the groundnuts.
- Prepared groundnuts were transferred into big flat pans which were kept on metal racks for cooling.
- These groundnuts were packed in food grade plastic packets, sealed, labelled and stored on metal racks.

Cooking of Breakfast items/ snacks





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Packing:

A route wise list of schools was prepared. The amount of food to be provided to each school was mentioned in the list. The supervisors had one copy of this list. It was also pasted on dal and rice tanks as well as near weighing machines for rotis and snacks.

Food items were packed in stainless steel tiffins of three sizes: small, medium and big. Workers at the dal dispatch area and rice dispatch area had numbers and size of the tiffins to be packed for each route mentioned on the list. Dal and rice were packed in batches and were taken out on hydraulic trolleys for dispatch.

Number of rotis/thepla to be packed for each school were mentioned in the list present near the roti station. Lids of the tiffins were labelled using stickers with name of schools and number of rotis for each school. Calibrated weighing balance was being used at the roti weighing station. A conversion chart of number of rotis to weigh was put up beside the weighing balance. The workers, with the help of the conversion chart, were weighing and packing rotis/thepla for each schools in stainless steel tiffins lined with food grade paper. These tiffins were packed and loaded on a hydrolic trolley for taking them to the dispatch area.

Dispatch and transportation:

Insulated mobile units (vans) were being used for transportation of meal to the schools. These modified mobile units (vans) had inbuilt racks to hold the tiffins in place in order to prevent spillage from the tiffins while transportation. The vans were loaded with tiffins under the guidance of the supervisor. Two employees, including the driver, were allocated for each van. They were handed over a copy of the list in order to ensure proper delivery of food to all the schools on the route. Mid day meals were delivered to the schools by these vans

Cleaning

Whole cooking area in the kitchen was washed thoroughly with soap after the cooking was done and wiped dry. Floors were often cleaned while the cooking

Packing and dispatch of meals

was in process in order to ensure food hygiene. Floor of the vegetable processing area was also washed with soap after vegetable cutting. Store-room floors were swept to maintain cleanliness.

All the cauldrons, tanks, dough making machines, flour fryer machines, Idli making machine were washed with soap. Stainless steel utensils were washed in the washing area by three bucket method, in three sinks. The utensils were rinsed and cleaned to remove any food stuck on the utensils. These utensils were further cleaned with soap in the second sink and thoroughly washed with water in the last sink. These cleaned utensils were sterilized with steam and kept on racks for drying. Washing was done simultaneously with cooking as well as post cooking. All the tiffins returned from the schools were washed by the same process.

Management of leftover foods

Centralised kitchen run by TAPF in Vadodara had a biogas plant. The leftover food items that were received from schools were first weighed when the tiffins were unloaded from the vans. These leftover foods were collected in bins and put into the biogas plant. The bio-gas produced by this plant was used for cooking in the kitchen.

Pest-control

Pest-control was taken care by a company hired on a contract basis. Pest control was done on a daily basis using pesticides. Pesticides were sprayed outside the kitchen and into the drains. Electronic flying insect catchers (6) were fixed at various points in the kitchen and storage area. Rodent batting stations were also installed at various points inside the kitchen and storage area (30) as well as outside the building (16) to prevent entry of rodents.

Cleaning of Machines

Cleaning of Kitchen and Equipment

Washing, steam-sterilising and storing the vessels

Unloading Tiffins from Mobile Units

Cleaning of Mobile Units- Vans

Flying Insects Catcher

Rodent Baiting Station

Pest-control outside kitchen building

Spot observations of functioning of kitchen

Spot observations of functioning of the centralised kitchen were carried out every month for six months.

Basic supplies and Cleanliness:

- The observations showed that adequate supply for cleaning and drinking water for cooking was available in the kitchen. (Table 4.59)
- Proper ventilation was also observed during all the visits. (Table 4.59)
- Adequate level of cleanliness was observed in the kitchen. Presence of dust, flies/insects, or dampness were not observed in the kitchen and stores in any observations. (Table 4.60)

Storage:

- Raw ingredients were systematically stored in closed containers/ sacks on raised platforms, as observed in all the visits.
- Although majority of the food items were stored away from the walls, some packets/ sacks of pulses and potatoes were seen to be touching the walls in two visits. (Table 4.61)

Personal Hygiene:

Personal hygiene of the staff members working in the kitchen is very important for ensuring food safety. Observations (Table 4.62) showed that,

- All the workers were wearing clean uniforms and headgears in the kitchen.
- None of the workers was seen wearing jewelry (chains, rings, bangles etc) in the kitchen.
- They all were practicing appropriate hand hygiene practices in the kitchen.
- Masks and gloves were provided to all the workers. Majority of them were wearing these in the kitchen, as observed during the visits.
- Most of the workers were wearing rubber boots, especially in the kitchen and washing area. Some workers were observed wearing

Table 4.59 Availability of Basic Supplies (N=6)

Running water	***
Drinking water	***
Ventilation	***

* Observed in <3 visits, ** Observed in 3-4 visits, *** Observed in >4 visits

Exhaust Mechanism in the roofs for ventilation

Table 4.60 Cleanliness of kitchen and storage (N=6)

Observations	Cooking area	Storage Area
Presence of dust	-	-
Dampness	-	-
Presence of flies/ insects	-	-
Signs of presence of rodents	-	-
Food sticking in working/ storage area	-	-

* Observed in <3 visits, ** Observed in 3-4 visits, *** Observed in >4 visits

Table 4.61 Observations of Storage (N=6)

Observations	Systematically stored	Stored in close containers/ sacks	Stored on raised platforms/ racks	Stored away from the walls
Cereals	***	***	***	***
Pulses	***	***	***	**
Groundnuts	***	***	***	***
Ghee/ Oil	***	***	***	***
Spices	***	***	***	***
Potatoes	***	***	***	**

* Observed in <3 visits, ** Observed in 3-4 visits, *** Observed in >4 visits

Table 4.62 Personal Hygiene of Staff Members

Observations	
Wearing uniforms	***
Clean clothes	***
Headgears	***
Mask	***
Aprons in washing area	***
Rubber boots in washing and cooking area	***
Gloves	***
Trimmed nails	***
Jewellery/ accessories worn	***
Washing shoes/ legs before entering the kitchen	***
Handwashing with soap before entering the kitchen	***

* Observed in <3 visits, ** Observed in 3-4 visits, *** Observed in >4 visits

footwear other than the rubber boots due to availability issue, in one of the visits. However, they were not allowed to wear outside footwear in the kitchen. Clean footwear were provided to them by TAPF.

Food handling:

- Vegetables were cut into medium size pieces.
- All the vegetables were washed before cutting. Potatoes were washed before and after cutting.
- All the vegetables were washed once with chlorinated water.
- Rice based items and whole pulses were cooked in excess water which was removed after cooking.
- Whole pulses were first separately cooked and then added along with other ingredients of the food item, for cooking.
- Supervisors were doing random check of temperature to ensure that cooking was done at proper temperature. (Table 4.65)

Cleaning of utensils, machines and equipment:

- Utensils were cleaned by three-bucket method followed by steam sterilisation as reported in all the visits. (Table 4.64)
- Lids of the tiffins were arranged in racks after cleaning. All the tiffins were stacked and stored in the vessel store.
- All the machines were cleaned after cooking. Roti making machine was cleaned with the help of vacuum cleaner and blower machine after each use. Removable parts of the machines were removed and washed with the help of soap and water.
- All the machines and equipment such as cauldrons, potato pealing machines, vegetable cutting machines, wet grinding machine, dough kneading machine, flour fryer, idli making machine, dal and rice tanks and stirrers (ladles and spatula) were cleaned with soap and water.

Packing and Dispatch:

A systematic process was followed for packing and dispatch of meals, as observed in all the visits. Followings are the observations (Table 4.66) recorded in all the visits:

Table 4.63 Cleaning of Kitchen Area

Observation	N
Cleaning Floors while Cooking	***
Cleaning of machines post cooking	***
Cleaning the floors post cooking:	***
• Sweeping	***
• Washing	***
• Wiping	***

* Observed in <3 visits, ** Observed in 3-4 visits, *** Observed in >4 visits

Table 4.64 Cleaning of Utensils

Observation	N
Washing with three bucket method	***
Steam sterilised	***
Arranged in racks	***

* Observed in <3 visits, ** Observed in 3-4 visits, *** Observed in >4 visits

Table 4.65 Food Handling at the Centralised Kitchen

Observation	
Cutting of Vegetables (small/ medium/ big)	Medium
Washing Vegetables:	
• Before Cutting	***
• After Cutting	*
Washing vegetables with chlorinated water	***
Cooking rice in excess water	***
Soaking pulses before cooking	-
Cooking whole pulses in excess water	***
Random check of temperature	***

* Observed in <3 visits, ** Observed in 3-4 visits, *** Observed in >4 visits

Temperature check of Food for quality control

Table 4.66 Dispatch of Food

Observation	
Route-wise list referred for dispatch	***
Route-wise list pasted near the tiffin filling spot	***
Containers of roti, thepla and breakfast items labelled	***
Copy of the list handed over to driver/ helper	***
Supervised loading	***
Clean mobile units/ vans	***

* Observed in <3 visits, ** Observed in 3-4 visits, *** Observed in >4 visits

- Route-wise list was pasted near the tiffin filling area, i.e.- dal tank, rice tank and near roti weighing machine.
- A copy of this list was pasted on a wall in the dispatch area to facilitate error free loading.
- Tiffins were loaded under the supervision of supervisors.
- A copy of the list was handed over to driver and helper of each mobile unit to facilitate error free delivery of meals to the schools.

PHASE 1 C: NUTRIENT COMPOSITION AND QUALITY ATTRIBUTES OF MDM

School children studying in Government primary schools are entitled to nutritious safe meals on all the working days in schools under Mid Day Meal programme. This programme works towards promoting education as well as nutritional status of school children of India. Nutrient quality and food safety are important aspects of such large scale food supplementation programmes.

Nutrient analysis of all the food items served by the Centralised kitchen on Vadodara was carried out in this phase. Weekly menu of MDM provided to the schools in study area by the centralised kitchen of TAPF is given in Table 4.67. Supplementary meals provided under MDMP were divided in two meals: breakfast and lunch in Gujarat since 2018. MDM breakfast was given after assembly in the school.

The menu included curry based items (dal and subji), rice based items (jeera rice, chana rice, vegetable pulao, peas pulao and khichadi) as well as roti and thepla. This study was carried out in the year 2018 after the Government implemented the decision of dividing MDM into two meals, i.e. breakfast (to be given at 11:30 AM) and lunch (to be given at 2:00 PM). The NGO was in the process of deciding on a menu of that they could provide through the centralised kitchen. Snacks that could be easily prepared with existing infrastructure were started being given in this duration. Snacks provided in breakfast were fried grounduts, sukhadi, bataka poha and idli.

Nutrient content of food items served in lunch under MDMP are given in Table 4.68 and Table 4.69. Energy content of rice based items ranged from 65 Kcal/

Table 4.67 Weekly Menu of MDM Provided by Centralised Kitchen

Day	Menu
Monday	Mix Dal, Peas Pulao, Roti
Tuesday	Aloo Subji, Jeera Rice, Thepla
Wednesday	Dal Dhokali, Chana Rice
Thursday	Chana Dal, Jeera Rice, Roti
Friday	Mix Veg, Khichadi, Thepla
Saturday	Mix Dal, Veg Pulao, Roti
Daily snacks: Fried Grounduts, Sukhadi, Bataka Poha, Idli (Any one everyday)	

Table 4.68 Nutrient Composition of Food Items Prepared at the Centralised Kitchen- Lunch

Food Item	Energy (Kcal/100 gm)	Carbohydrates (gm/100 gm)	Protein (gm/100 gm)	Fat (gm/100 gm)	Calcium (mg/100 gm)	Iron (mg/100 gm)
Rice Based Items						
Peas Pulao	129	14.19	5.51	5.54	39	0.0089
Jeera Rice	169	28.92	3.13	4.58	11	0.006
Chana Rice	173	21.66	7.38	6.29	9	0.0092
Khichadi	65	6.79	2.61	3.04	15	0.008
Veg Pulao	115	17.61	3.23	3.58	18	0.006
Curry Based Items- Dal and Subji						
Mix Dal	129	1.09	5.18	11.52	19	0.0098
Aloo Subji	37	2.23	2.35	2.05	14	0.006
Dal Dhokali	118	16.35	5.37	3.5	18	0.0009
Chana Dal	38	1.39	4.22	1.76	12	0.008
Mix Veg	49	0.37	2.97	4.02	14	0.008
Roti and Thepla						
Roti	343	60.14	8.51	7.64	22	0.021
Thepla	351	59.17	8.1	9.13	9	0.014

Table 4.69 Nutrient Composition of Food Items Prepared at the Centralised Kitchen- Breakfast

Food Item	Energy (Kcal/100 gm)	Carbohydrates (gm/100 gm)	Protein (gm/100 gm)	Fat (gm/100 gm)	Calcium (mg/100 gm)	Iron (mg/100 gm)
Idli	159	24.32	6.62	3.93	22	0.001
Sukhadi	468	67.94	6.5	18.89	25	0.009
Shingdana	643	17.27	23.89	53.18	50	0.011
Bataka Poha	338	32.25	4.66	21.18	30	1.6
Split Shing	597	31	22.59	42.52	40	1.85

100 gm for khichadi to 173 Kcal/100 gm for chana rice. Jeera rice also had similar calorie content (169 Kcal/100 gm) as chana rice. Peas pulao and vegetable pulao contained 129 Kcal/100 and 115 Kcal/100 gm respectively. Curry based items had lower calories per 100 gm as compared to rice based items and rotis. Aloo subji had the lowest caloric content (37 Kcal/100 gm) followed by chana dal (38 Kcal/100 gm) and mix vegetable (49 Kcal/100 gm). Energy content of mix dal was 129 Kcal/100 gm and that of dal dhokali was 118 Kcal/100 gm. Roti (343.36 Kcal/100 gm) and thepla (351 Kcal/100 gm) provided highest energy among all the food items served in lunch. All the snacks served as MDM breakfast were high calorie foods, except for idlis (159 Kcal/100 gm). Fried groundnuts had the highest calorie content (whole groundnuts-643 Kcal/100 gm and split grounduts-597 Kcal/100 gm)

MDM is supposed to provide good amount of protein in order to meet the nutrient norms of the programme i.e.- 12 gm/day for primary school children and 20 gm/day for upper primary school children. Chana rice provided highest amount of protein per 100 gm (7.38 gm/100 gm) followed by peas pulao (5.51 gm/100 gm). Vegetable pulao (3.23 gm/ 100 gm), jeera rice (3.13 gm/ 100 gm) and Khichadi (2.61 gm/ 100gm) provided similar amount or protein per 100 gm. Fried groundnuts had the highest amount of protein (whole groundnuts- 23.89 gm/ 100 gm and split groundnuts 22.59 gm/ 100 gm) among all the food items served in breakfast and lunch items. Protein content of sukhadi, idli and bataka poha was 6.5 gm/ 100 gm, 6.62 gm/ 100 gm and 4.66 gm/ gm 100 gm.

With respect to fat content, breakfast items had higher fat content per 100 gm (except for idli) as compared to food items served in lunch. Fried ground nuts provided highest fat content per 100 gm (whole- 53.18 gm/ 100 gm and split- 42.52 gm/ 100 gm) among all the food items.

Peas pulao had highest content of calcium (39 mg/ 100 gm) among all the food items of lunch. Calcium content of breakfast items was higher than all the lunch items (other than peas pulao). Highest amount of calcium was present in groundnuts among all the food items. With respect to iron, the food items were not found to be providing good amount of iron.

Microbial Profile of MDM

Food safety is an important aspect of programme implementation in large scale programmes involving food supplementation such as the MDM programme. Various cases of compromised food safety of MDM have been reported in media raising health concern. Government has given guidelines for food safety and hygiene as an effort to address such issues. Periodic microbial assessment of foods have also been incorporated into the programme. Centralised kitchens, where food safety protocols are followed, are believed to be providing foods that are safe for consumption.

Microbial analysis of all the food items served in lunch to the schools in the study area was carried out as an attempt to look at the food safety aspect. Analysis of foods at the time of production and consumption was carried out to see if there were any major changes in the microbial profile of food items which can compromise food safety.

Results of microbial analysis showed that roti, thepla and dal dhokali had higher TPC (total plate count) in general as compared to other food items. Roti and thepla involved some human handling at the time of packing. Rolled dough sheets for dhokali were also handled by people while taking it from the roti machine to processing area and while cutting the sheet into pieces. However, these pieces were cooked with dal at a high temperature after that. Overall, the rice based foods had the least TPC count except for khichadi. Food items containing vegetables such as dal and subji had higher TPC than rice items. It was important to note that the TPC count of all the analysed samples were well within the safe limits. TPC count was reported to have increased at the time of consumption for majority of the food items but it was within the safe limits.

Coliforms (<10 cfu/gm), E. coli (0 MNP/gm), yeast (<10 cfu/gm) and mould (<10 cfu/gm) were within the safe limits for human consumption; both at the time of production and consumption in all the samples.

Thus, results of the microbial analysis showed that food safety was maintained by the centralised kitchen. All the food items were found to be fit for human consumption at the time of production as well as serving.

Table 4.70 Microbial Profile of Thepla at the time of Production and Serving

Thepla		TPC (CFU/gm)	Coliform (CFU/gm)	E.Coli (MPN/gm)	Yeast (CFU/gm)	Mould (CFU/gm)	pH
School 1	Production	$5X10^1$	<10	0	<10	<10	3.78
	Serving	$1.3X10^2$	<10	0	<10	<10	3.5
School 2	Production	<10	<10	0	<10	<10	3.51
	Serving	$3.0X10^2$	<10	0	<10	<10	3.56
School 3	Production	$3.5X10^1$	<10	0	<10	<10	3.65
	Serving	$5X10^1$	<10	0	<10	<10	3.69

Table 4.71 Microbial Profile of Roti at the time of Production and Serving

Roti		TPC (CFU/gm)	Coliform (CFU/gm)	E.Coli (MPN/gm)	Yeast (CFU/gm)	Mould (CFU/gm)	pH
School 1	Production	$5.5X10^1$	<10	0	<10	<10	3.21
	Serving	$2.5X10^2$	<10	0	<10	<10	3.24
School 2	Production	$3.5X10^1$	<10	0	<10	<10	3.54
	Serving	$9.6X10^2$	<10	0	<10	<10	3.61
School 3	Production	$9X10^1$	<10	0	<10	<10	3.25
	Serving	$7.7X10^2$	<10	0	<10	<10	3.24

Table 4.72 Microbial Profile of Dal Dhokali at the time of Production and Serving

Dal Dhokali		TPC (CFU/gm)	Coliform (CFU/gm)	E.Coli (MPN/gm)	Yeast (CFU/gm)	Mould (CFU/gm)	pH
School 1	Production	$3.3X10^2$	<10	0	<10	<10	3.77
	Serving	$7.1X10^3$	<10	0	<10	<10	3.85
School 2	Production	$4.1X10^2$	<10	0	<10	<10	4.76
	Serving	$4.9X10^2$	<10	0	<10	<10	4.78
School 3	Production	$1.3X10^2$	<10	0	<10	<10	4.79
	Serving	$2.1X10^2$	<10	0	<10	<10	4.68

Table 4.73 Microbial Profile of Mix Dal at the time of Production and Serving

Mix Dal		TPC (CFU/gm)	Coliform (CFU/gm)	E.Coli (MPN/gm)	Yeast (CFU/gm)	Mould (CFU/gm)	pH
School 1	Production	<10	<10	0	<10	<10	3.42
	Serving	<10	<10	0	<10	<10	3.26
School 2	Production	$2.5X10^3$	<10	0	<10	<10	4.73
	Serving	$5.1X10^3$	<10	0	<10	<10	4.77
School 3	Production	$1.1X10^3$	<10	0	<10	<10	4.71
	Serving	$1.5X10^3$	<10	0	<10	<10	4.65

Table 4.74 Microbial Profile of Chana Dal at the time of Production and Serving

Chana Dal		TPC (CFU/gm)	Coliform (CFU/gm)	E.Coli (MPN/gm)	Yeast (CFU/gm)	Mould (CFU/gm)	pH
School 1	Production	$2X10^1$	<10	0	<10	<10	3.56
	Serving	$1.4X10^2$	<10	0	<10	<10	3.51
School 2	Production	<10	<10	0	<10	<10	4.13
	Serving	<10	<10	0	<10	<10	4.14
School 3	Production	$7.5X10^1$	<10	0	<10	<10	3.61
	Serving	$3.2X10^2$	<10	0	<10	<10	3.51

Table 4.75 Microbial Profile of Aloo Subji at the time of Production and Serving

Aloo Subji		TPC (CFU/gm)	Coliform (CFU/gm)	E.Coli (MPN/gm)	Yeast (CFU/gm)	Mould (CFU/gm)	pH
School 1	Production	$2X10^1$	<10	0	<10	<10	2.51
	Serving	$4X10^1$	<10	0	<10	<10	3.18
School 2	Production	$3.5X10^1$	<10	0	<10	<10	4.14
	Serving	$9X10^1$	<10	0	<10	<10	4.13
School 3	Production	$1.5X10^2$	<10	0	<10	<10	4.15
	Serving	$1.9X10^2$	<10	0	<10	<10	4.16

Table 4.76 Microbial Profile of Mix Subji at the time of Production and Serving

Mix Subji		TPC (CFU/gm)	Coliform (CFU/gm)	E.Coli (MPN/gm)	Yeast (CFU/gm)	Mould (CFU/gm)	pH
School 1	Production	$3X10^1$	<10	0	<10	<10	2.34
	Serving	$4.5X10^1$	<10	0	<10	<10	2.91
School 2	Production	$2.3X10^2$	<10	0	<10	<10	4.37
	Serving	$5.8X10^2$	<10	0	<10	<10	4.35
School 3	Production	$1.2X10^2$	<10	0	<10	<10	4.27
	Serving	$5.4X10^2$	<10	0	<10	<10	4.15

Table 4.77 Microbial Profile of Jeera Rice at the time of Production and Serving

Jeera Rice		TPC (CFU/gm)	Coliform (CFU/gm)	E.Coli (MPN/gm)	Yeast (CFU/gm)	Mould (CFU/gm)	pH
School 1	Production	<10	<10	0	<10	<10	4.03
	Serving	<10	<10	0	<10	<10	4.32
School 2	Production	<10	<10	0	<10	<10	5.03
	Serving	<10	<10	0	<10	<10	4.48
School 3	Production	<10	<10	0	<10	<10	4.73
	Serving	<10	<10	0	<10	<10	5.13

Table 4.78 Microbial Profile of Chana Rice at the time of Production and Serving

Chana Rice		TPC (CFU/gm)	Coliform (CFU/gm)	E.Coli (MPN/gm)	Yeast (CFU/gm)	Mould (CFU/gm)	pH
School 1	Production	<10	<10	0	<10	<10	4.5
	Serving	<10	<10	0	<10	<10	4.31
School 2	Production	<10	<10	0	<10	<10	4.64
	Serving	<10	<10	0	<10	<10	4.14
School 3	Production	<10	<10	0	<10	<10	4.85
	Serving	<10	<10	0	<10	<10	4.93

Table 4.79 Microbial Profile of Khichadi at the time of Production and Serving

Khichadi		TPC (CFU/gm)	Coliform (CFU/gm)	E.Coli (MPN/gm)	Yeast (CFU/gm)	Mould (CFU/gm)	pH
School 1	Production	$7.6X10^2$	<10	0	<10	<10	3.84
	Serving	$1.2X10^3$	<10	0	<10	<10	4.08
School 2	Production	$6X10^1$	<10	0	<10	<10	4.98
	Serving	$4.4X10^2$	<10	0	<10	<10	4.97
School 3	Production	<10	<10	0	<10	<10	4.85
	Serving	<10	<10	0	<10	<10	4.79

Table 4.80 Microbial Profile of Vegetable Pulao at the time of Production and Serving

Vegetable Pulao		TPC (CFU/gm)	Coliform (CFU/gm)	E.Coli (MPN/gm)	Yeast (CFU/gm)	Mould (CFU/gm)	pH
School 1	Production	<10	<10	0	<10	<10	3.8
	Serving	<10	<10	0	<10	<10	3.87
School 2	Production	<10	<10	0	<10	<10	4.8
	Serving	$9X10^1$	<10	0	<10	<10	4.77
School 3	Production	<10	<10	0	<10	<10	3.8
	Serving	<10	<10	0	<10	<10	3.87

Table 4.81 Microbial Profile of Peas Pulao at the time of Production and Serving

Peas Pulao		TPC (CFU/gm)	Coliform (CFU/gm)	E.Coli (MPN/gm)	Yeast (CFU/gm)	Mould (CFU/gm)	pH
School 1	Production	<10	<10	0	<10	<10	3.22
	Serving	<10	<10	0	<10	<10	3.87
School 2	Production	<10	<10	0	<10	<10	4.65
	Serving	$5.2X10^2$	<10	0	<10	<10	4.54
School 3	Production	<10	<10	0	<10	<10	4.93
	Serving	<10	<10	0	<10	<10	4.87

PHASE II: IMPACT OF NUTRITION HEALTH EDUCATION ON NUTRITIONAL STATUS OF MODERATE AND SEVERELY UNDERNOURISHED UPPER PRIMARY SCHOOL CHILDREN OF RURAL VADODARA

Phase two of the study was an intervention phase. In this phase, six schools from the 47 Government Primary schools of villages in petrochemicals area of Vadodara block were selected. List of schools selected for this phase is given in Table 4.82. All the six schools were co-ed with both primary and upper primary sections. This phase was also conducted on children studying in 5^{th} to 8^{th} standard. All the six schools had facilities such as drinking water stations, separate hand-washing stations and separate washrooms for boys and girls. Water purifier such as RO plants were available in five of the six selected schools. Only one school had a separate dedicated dining area, however it was not being used for serving MDM. Open space (2 schools), playground (2 schools) and corridor (2 schools) were used as dining areas for MDM. (Table 4.83)

PHASE 2 A: SCREENING OF STUDENTS FOR THINNESS

Phase 2 A was the screening phase. Anthropometric screening was done on all the children studying in standard 5^{th} to standard 8^{th} of selected schools. The children were classified into categories of malnutrition using WHO 2007 growth reference standards. The mean weight, height and BMI of children were 29.6±7.6 Kg, 138.1±10.2 cm and 15.3±2.4 Kg/m^2. No gender wise difference was observed in the mean anthropometric measurements of children. (Table 4.84) School wise data showed that the mean anthropometric measurements of children were comparable in all the selected schools. (Table 4.85) A total of 151 children were below the age of 10 years. Weight for age data showed that 43% of these children were underweight with higher prevalence among girls (46.9%) as compared to boys (38.6%). (Figure 4.6) Prevalence of moderate underweight (WAZ: -3SD to -2SD) severe underweight (WAZ<-3SD) among children was 25.8% and 17.2% respectively.

Table 4.82 Lists of Schools Selected from Rural Industrial area of Vadodara (Phase Two)

NO.	SCHOOL
1	Karodiya Prathamik Shala No 1
2	Karodiya Prathamik Shala No 2
3	Bajwa Prathamik Shala No 1
4	Bajwa Prathamik Shala No 2
5	Indira Nagar Prathamik Shala, Dashrath
6	Karachiya Prathamik Shala

Table 4.83 Infrastructure and Facilities at the Schools Selected in Phase 2 of the study

Variable	N	%
Number of classrooms		
• <8	1	16.7
• >8	5	83.3
Playground	6	100
Drinking water facility	6	100
Water Purifier for Drinking Water	5	83.3
Separate Hand-washing Station	6	100
Separate Washrooms for Girls and Boys	6	100
Separate space for dining	1	16.7
MDM Serving Area:		
• Open Space	2	33.3
• Play Ground	2	33.3
• Corridor	2	33.3

Table 4.84 Genderwise mean anthropometric measurements (N=933) (Screening)

	Age (Year)		Weight (kg)		Height (cm)		BMI (kg/m^2)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Male	11.9	1.7	29.7	7.7	138.2	10.9	15.3	2.3
Female	11.5	1.5	29.6	7.5	138.0	9.5	15.3	2.5
Total	11.7	1.6	29.6	7.6	138.1	10.2	15.3	2.4

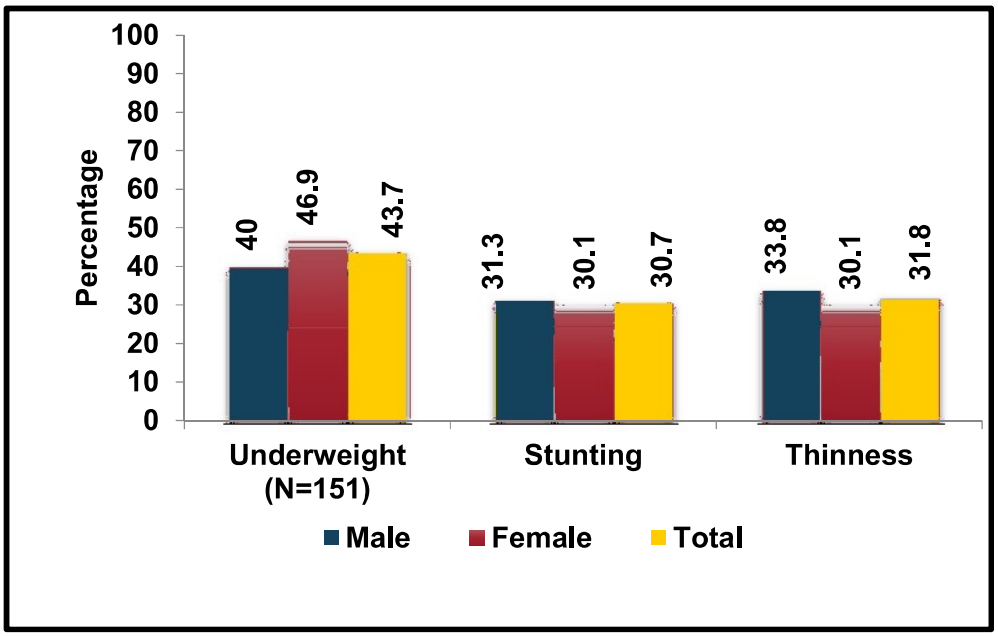
Table 4.85 Mean anthropometric measurements across the schools (N=933) (Screening)

	Age (Year)		Weight (kg)		Height (cm)		BMI (kg/m^2)	
School	Mean	SD	Mean	SD	Mean	SD	Mean	SD
E1	11.7	1.5	29.0	7.2	138.6	9.5	14.9	2.0
E2	11.8	1.8	29.4	7.5	138.6	11.5	15.1	2.2
E3	11.6	2.0	29.0	7.4	136.6	10.2	15.4	2.5
C1	11.8	1.5	31.5	8.6	139.0	9.8	16.1	2.9
C2	11.7	1.5	28.9	6.6	137.2	10.2	15.2	2.3
C3	11.6	1.7	29.3	7.1	137.2	10.6	15.4	2.0
Total	11.7	1.6	29.6	7.6	138.1	10.2	15.3	2.4

Table 4.86 Gender wise Mean anthropometric indices (Screening)

	Male (N=441)		Female (N=492)		Total (N=933)	
	Mean	SD	Mean	SD	Mean	SD
Male	-1.8	1.1	-1.6	1.1	-1.6	1.3
Female	-1.7	1.5	-1.4	1.3	-1.4	1.3
Total	-1.8	1.3	-1.5	1.2	-1.5	1.3

Figure 4.6 Gender wise Prevalence of Undernutritoin among Children (N=933) (Screening)



There was no gender wise difference in the prevalence of moderate underweight. Severe underweight was higher amongst girls (21%) than boys (12.9%). (Table 4.87)

Prevalence of Stunting was 31.9% among children with no significant difference between boys and girls. (Figure 4.6) One fourth (25.4%) of the children were moderately stunted (HAZ: -3 SD to -2 SD). There was no gender wise difference in moderate stunting. A total of 6.5% children were severely stunted (HAZ <-3SD). Severe stunting was higher (7%) among boys as compared to girls (6.1%). However, this difference was not statistically significant. (Table 4.89)

Almost one third (34%) of the children were found to be thin (BAZ<-2SD) with 37.2% boys and 31.1% girls being thin. (Figure 4.6) Prevalence of moderate thinness (BAZ: -3 SD to -2 SD) was 20.6% with no gender wise difference. Severe thinness was reported to be 13.4%. It was higher among boys (15.9%) than girls (11.2%). The BAZ data revealed that 3.6% children were overweight and obese. (Table 4.91)

Anthropometric Profile of Thin Children at Baseline

Anthropometric assessment was explored on all thin children (N=310). (Table 4.93) Mean weight of thin children was 25.5±4.9 Kg. It was slightly higher among boys as compared to girls but this difference was not statistically significant. Age wise data also showed no significant difference in the mean weights of boys and girls. (Table 4.94) Mean height was 137.1±9.7 cm among subjects. There was no gender wise difference in the mean height among children across the age groups. (Table 4.95) Body Mass Index was 13.4±1 Kg/m^2 for the thin children enrolled. It was slightly higher among boys than girls. This difference was not statistically significant. However, age wise data showed that boys (13.5±0.7 Kg/m^2) had significantly ($p<0.05$) higher BMI than girls (13.1±0.6 Kg/m^2) at 11 years of age. (Table 4.96)

Data on underweight among thin children below 10 years of age (N=42) revealed that majority of them were underweight (88.1%). All the severely thin children were underweight, too. (Table 4.97, Figure 4.7) Data on height for age among thin children revealed that 41% of thin children were stunted, with

Table 4.87 Gender wise Prevalence of Underweight among Children <10 years of Age (Screening)

	Male (N=70)		Female (N=81)		Total (N=151)	
	n	%	n	%	n	%
Normal	43.0	61.4	43.0	53.1	86.0	57.0
Severe Underweight	9.0	12.9	17.0	21.0	26.0	17.2
Underweight	18.0	25.7	21.0	25.9	39.0	25.8

Table 4.88 School wise Prevalence of Underweight among Children <10 years of Age (N= 151) (Screening)

School	Normal		Underweight		Severe Underweight	
	n	%	n	%	n	%
E1	20.0	55.6	9.0	25.0	7.0	19.4
E2	17.0	51.5	9.0	27.3	7.0	21.2
E3	7.0	41.2	5.0	29.4	5.0	29.4
C1	23.0	76.7	6.0	20.0	1.0	3.3
C2	13.0	61.9	5.0	23.8	3.0	14.3
C3	6.0	42.9	5.0	35.7	3.0	21.4
Total	86.0	57.0	39.0	25.8	26.0	17.2

Table 4.89 Gender wise Prevalence of Stunting among Children (Screening)

	Male (N=441)		Female (N=492)		Total (N=933)	
	n	%	n	%	n	%
Normal	297.0	67.3	338.0	68.7	635.0	68.1
Stunted	113.0	25.6	124.0	25.2	237.0	25.4
Severely Stunted	31.0	7.0	30.0	6.1	61.0	6.5

Table 4.90 School wise Prevalence of Stunting among Children (N=933) (Screening)

School	Normal		Stunted		Severely Stunted	
	n	%	n	%	n	%
E1	168.0	72.4	52.0	22.4	12.0	5.2
E2	102.0	66.7	41.0	26.8	10.0	6.5
E3	64.0	70.3	23.0	25.3	4.0	4.4
C1	154.0	72.3	46.0	21.6	13.0	6.1
C2	89.0	57.8	52.0	33.8	13.0	8.4
C3	58.0	64.4	23.0	25.6	9.0	10.0
Total	635.0	68.1	237.0	25.4	61.0	6.5

Table 4.91 Gender wise Prevalence of Thinness, Overweight and Obesity among Children (Screening)

	Male (N=441)		Female (N=492)		Total (N=933)	
	n	%	n	%	n	%
Severely Thin	70.0	15.9	55.0	11.2	125.0	13.4
Thin	94.0	21.3	98.0	19.9	192.0	20.6
Normal	260.0	59.0	323.0	65.7	583.0	62.5
Obese	5.0	1.1	4.0	0.8	9.0	1.0
Overweight	12.0	2.7	12.0	2.4	24.0	2.6

Table 4.92 School wise Prevalence of Thinness, Overweight and Obesity among Children (N=933) (Screening)

School	Severely Thin		Thin		Normal		Overweight		Obesity	
	n	%	n	%	n	%	n	%	n	%
E1	27.0	17.6	33.0	21.6	88.0	57.5	4.0	2.6	1.0	0.7
E2	6.0	6.6	25.0	27.5	56.0	61.5	3.0	3.3	1.0	1.1
E3	21.0	13.6	32.0	20.8	98.0	63.6	2.0	1.3	1.0	0.6
C1	13.0	14.4	11.0	12.2	64.0	71.1	2.0	2.2	0.0	0.0
C2	43.0	18.5	51.0	22.0	136.0	58.6	1.0	0.4	1.0	0.4
C3	15.0	7.0	40.0	18.8	141.0	66.2	12.0	5.6	5.0	2.3
Total	125.0	13.4	192.0	20.6	583.0	62.5	24.0	2.6	9.0	1.0

Table 4.93 Population Covered for Data Collection

	TOTAL NUMBER OF SUBJECTS
Boys (Screening)	441
Girls (Screening)	492
Total Enrolled children- Screening	933
Total thin children (BAZ<-2SD)	317
Total children enrolled for anthropometric data	310
Number of children enrolled for pre data collection	308

Table 4.94 Mean Weight (Kg) of the Moderate and Severely Thin Children Cross Tabulated by Age and Sex

	Male (N=160)		Female (N=150)		Total (N=310)		't' test	p
	Mean	SD	Mean	SD	Mean	SD		
9.0	20.5	3.2	19.7	1.7	20.1	2.5	0.379	0.8170
10.0	21.8	2.7	21.7	2.4	21.7	2.5	0.822	0.1455
11.0	24.1	2.3	24.4	3.5	24.3	3.0	0.714	-0.2789
12.0	26.9	3.0	27.1	4.0	27.0	3.4	0.849	-0.1413
13.0	28.3	3.8	29.6	4.0	28.8	3.9	0.245	-1.2798
14.0	32.7	2.3	33.9	3.0	33.0	2.4	0.433	-1.2083
15.0	37.4	5.4	29.0	5.7	35.0	6.4	0.198	7.3571
16.0	42.5	-	-	-	42.5	-	-	-
17.0	32.5	4.9	-	-	32.5	4.9	-	-
18.0	35.5	-	-	-	35.5	-	-	-
Total	26.1	5.1	24.8	4.7	25.5	4.9		

Table 4.95 Mean Height (cm) of the Moderate and Severely Thin Children Cross Tabulated by Age and Sex

	Male (N=160)		Female (N=150)		Total (N=310)		't' test	p
	Mean	SD	Mean	SD	Mean	SD		
9.0	126.5	7.4	127.1	5.5	126.8	6.3	-0.255	0.801
10.0	129.5	6.0	129.8	6.0	129.7	6.0	-0.226	0.822
11.0	133.7	5.6	136.0	7.9	135.0	7.0	-1.332	0.188
12.0	140.5	6.8	141.5	7.8	140.9	7.3	-0.734	0.465
13.0	141.7	7.8	145.3	6.0	143.2	7.3	-1.509	0.139
14.0	151.4	3.6	150.7	6.1	151.2	4.3	0.286	0.780
15.0	155.6	11.0	140.5	11.6	151.3	12.5	1.702	0.133
16.0	160.6	-	-	-	160.6	-	-	-
17.0	142.6	7.8	-	-	142.6	7.8	-	-
18.0	150.5	-	-	-	150.5	-	-	-
Total	137.7	9.9	136.5	9.4	137.1	9.7		

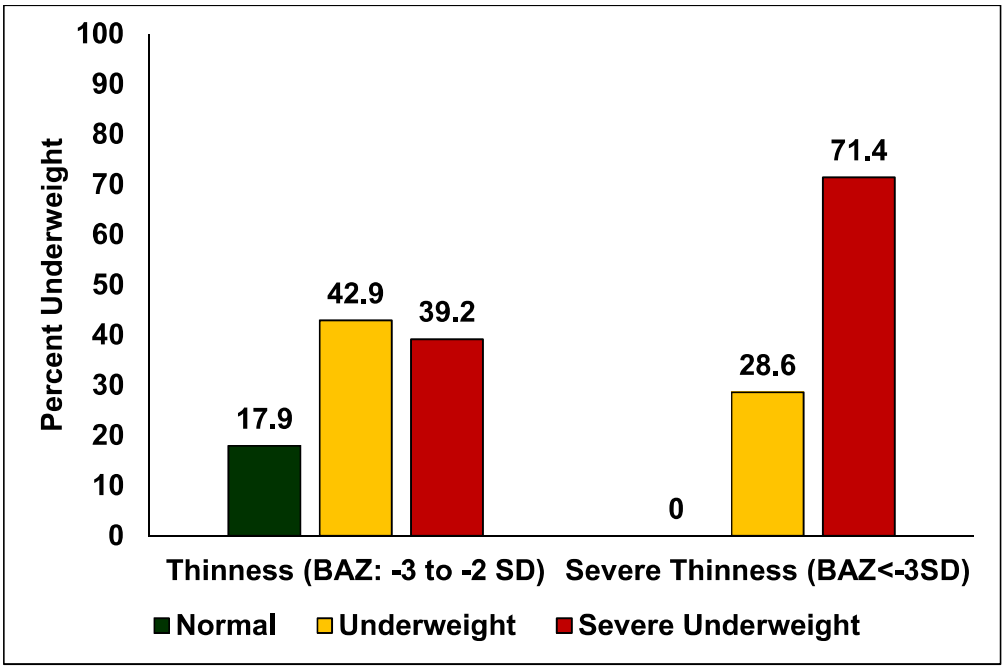
Table 4.96 Mean BMI (Kg/m2) of the Moderate and Severely Undernourished Children Cross Tabulated by Age and Sex

	Male (N=160)		Female (N=150)		Total (N=310)		't' test	p
	Mean	SD	Mean	SD	Mean	SD		
9.0	12.8	0.7	12.2	0.8	12.5	0.8	1.876	0.071
10.0	13.0	0.6	12.8	0.6	12.9	0.6	0.862	0.392
11.0	13.5	0.7	13.1	0.6	13.3	0.7	2.229	0.030
12.0	13.6	0.6	13.5	0.8	13.5	0.7	1.307	0.195
13.0	14.0	0.7	13.9	1.0	14.0	0.8	-0.104	0.918
14.0	14.2	0.7	14.9	0.7	14.4	0.7	-1.617	0.134
15.0	15.4	0.7	14.6	0.5	15.2	0.7	0.322	0.757
16.0	16.5	-	-	-	16.5	-	-	-
17.0	15.9	0.7	-	-	15.9	0.7	-	-
18.0	15.7	-	-	-	15.7	-	-	-
Total	13.6	0.9	13.2	0.9	13.4	1.0		

Table 4.97 Prevalence of Underweight in Moderate and Severely Thin Children (<10 Years of age) (N=42)

Nutritional Status	Severe Underweight (WAZ<-3 SD)		Moderate Underweight (WAZ:-3SD to -2 SD)		Normal (WAZ≥-2 SD)	
	n	%	n	%	n	%
Thinness (BAZ: -3SD to -2 SD)	11	39.3	12	42.9	5	17.9
Severe Thinness (BAZ<-3 SD)	10	71.4	4	28.6	0	0
Total	21	50.0	16	38.1	5	11.9

Figure 4.7 Prevalence of Underweight among Thin and Severely Thin Children (<10 Years of age) (N=42)



33.8% of moderately thin and 52.1% severely thin children being stunted. (Table 4.98 and Figure 4.8)

Socio Economic Background of Thin Children

Data on socio demographic background of thin children showed that majority of the children were Hindus (90.6%) with only 9.1% and 0.3% being Muslim and Christian respectively. Higher number of Muslim students were reported in control group as compared to experimental group. Amongst the children, majority (41.6%) were from general category, followed by OBC (25.0%), SC (18.8%) and ST (14.6%) categories. Higher number of OBC children were present in control group and higher number of SC children were present in experimental group. (Table 4.99)

Data on family structure of thin children showed that half of the children (51.9%) were from nuclear family followed by extended nuclear family (28.6%). Most of the children had families with <6 (46.4%) and 6-10 (43.8%) members. (Table 4.99)

Data on education of parents showed that 22.4% mothers and only 5.5% of the fathers were illiterate. Thus, the illiteracy levels were much higher among mothers as compared to fathers. Majority (42.2%) of the fathers had studied till primary level followed by one fourth (25.3%) who had studied upto secondary section (8^{th}-9^{th} standards). In contrast to this, half of the mothers (51.3%) had left studies while or after primary schooling (1^{st} to 7^{th} standard). Only 13.3% mothers had studied up to secondary section of schooling. Thus, fathers of the children had a better educational status as compared to mothers. (Table 4.100)

According to the data on occupation of the parents of thin children, majority (42.2%) of the fathers were working as salaried employees. This included service in industries and other sectors as well as salaried drivers. One third (33.8%) of the fathers were working as daily wage labourers. Almost half of the mothers were reported to be home makers (53.9%) followed by self-employed (13.3%) and daily wage labourers (10.4%). (Table 4.101)

Table 4.98 Prevalence of Stunting in Moderate and Severely Thin Children (N=310)

Nutritional Status	Severe Stunting (HAZ<-3 SD)		Stunting (HAZ:-3SD to -2 SD)		Normal (HAZ≥-2SD)	
	n	%	n	%	n	%
Thinness (BAZ: -3SD to -2 SD)	11	5.8	53	28.1	125	66.1
Severe Thinness (BAZ<-3 SD)	20	16.5	43	35.6	58	47.9
Total	31	10.0	96	31.0	183	59.0

Figure 4.8 Prevalence of Stunting among Thin and Severely Thin Children (N=310)

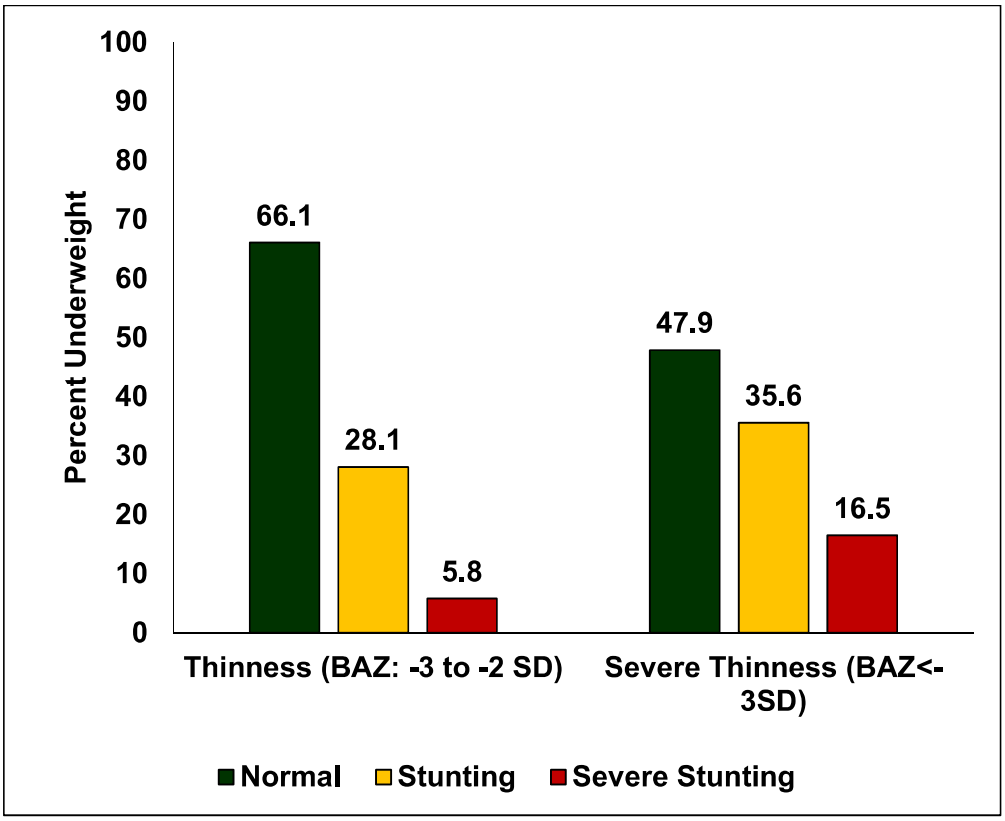


Table 4.99 Socio Demographic Background of Thin Children across the Study Groups

	Control (N=125)		Experimental (N=183)		Total (N=308)	
	N	%	N	%	N	%
Religion						
Hindu	99	79.2	180	98.4	279	90.6
Muslim	26	20.8	2	1.1	28	9.1
Sikh	0	0.0	1	0.5	1	0.3
Caste						
General	49	39.2	79	43.2	128	41.6
OBC	40	32.0	37	20.2	77	25.0
SC	16	12.8	42	23.0	58	18.8
ST	20	16.0	25	13.7	45	14.6
Type of Family						
Nuclear	64	51.2	96	52.5	160	51.9
Extended Nuclear	32	25.6	56	30.6	88	28.6
Joint	20	16.0	23	12.6	43	14.0
No answer	9	7.2	8	4.4	17	5.5
Number of Family Members						
<6	57	45.6	86	47.0	143	46.4
6-10	52	41.6	83	45.4	135	43.8
11-15	2	1.6	4	2.2	6	1.9
15-18	0	0.0	1	0.5	1	0.3
No Answer	14	11.2	9	4.9	23	7.5

Table 4.100 Education of Parents of Thin Children across the Study Groups

	Control (N=125)		Experimental (N=183)		Total (N=308)	
	N	%	N	%	N	%
Father's Education						
Illiterate	5	4.0	12	6.6	17	5.5
Primary	58	46.4	72	39.3	130	42.2
Secondary	29	23.2	49	26.8	78	25.3
SSC	17	13.6	30	16.4	47	15.3
HSC	3	2.4	9	4.9	12	3.9
Graduate and above	1	0.8	0	0.0	1	0.3
Father no more	2	1.6	4	2.2	6	1.9
No answer	10	8.0	7	3.8	17	5.5
Mother's Education						
Illiterate	22	17.6	47	25.7	69	22.4
Primary	69	55.2	89	48.6	158	51.3
Secondary	18	14.4	23	12.6	41	13.3
SSC	4	3.2	12	6.6	16	5.2
HSC	0	0.0	1	0.5	1	0.3
Graduate and above	0	0	0	0	0	0
Mother no more	2	1.6	2	1.1	4	1.3
No answer	10	8.0	9	4.9	19	6.2

Table 4.101 Occupation of Parents of Thin Children across the Study Groups

	Control (N=125)		Experimental (N=183)		Total (N=308)	
	N	%	N	%	N	%
Father's Occupation						
Salaried employee	54	43.2	76	41.5	130	42.2
Daily wage labourers	39	31.2	65	35.5	104	33.8
Farming/ Animal Husbandry	3	2.4	7	3.8	10	3.2
Self employed	14	11.2	11	6.0	25	8.1
Unemployed	3	2.4	7	3.8	10	3.2
Father passed away	2	1.6	7	3.8	9	2.9
No answer	10	8.0	10	5.5	20	6.5
Mother's Occupation						
Housewife	62	49.6	104	56.8	166	53.9
Daily wage labourers	14	11.2	18	9.8	32	10.4
Domestic workers	6	4.8	14	7.7	20	6.5
Salaried employee	9	7.2	12	6.6	21	6.8
Self employed	20	16.0	21	11.5	41	13.3
Mother Passed away	2	1.6	2	1.1	4	1.3
No answer	12	9.6	12	6.6	24	7.8

Total monthly family income of the children's parents was categorised according to revised Kuppuswamy classification for the year 2019 (Dalvi et al. 2020). The data showed that majority of thin children had monthly family income of 2555-7587 INR. (Figure 4.9). Data on per capita income (Figure 4.10) showed that majority of the children belonged to lower income class (43.8%) and lower middle income class (36.7%) families based on per capita income according to the revised B G Prasad classification for 2019. Data related to family income across the study groups showed no difference between control and experimental group. (Table 4.102)

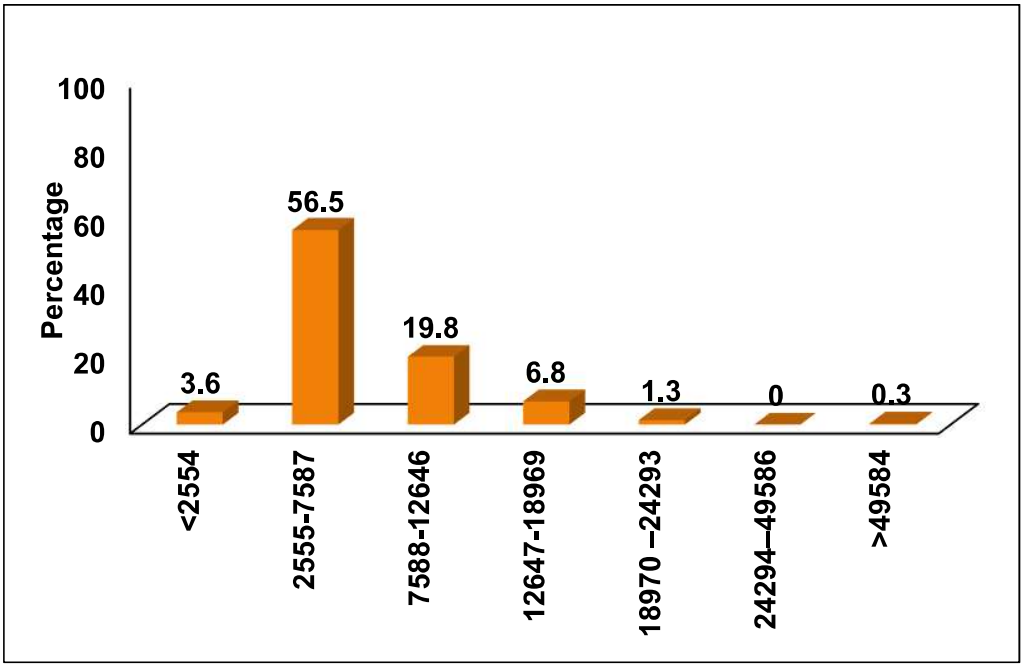
Hemoglobin status and anemia among thin children

Iron deficiency and anaemia among children of this age group are considered to be major nutrition related problems. Iron deficiency anemia among adolescents, both boys and girls, is one of the top global contributors to morbidities among 10-14 years old children. (WHO 2019, UNICEF 2020)

Estimation of hemoglobin levels among thin children were carried out to measure anemia among them. Separate consent was taken for collection of blood samples for hemoglobin estimations. Blood samples were collected only from those children whose parents gave written consent for it. Children were allowed to opt out from blood sample collection any time during the study. The estimation was done for a total of 155 thin children, at baseline.

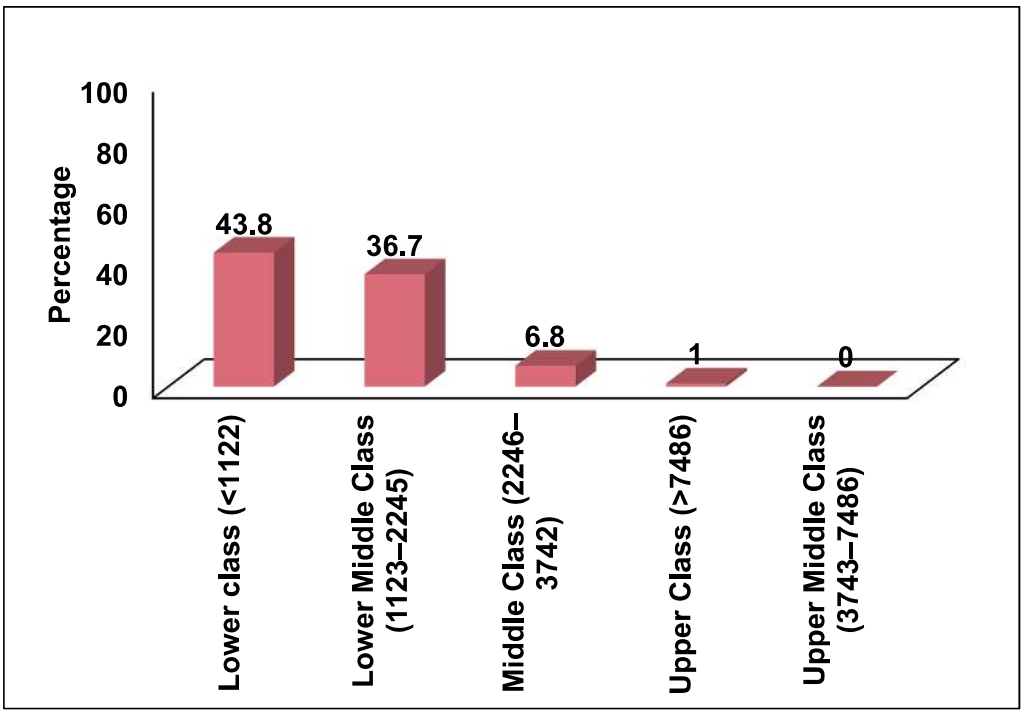
Mean hemoglobin levels among subjects were 11.5±1.4 g/dl. No difference was reported in the mean hemoglobin of boys (11.7±1.3 g/dl) and girls (11.3±11.5 g/dl). Children were classified into categories of anemia using WHO 2011 cut-offs. The results revealed that nearly 49.7% children were anemic with higher prevalence (63%) among girls than boys (46.1%). Almost one fourth of the children were mildly anemic (23.9%) and moderately anemic (23.9%). Severe anemia was reported in 1.9% children. Mild anemia was more among boys compared to girls (25% vs 22.8%) where as more girls had moderate (27.9% vs 19.7%) and severe anemia (2.5% vs 1.3%) than boys. However, these differences were not found to be statistically significant. (Table 4.103). Severe anemic children were referred to PHC.

Figure 4.9 Monthly Family Income* (INR) of Thin Children



* Categories According to Revised Kuppuswamy classification for the year 2019 (Dalvi et al. 2020)

Figure 4.10 Monthly Family Per Capita Income* (INR) of Thin Children



* According to Revised B G Prasad's classification of SES for 2019 (Dalvi et al. 2020)

Table 4.102 Family Income of Thin Children across the Study Groups

	Control (N=125)		Experimental (N=183)		Total (N=308)	
	N	%	N	%	N	%
Total Family Income (INR)						
<2554	9	7.2	2	1.1	11	3.6
2555-7587	66	52.8	108	59.0	174	56.5
7588-12646	23	18.4	38	20.8	61	19.8
12647-18969	5	4.0	16	8.7	21	6.8
18970 –24293	2	1.6	2	1.1	4	1.3
24294–49586	0	0	0	0	0	0
>49584	1	0.8	0	0.0	1	0.3
Don't Know	19	15.2	17	9.3	36	11.7
Monthly Per Capita Income (INR)*						
Lower class (<1122)	55	44.0	80	43.7	135	43.8
Lower Middle Class (1123–2245)	43	34.4	70	38.3	113	36.7
Middle Class (2246–3742)	7	5.6	14	7.7	21	6.8
Upper Class (>7486)	1	0.8	2	1.1	3	1.0
Upper Middle Class (3743–7486)	0	0	0	0	0	0
Don't Know	19	15.2	17	9.3	36	11.7

* According to Revised B G Prasad's classification of SES for 2019 (Dalvi et al. 2020)

Table 4.103 Genderwise Hemoglobin Levels (g/dl) and Prevalence of Anemia among Thin Children

	Boys (N=76)		Girls (N=79)		Total (N=155)	
Mean Hemoglobin Level among Thin Children	Mean	SD	Mean	SD	Mean	SD
	11.7	1.3	11.3	1.5	11.5	1.4
Prevalence of Anemia among Thin Children						
Category of Anemia	n	%	n	%	n	%
Non -anemic	41	54.0	37	46.8	78	50.3
Mild Anemia	19	25.0	18	22.8	37	23.9
Moderate Anemia	15	19.7	22	27.9	37	23.9
Severe Anemia	1	1.3	2	2.5	3	1.9

Dietary Intakes among Children

Dietary data was collected on the children who gave blood samples for haemoglobin estimations. One day data on 24 hour diet recall was collected to assess the nutrient intake and dietary adequacy among thin children.

Data showed that mean dietary intake among children were, 1009 ±338.2 Kcal energy, 141.0±50.8 gm carbohydrates, 26.9±9.7 gm protein, 33.2±14.7 gm fat, 178.2±102.1 mg calcium and 4.4±3.2 mg iron. Dietary intakes among children were higher among boys than girls. Intake of energy (boys- 1069±363 Kcal, girls-951±304 Kcal; $p<0.05$), protein (boys- 28.7±10.2 gm, girls-25.1±8.9 gm; $p<0.05$) and calcium (boys- 201.6±124 mg, girls-156±70 mg; $p<0.01$) showed significant difference (Table 4.104).

The dietary intake of energy, protein, calcium and iron were compared with RDA 2010 and EAR 2020. Mean percent RDA 2010 showed that children only consumed foods to meet nearly half of the RDA of energy (46.4±15.4), more than two third RDA of protein (63.8±23.9) and nearly one fourth RDA of calcium (22.3±12.8) and iron (18.2±14.7). With respect to the newer guidelines, percent EAR of protein and iron met through diet was 94.7±35.4 and 31.4±25.6. Mean percent RDA 2010 and EAR 2020 with respect to protein, calcium and iron were higher among boys as compared to girls. This reflected a better dietary adequacy among boys as compared to girls. (Table 4.105)

PHASE II B: IMPACT EVALUATION OF NUTRITION HEALTH EDUCATION

Schools are considered to as a good strategic place to educate children about health and nutrition. Imparting Nutrition Health Education in schools can encourage children to follow healthy life-style. Promotion of healthy life-style though interactive strategies can be adopted at school levels.

Existing review and results of the previous phase suggest that despite MDM being implemented in Government primary schools, prevalence of undernutrition, especially thinness is very high. In addition to undernutrition at present, poor eating choices can lead to overnutrition and the complications associated with it in future. Inadequate dietary intake, insufficient personal hygiene practices along with sub-optimal utilisation of MDM programme are

Table 4.104 Genderwise Mean Nutrient Intake among Thin Children

	Boys (N=76)		Girls (N=79)		Total (N=155)	
	Mean	SD	Mean	SD	Mean	SD
Energy (Kcal)	1069.1	363.1	951.2*	303.6	1009.0	338.2
Carbohydrates (gm)	148.1	57.2	134.1	43.0	141.0	50.8
Protein (gm)	28.7	10.2	25.1*	8.9	26.9	9.7
Fat (gm)	36.3	15.5	30.3*	13.5	33.2	14.7
Calcium (mg)	201.6	123.7	155.6**	69.6	178.2	102.1
Iron (mg)	4.7	3.8	4.1	2.6	4.4	3.2

*p<0.05, **p<0.01

Table 4.105 Genderwise Mean Recommended Allowances through Dietary Intakes among Thin Children

	Boys (N=76)		Girls (N=79)		Total (N=155)	
	Mean	SD	Mean	SD	Mean	SD
Percent RDA 2010						
Energy (Kcal)	46.8	15.7	46.1	15.1	46.4	15.4
Protein (gm)	68.2	25.4	59.5	21.7*	63.8	23.9
Calcium (mg)	25.2	15.5	19.5	8.7**	22.3	12.8
Iron (mg)	21.2	18.2	15.3	9.6*	18.2	14.7
Percent EER/EAR 2020						
Energy (Kcal)	45.9	15.5	44.9	14.7	45.4	15.1
Protein (gm)	100.7	37.4	88.9	32.5*	94.7	35.4
Calcium (mg)	29.9	18.5	23.1	10.6**	26.5	15.4
Iron (mg)	37.6	31.7	25.4	15.8*	31.4	25.6

*p<0.05, **p<0.01

some issues that need to be tackled in the children. Awareness generation activities such as nutrition health education can be effective in addressing these problems.

Nutrition Health Education was planned with reinforcement strategies for primary school children in the second phase of this study. Main session of NHE was given in schools enrolled in experimental group, using a PowerPoint presentation in local language. NHE was planned with reinforcement strategies for primary school children in the second phase of this study. Main session of NHE was given in schools enrolled in experimental group, using a PowerPoint presentation in local language. It was given class wise so as to make it understandable to children of different age groups. Reinforcement of messages was done every fifteen days though interactive activities such as posters displayed at key locations in the schools, performances on '*Sanedo'* (folk song), game, skit and drawings. Total duration of the NHE was two months. Post data was collected after the intervention. Data was again collected after a period of two months washout period.

Impact of NHE on nutritional status of thin children- Anthropometric Profile

Anthropometric data showed an increase in mean weight, height and BMI in both control and experimental group. This shift did not show a significant difference between experimental and control group. (Table 4.106) Similarly, mean anthropometric indices also did not show much difference between the two groups. (Table 4.107)

Underweight is used for children less than 10 years of age. There were only 42 children (Experimental- 31, Control-11) in that age group at baseline. This number reduced to 25 (experimental- 16, Control- 9) at the time of post data collection. No shift in underweight in experimental group was observed while a positive shift from underweight to normal category was seen in control group. However, this was because of the very small number of children (11 at baseline and 9 post intervention) in the group. (Table 4.108)

Prevalence of stunting did not change post intervention among the subjects in both the groups. A shift from moderate stunting to severe stunting was seen in

Table 4.106 Shifts in Mean anthropometric Measurements post Intervention

	Data Point	Experimental (N=183)		Control (N=124)		Total (N=307)	
		Mean	SD	Mean	SD	Mean	SD
Weight (KG)	Pre	25.4	5.1	25.5	4.8	25.5	4.9
	Post	26.6	5.6	26.2	5.0	26.4	5.4
Height (cm)	Pre	137.0	9.8	137.1	9.9	137.0	9.8
	Post	138.6	9.7	138.7	9.7	138.7	9.7
BMI (Kg/m^2)	Pre	13.4	1.0	13.4	0.9	13.4	0.9
	Post	13.7	1.4	13.5	1.0	13.6	1.2

Table 4.107 Mean Anthropometric Indices Before and After Intervention

	Data Point	Experimental (N=183)		Control (N=124)		Total (N=307)	
		Mean	SD	Mean	SD	Mean	SD
WAZ	Pre	-2.8	0.8	-2.7	0.7	-2.8	0.8
	Post	-2.8	0.9	-2.6	0.7	-2.7	0.9
HAZ	Pre	-1.7	1.0	-1.8	1.0	-1.8	1.0
	Post	-1.8	1.0	-1.9	1.0	-1.8	1.0
BAZ	Pre	-2.9	0.6	-2.8	0.6	-2.9	0.6
	Post	-2.8	0.8	-2.9	0.7	-2.8	0.8

Table 4.108 Underweight Before and After Intervention among Subjects (<10 years)

	Data Point	Experimental			Control			Total		
		N	n	%	N	n	%	N	n	%
Normal	Pre	31	4	12.9	11	1	9.1	42	5	11.9
	Post	16	2	12.5	9	3	33.3	25	5	20.0
Underweight	Pre	31	11	35.5	11	5	45.5	42	16	38.1
	Post	16	5	31.3	9	2	22.2	25	7	28.0
Severe underweight	Pre	31	16	51.6	11	5	45.5	42	21	50.0
	Post	16	9	56.3	9	4	44.4	25	13	52.0

both the groups. (Table 4.109) Stunting is an indicator of long-term nutritional deprivation. Improvement in height and stunting can be expected from long term nutritional intervention. Intervention in this study being for two months no improvement in stunting in thin children was seen. All the children enrolled in this phase were thin to start with. No change was reported in severe thinness (41.0%) in experimental group while it increased from 38.7% to 41.1% in control group. Moderate thinness (BAZ: -3SD to -2SD) decreased in both experimental (59% to 45.4%) and control (61.3% to 53.2%). A positive shift from thinness to normal (10.4%) was reported post intervention. Higher number of children shifted from thinness to normal BAZ in experimental group (13.7%) as compared to control group (5.6%) post intervention. (Table 4.110)

MDM consumption and perceptions regarding MDM post intervention

Majority of the children reported to be consuming MDM in school both pre and post intervention. Slight increase (95.9% to 97%) in number of children consuming MDM at school was reported in experimental group post intervention whereas no change was reported in control group. (Table 4.111) Weekly frequency of consumption of MDM among children was also recorded after intervention. The data showed that almost one fifth (18.2%) of the children reported increase in frequency of consumption of MDM per week. Higher increase was recorded in experimental group (24.3%) as compared to control group (8.5%). (Table 4.111)

Data on preference for food served under MDM showed that majority of the children (92.4%- pre intervention and 96.7% post intervention) reported that they liked the food. The percentage was lower in experimental group (89.9%) as compared to control group (96.2%) before intervention (89.9% vs 96.2%). More number of children in experimental group reported that they liked the food served in MDM, post intervention. No change was observed in the control group. (Table 4.112)

Children were asked if they considered MDM to be beneficial for them. (Table 4.113) Three fourth of the children (75.7%) in experimental group and 82.1% children in control group before intervention, opined that MDM is beneficial for them. An increase in this number was reported in both the groups post

Table 4.109 Stunting among Subjects Before and After Intervention

	Data Point	Experimental (N=183)		Control (N=124)		Total (N=307)	
		n	%	n	%	n	%
Normal	Pre	111	60.7	68	54.8	179	58.3
	Post	111	60.7	67	54.0	178	58.0
Stunting	Pre	55	30.1	41	33.1	96	31.3
	Post	54	29.5	39	31.5	93	30.3
Severe stunting	Pre	17	9.3	15	12.1	32	10.4
	Post	18	9.8	18	14.5	36	11.7

Table 4.110 Shift in Thinness among Subject Post Intervention

	Data Point	Experimental (N=183)		Control (N=124)		Total (N=307)	
		n	%	n	%	n	%
Normal	Pre	-	-	-	-	-	-
	Post	25	13.7	7	5.6	32	10.4
Thinness	Pre	108	59.0	76	61.3	184	59.9
	Post	83	45.4	66	53.2	149	48.5
Severe Thinness	Pre	75	41.0	48	38.7	123	40.1
	Post	75	41.0	51	41.1	126	41.0

Table 4.111 Impact of NHE on Mid Day Meal Consumption Pattern of Thin Children (N=275)

	Data Point	Experimental (N=169)		Control (N=106)		Total (N=275)	
		n	%	n	%	n	%
Number of children consuming MDM	Pre	162	95.9	102	96.2	264	96.0
	Post	164	97.0	102	96.2	266	96.7
Frequency of MDM Consumption							
1 Day/ week	Pre	14	8.3	6	5.7	20	7.3
	Post	7	4.1	6	5.7	13	4.7
2 Days/ week	Pre	11	6.5	8	7.5	19	6.9
	Post	22	13.0	6	5.7	28	10.2
3 Days/ week	Pre	12	7.1	1	0.9	13	4.7
	Post	9	5.3	5	4.7	14	5.1
4 Days/ week	Pre	9	5.3	10	9.4	19	6.9
	Post	14	8.3	6	5.7	20	7.3
5 Days/ week	Pre	43	25.4	14	13.2	57	20.7
	Post	39	23.1	13	12.3	52	18.9
6 Days/ week	Pre	71	42.0	63	59.4	134	48.7
	Post	72	42.6	66	62.3	138	50.2
Sometimes	Pre	2	1.2	0	0.0	2	0.7
	Post	1	0.6	0	0.0	1	0.4
Never	Pre	7	4.1	4	3.8	11	4.0
	Post	5	3.0	4	3.8	9	3.3
Number of Children with Increased Frequency of MDM Consumption Post intervention		41	24.3	9	8.5	50	18.2

Table 4.112 Impact of NHE on Preference for Mid Day Meal among Thin Children

	Data Point	Experimental (N=169)		Control (N=106)		Total (N=275)	
		n	%	n	%	n	%
Like MDM	Pre	152	89.9	102	96.2	254	92.4
	Post	164	97.0	102	96.2	266	96.7
Sometimes Like MDM	Pre	1	0.6	0	0	1	0.4
	Post	0	0	0	0	0	0
Don't Like MDM	Pre	9	5.3	0	0	9	3.3
	Post	0	0	0	0	0	0
NA	Pre	7	4.1	4	3.8	11	4.0
	Post	5	3.0	4	3.8	9	3.3

Table 4.113 Impact of NHE on Perceptions on Benefits of Mid Day Meal among Thin Children

	Data Point	Experimental (N=169)		Control (N=106)		Total (N=275)	
		n	%	n	%	n	%
MDM considered beneficial	Pre	128	75.7	87	82.1	215	78.2
	Post	146	86.4	92	86.8	238	86.5
MDM not considered beneficial	Pre	14	8.3	6	5.7	20	7.3
	Post	5	3.0	3	2.8	8	2.9
No answer	Pre	20	11.8	9	8.5	29	10.5
	Post	13	7.7	7	6.6	20	7.3
Not applicable	Pre	7	4.1	4	3.8	11	4.0
	Post	5	3.0	4	3.8	9	3.3

intervention. Experimental group showed a higher number of children who identified MDM to be beneficial for them post intervention than control group. However, this was not statistically significant. (Table 4.113)

Improvement in health (26% in experimental group and 30.2% in control group) and nutrition (22% in experimental group and 12% in control group) were the most commonly identified benefits of MDM by children in both the groups at baseline. An increase in number of children identifying these benefits of MDM was reported in both the groups post intervention. This increase was higher in experimental group as compared to control group. (Table 4.114) Majority children who said that they do not consider MDM to be beneficial for them could not state any reason. (Table 4.115)

Practices and Perceptions regarding Sanitation and Hygiene

Hand-washing is an important indicator of health among children. Poor hand-washing practices can contribute to higher rate of infectious diseases and in turn affect the nutritional status of growing children. Most of the children in experimental as well as control group reported that they considered hand-washing to be an important hygiene practice. Majority of the children before intervention in experimental (60.4%) as well as control (67%) group said that hand-washing practiced to ensure hygiene. Nearly one third of the children in both the groups (37.9% in experimental and 31.1% in control group) opined that following proper hand-washing practice can prevent illnesses. An increase in this number was reported in both the groups post intervention. A significantly ($p<0.05$) higher number of children in experimental group reported that hand-washing ensures hygiene, whereas no change was seen in control group. (Table 4.116)

With respect to hand-washing practices, most of the children reported to be washing hands after consuming food and after using toilet at baseline. Most of the children (98.1%) in control group and majority (91.1%) in experimental group reported to be washing hands before consuming food, before intervention. (Table 4.116) An increase (8.3%) in number of children reported to be practicing hand-washing before eating in experimental group was reported post intervention, whereas this number decreased by 3.8% in control

Table 4.114 Perceived Benefits of MDM among Children- Pre and Post Intervention Comparison

	Data Point	Experimental (N=169)		Control (N=102)		Total (N=275)	
		n	%	n	%	n	%
Improvement in health and growth	Pre	44	26.0	32	30.2	76	27.6
	Post	86	50.9	45	42.5	131	47.6
Provides nutrition	Pre	22	13.0	12	11.3	34	12.4
	Post	38	22.5	23	21.7	61	22.2
Replacement of home meal	Pre	3	1.8	3	2.8	6	2.2
	Post	1	0.6	3	2.8	4	1.5
Better educational outcome	Pre	3	1.8	2	1.9	5	1.8
	Post	5	3.0	1	0.9	6	2.2
Hygienic Food though Centralised kitchen	Pre	0	0.0	1	0.9	1	0.4
	Post	2	1.2	1	0.9	3	1.1
Food availability	Pre	5	3.0	7	6.6	12	4.4
	Post	5	3.0	5	4.7	10	3.6
General liking for MDM	Pre	0	0.0	4	3.8	4	1.5
	Post	2	1.2	1	0.9	3	1.1
Like the food	Pre	4	2.4	6	5.7	10	3.6
	Post	8	4.7	5	4.7	13	4.7
Improvement in growth	Pre	4	2.4	1	0.9	5	1.8
	Post	5	3.0	0	0.0	5	1.8
Other	Pre	0	0.0	1	0.9	1	0.4
	Post	0	0	0	0	0	0
No answer	Pre	52	30.8	27	25.5	79	28.7
	Post	27	16.0	21	19.8	48	17.5
Not applicable	Pre	41	24.3	18	17.0	59	21.5
	Post	5	3.0	4	3.8	9	3.3

Table 4.115 Reasons for not considering MDM as beneficial- Pre and Post Intervention Comparison

	Data Point	Experimental (N=169)		Control (N=102)		Total (N=275)	
		n	%	n	n	%	n
No Answer	Pre	10	5.9	5	4.8	14	5.4
	Post	4	2.6	3	3.0	7	2.7
Don't like	Pre	3	1.8	1	1.0	4	1.5
	Post	0	0	0	0	0	0
Other	Pre	1	0.6	0	0.0	1	0.4
	Post	0	0	0	0	0	0
Not Applicable	Pre	155	91.7	99	94.3	254	92.7
	Post	152	97.4	96	97.0	248	97.3

Table 4.116 Practices and Perception regarding Hand-washing- Pre and Post Intervention Comparison

	Data Point	Experimental (N=169)		Control (N=102)		Total (N=275)	
		n	%	n	%	n	%
No. of children regarding hand washing as important	Pre	167	98.8	106	100	273	99.3
	Post	167	98.8	106	100	273	99.3
Perceptions on benefits of hand-washing							
Prevents illness	Pre	64	37.9	33	31.1	97	35.3
	Post	61	36.1	36	34.0	97	35.3
Hygiene	Pre	102	60.4	71	67.0	173	62.9
	Post	122	72.2	73	68.9	195	70.9
No answer	Pre	16	9.5	12	11.3	28	10.2
	Post	5	3.0	10	9.4	15	5.5*
Other	Pre	3	1.8	1	0.9	4	1.5
	Post	3	1.8	2	1.9	5	1.8
NA	Pre	2	1.2	0	0	2	0.7
	Post	1	0.6	0	0	1	0.4
Hand-washing practice							
Before eating/ food handling	Pre	154	91.1	104	98.1	258	93.8*
	Post	168	99.4	100	94.3	268	97.5**
After eating	Pre	165	97.6	104	98.1	269	97.8
	Post	167	98.8	101	95.3	268	97.5
After using toilet	Pre	166	98.2	106	100	272	98.9
	Post	169	100	106	100	275	100
When come home from outside	Pre	34	20.1	26	24.5	60	21.8
	Post	52	30.8	22	20.8	74	26.9
After doing household chores	Pre	8	4.7	16	15.1	24	8.7
	Post	12	7.1	14	13.2	26	9.5
Whenever hands get dirty	Pre	4	2.4	3	2.8	7	2.5
	Post	5	3.0	0	0.0	5	1.8
Other	Pre	8	4.8	10	9.4	18	6.5
	Post	6	3.6	1	0.9	7	2.5

*p<0.05, **p<0.01

group. Thus, significantly higher number of children reported hand-washing before meal or food handling in experimental group than control group, after intervention. More number of children in experimental group reported that they washed hands after coming home from outside post intervention in experimental group. (Table 4.116)

Usage of soap for hand-washing is important to ensure optimum hygiene. Majority of the children (experimental group- 93.5% and control group- 94.3%) reported using soap for hand-washing at home at baseline. However, only 5.3% children in experimental group and 35.8% children in control group said that they washed hands with soap in school. A significantly higher increase (5.3% to 55.4%) in number of children washing hands with soap in school was reported in experimental group vs no change in control group (35.8% to 36.2%). (Table 4.117)

As all the children were consuming MDM in school with hands, maintaining nail hygiene is important for them. Most (97.5%) of the children opined that keeping nails trimmed as well as clean is an important practice, at baseline. Health and hygiene were the most commonly cited reasons as reported by nearly half of the children in both the groups. An increase in this number was seen in experimental group post intervention. A slight decrease in number of children citing keeping nails clean and trimmed for maintaining hygiene was reported in control group. However, these differences were not significant. (Table 4.118)

Most (94.5%) of the children at baseline in both the groups reported that they keep their nails clean and trimmed. Majority (46.2%) of them said that they cut their nails every week followed by 22.2% who said that they trim their nails whenever they feel that nails have grown. Despite majority reported that they followed good nails hygiene, nearly half of the children did not have cut or clean nails as observed at the time of interview. The observation did not change post intervention. (Table 4.119)

Most of the children identified bathing as an important personal hygiene practice. (Table 4.120) However, one fourth children in both the groups could

Table 4.117 Impact of NHE on Usage of Soap for Hand-washing among Thin Children

	Data Point	Experimental (N=169)		Control (N=102)		Total (N=275)	
		n	%	n	n	%	n
Only water at school	Pre	160	94.7	68	64.2	228	82.9
	Post	75	44.6	67	63.8	142	52.0
Water and soap at school	Pre	9	5.3	38	35.8	47	17.1
	Post	93	55.4	38	36.2	131	48.0
Only water at home	Pre	11	6.5	6	5.7	17	6.2
	Post	4	2.4	4	3.8	8	2.9
Water and soap at home	Pre	158	93.5	100	94.3	258	93.8
	Post	164	97.6	101	96.2	265	97.1

Table 4.118 Perceptions of Children Regarding Nail Hygiene- Pre and Post Intervention

	Data Point	Experimental (N=169)		Control (N=102)		Total (N=275)	
		n	%	n	%	n	%
No. of children regarding nail hygiene as important	Pre	162	95.9%	106	100	268	97.5
	Post	167	99.4%	105	99.1	272	99.3
Perceptions on benefits of hand-washing							
Health	Pre	93	55.0	59	55.7	152	55.3
	Post	95	56.5	51	48.1	146	53.3
Hygiene	Pre	86	50.9	54	50.9	140	50.9
	Post	99	58.9	51	48.1	150	54.7
Aesthetic reasons	Pre	3	1.8	2	1.9	5	1.8
	Post	15	8.9	4	3.8	19	6.9
Discomfort	Pre	6	3.6	7	6.6	13	4.7
	Post	54	32.1	23	21.7	77	28.1
Personal Preference	Pre	1	0.6	0	0.0	1	0.4
	Post	2	1.2	0	0.0	2	0.7
No answer/ Don't know	Pre	10	5.9	5	4.7	15	5.5
	Post	2	1.2	8	7.5	10	3.6

Table 4.119 Practices Related to Nail Hygiene among Children- Pre and Post Intervention

	Data Point	Experimental (N=169)		Control (N=102)		Total (N=275)	
		n	%	n	%	n	%
Children reported to be keeping their nails clean and trimmed	Pre	155	91.7	105	99	260	94.5
	Post	155	92.3	104	98.1	259	94.2
Observation of Nails at the Time of Interview							
Trimmed and clean	Pre	67	40.9	56	52.8	123	45.6
	Post	72	43.1	48	45.3	120	44.0
Untrimmed and not clean	Pre	62	37.8	34	32.1	96	35.6
	Post	77	46.1	49	46.2	126	46.2
Trimmed but not clean	Pre	20	12.2	9	8.5	29	10.7
	Post	16	9.6	8	7.5	24	8.8
Untrimmed but clean	Pre	15	9.1	7	6.6	22	8.1
	Post	2	1.2	1	0.9	3	1.1
Reported Frequency of Cutting Nails							
Daily	Pre	2	1.2	0	0.0	2	0.7
	Post	1	0.6	0	0.0	1	0.4
2-3 times a week	Pre	6	3.6	7	6.6	13	4.7
	Post	5	3.0	1	0.9	6	2.2
Once a week	Pre	73	43.2	54	50.9	127	46.2
	Post	93	55.0	49	46.2	142	51.6
Once in 10-15 days	Pre	18	10.7	10	9.4	28	10.2
	Post	27	16.0	15	14.2	42	15.3
Once a month	Pre	25	14.8	6	5.7	31	11.3
	Post	13	7.7	12	11.3	25	9.1
Sometimes	Pre	7	4.1	1	0.9	8	2.9
	Post	1	0.6	0	0.0	1	0.4
When nails grow	Pre	35	20.7	26	24.5	61	22.2
	Post	26	15.4	26	24.5	52	18.9
Other	Pre	2	1.2	2	1.9	4	1.5
	Post	1	0.6	1	0.9	2	0.7
No Answer	Pre	1	0.6	0	0.0	1	0.4
	Post	2	1.2	2	1.9	4	1.5

Table 4.120 Perception regarding Bathing as a Hygiene Practice - Pre and Post Intervention Comparison

	Data Point	Experimental (N=169)		Control (N=102)		Total (N=275)	
		n	%	n	%	n	%
No. of children considering bathing as important hygiene practice	Pre	168	99.4	105	99.1	273	99.3
	Post	168	99.4	10	100	274	99.6
Don't know	Pre	40	23.7	24	22.6	64	23.3
	Post	14	8.3	13	12.3	27	9.9
Prevents illness	Pre	61	36.1	25	23.6	86	31.3
	Post	80	47.6	25	23.6	105	38.3
To maintain hygiene	Pre	51	30.2	49	46.2	100	36.4
	Post	69	41.1	64	60.4	133	48.5
Social acceptability	Pre	23	13.6	9	8.5	32	11.6
	Post	20	11.9	9	8.5	29	10.6
Other	Pre	4	2.4	3	2.8	7	2.5
	Post	7	4.2	4	3.8	11	4.0

not state the reason for that, before intervention. This number decreased from 23.3% to 9.9%. The decrease was comparable in control group as well as experimental group. (Table 4.120)

Nearly one third of the children at baseline said that bathing helps in maintaining hygiene and prevent illnesses. Number of children who said that bathing helps in maintaining hygiene increased in both the groups post intervention. An increase in number of children saying that bathing helps in preventing illnesses increased in experimental group (36.1% to 47.6%) post intervention. No change was reported in control group. (Table 4.120) Thus, improvement in hygiene practices was seen after NHE intervention.

Spot Observations

Spot observations were carried out in schools before and after intervention to study if there were any changes in the practices related to MDM as well as hand-washing among children. Ten observations in each school were carried out before as well as after intervention.

It was observed that both, MDM helpers and students were involved in serving of MDM in all the schools. Presence of teachers at the time of MDM serving was also observed in all the observations in experimental group and in 84% observations in control group before intervention. Attendance of beneficiaries consuming MDM was not recorded as reported. The observations revealed that leftover food was distributed among village people or given to animals. These practices remained unchanged post intervention. Plate waste was collected in disposal bins and was fed to animals in all the observations. (Table 4.121)

Regular supply of water was reported in all the observations. Positive changes in hand-washing practices were observed in experimental group after intervention. Majority of children washed their hands with water at school before consuming MDM before intervention, but 66.7% observations reported hand-washing with soap after NHE in experimental school. It was also supervised by senior students. (Table 4.122)

Table 4.121 Observations Related to MDM Implementation at School Level Before and After Intervention

Observations	Experimental				Control			
	Pre (N=30)		Post (N=30)		Pre (N=30)		Post (N=30)	
	N	%	N	%	N	%	N	%
Responsibility of Serving MDM								
• MDM Helpers	30	100	30	100	30	100	30	100
• School children	30	100	20	66.7	30	100	20	66.7
Presence of teachers								
• 1-2 teachers	30	100	30	100	25	83.3	26	86.7
• No One	0	0	0	0	5	16.7	4	13.3
Attendance taken at the time of serving	0	0	0	0	0	0	0	0
Plate-waste disposal in disposal bins	30	100	30	100	30	100	30	100
Leftover food management								
• Given to village people/ helpers/ children	3	10	4	13.3	11	36.7	11	36.7
• Given to shepherds/ animals	26	86.7	22	73.3	17	56.7	17	56.7

Table 4.122 Observations Related to Water, Sanitation and Hygiene at School Level Before and After Intervention

Observations	Experimental				Control			
	Pre (N=30)		Post (N=30)		Pre (N=30)		Post (N=30)	
	N	%	N	%	N	%	N	%
Regular Supply of Drinking Water	30	100	30	100	30	100	30	100
Handwashing with soap and water	3	10	20	66.7	9	30	8	26.7
Majority of the children washing hands with soap	0	0	13	0	0	0	0	0
Supervision of handwashing	0	0	0	0	0	0	0	0
Dedicated time for handwashing	0	8	0	0	0	0	0	0
Person responsible for supervision of hand washing								
• Teachers	30	100	30	100	30	100	30	100
• Students	20	66.7	20	66.7	20	66.7	20	66.7

Thus, observations also supported the findings of interview that showed a positive shift in hand-washing practices at school level.

Morbidity Profile in Thin Children

Data on presence of morbidity among thin children was collected for a reference period of 15 days. More than half (56.4%) of the children reported having morbidities during the 15 days reference period. This number was comparable in experimental group (57.9%) and control group (54%) at baseline. A 7.2% reduction in number of children who had experienced morbidities in past 15 days was reported at the time of post data collection. There was no significant difference between experimental (57.9% to 48.1%) and control group (54% to 50.8%) with respect to presence of illness. Data on type of morbidity showed that majority children suffered from cough and cold (36.8%) followed by headache (15.6%) and stomach ache, vomiting, diarrhoea (12.7%) at baseline. Slight reduction in morbidities except for stomach ache, vomiting and diarrhoea was reported among children post intervention. This may be due to the fact that pre data was collected during winters when respiratory infections such as common cold occur more, which usually reduces after winters. No significant impact of NHE on prevalence of morbidities was seen. (Table 4.123)

Impact of NHE on Scores of Cognitive Test among Thin Children

Cognitive scores were calculated using a self-administered Performa for cognitive development assessment. It a combination of RAVEN's Progressive Matrices and Clerical test. The maximum score was 15. Mean cognitive scores among children was 9.4±3.3. The average score was higher among children of control group than experimental group at baseline. An increase in mean scores was reported in both the groups. No difference was observed in the increase in scores between both the groups. (Table 4.124)

Impact of NHE on Physical Work Capacity among Thin Children

Physical work capacity of children was assessed using a 3 minutes steps test. Mean number of steps among children was 110.6±16.5. The average number of steps increased slightly to 116.1±17.5. There was no significant difference

Table 4.123 Morbidity Profile of Thin Children- Pre and Post intervention

		Experimental (N=183)		Control (N=124)		Total (N=307)	
		n	%	n	%	n	%
Presence of illness	Pre	106	57.9	67	54.0	173	56.4
	Post	88	48.1	63	50.8	151	49.2
Cough and Cold	Pre	73	39.9	40	32.3	113	36.8
	Post	58	31.7	41	33.1	99	32.2
Headache	Pre	32	17.5	16	12.9	48	15.6
	Post	21	11.5	11	8.9	32	10.4
Fever	Pre	24	13.1	12	9.7	36	11.7
	Post	21	11.5	8	6.5	29	9.4
Stomach ache, vomiting, diarrhoea	Pre	16	8.7	23*	18.5	39	12.7
	Post	27	14.8	19	15.3	46	15
Other	Pre	25	13.7	6*	4.8	31	10.1
	Post	9	4.9	5	4	14	4.6
Duration of illness							
≤4 days	Pre	62	33.9	41	33.1	103	33.6
	Post	3	1.6	0	0	3	1
4-7 days	Pre	23	12.6	21	16.9	44	14.3
	Post	16	8.7	9	7.3	25	8.1
>7days	Pre	21	11.5	5	4	26	8.5
	Post	9	4.9	3	2.4	12	3.9
NA	Pre	77	42.1	57	46	134	43.6
	Post	93	50.8	61	49.2	154	50.2

*p<0.05

Table 4.124 Impact of NHE on Cognition Scores in Thin Children

	Data Point	Experimental (N=169)		Control (N=102)		Total (N=275)	
		Mean	SD	Mean	SD	Mean	SD
Cognitive Scores	Pre	8.8	3.6	10.3	2.7	9.4	3.3
	Post	9.7	3.2	11.1	3.0	10.2	3.2

in the mean number of steps before and after intervention between experimental and control groups. This indicated that there was no impact of NHE on physical work capacity of thin children. (Table 4.125)

Impact of NHE on Mean Hemoglobin Levels and Anemia among Thin Children

Mean haemoglobin levels among subjects were 11.4±1.3 g/dl. A non-significant increase in mean haemoglobin levels was observed in both experimental and control groups after intervention. Thus, NHE did not have a significant effect on mean haemoglobin levels of thin children. Further, children were categorised according to anemia classification given by WHO (2011). Experimental group (61.5%) had higher anemic children as compared to control group (37.8%) at baseline. The overall prevalence of anemia reduced by 17.9% in experimental group whereas it increased by 5.7% in control group. Reduction in number of subjects in mild (30.8% to 25.6%), moderate (28.2% to 18%) and severe anemia (2.6% to 0%) was recorded in experimental group. Mild anemia did not change in control group. A slight increase in moderate anemia (18.9% to 24.3%) was observed in control group. (Table 4.126)

Impact of NHE on Nutrient Intake and Dietary Adequacy in Thin Children

One day, 24 hours diet data was collected on children who gave consent for collection of blood sample for haemoglobin estimation at baseline and post intervention. Mean intake of energy, carbohydrates and iron were comparable in experimental and control group. Intake of protein, fat and calcium was slightly higher in experimental group than control group. (Table 4.127)

Experimental group showed a significant increase in mean energy intakes (985±261 Kcal to 1116±316 Kcal, $p<0.001$) post intervention versus no significant change (966±355 Kcal to 971±367 Kcal) in control group. Mean intake of carbohydrate (134.3±38.4 gm to 160.3±54.4 gm, $p<0.01$) and protein (27.4±9.0 gm to 31.2±8.4 gm, $p<0.01$) significantly increased in experimental group post intervention whereas control group showed a non-significant increase in mean carbohydrate (138.2±49.8 gm to 142.1±54 gm) and protein (25.3±8.7 gm to 25.5±8.8 gm). Average intake of cacium and iron did not

Table 4.125 Impact of NHE on Physical Work Capacity among Thin Children

	Data Point	Experimental (N=183)		Control (N=124)		Total (N=307)	
		Mean	SD	Mean	SD	Mean	SD
No. of steps in 3 minutes	Pre	110.3	15.5	111.1	17.9	110.6	16.5
	Post	116.1	17.0	116.1	18.3	116.1	17.5

Table 4.126 Impact of NHE on Hemoglobin Levels (mg/dl) and Anemia among Thin Children

Mean Hb Levels	Data Point	Experimental (N=39)		Control (N=37)		Total (N=76)	
		Mean	SD	Mean	SD	Mean	SD
	Pre	11.2	1.5	11.6	1.0	11.4	1.3
	Post	11.6	1.5	11.5	1.1	11.6	1.3
Prevalence of Anemia among Thin Children							
Category of Anemia	Data Point	n	%	n	%	n	%
Non - anemic	Pre	15	38.5	23	62.2	38	50.0
	Post	22	56.4	21	56.8	43	56.6
Mild Anemia	Pre	12	30.8	7	18.9	19	25.0
	Post	10	25.6	7	18.9	17	22.4
Moderate Anemia	Pre	11	28.2	7	18.9	18	23.7
	Post	7	18	9	24.3	16	21.1
Severe Anemia	Pre	1	2.6	0	0	1	1.3
	Post	0	0	0	0	0	0

Table 4.127 Impact of NHE on Mean Nutrient Intake among Subjects

	Data Point	Experimental (N=39)		Control (N=37)		Total (N=76)	
		Mean	SD	n	%	n	%
Energy (Kcal)	Pre	985.0	260.9	965.5	355.2	975.5	308.5
	Post	1115.6	316.3	970.8	366.7	1045.1	347.2
Carbohydrates (gm)	Pre	134.3	38.4	138.2	49.8	136.2	44.1
	Post	160.3	54.4	142.1	54.0	151.4	54.6
Protein (gm)	Pre	27.4	9.0	25.3	8.7	26.4	8.9
	Post	31.2	8.4	25.5**	8.8	28.4	9.0
Fat (gm)	Pre	32.6	12.3	30.6	14.0	31.7	13.1
	Post	35.9	12.6	30.6	15.8	33.3	14.4
Calcium (mg)	Pre	187.4	89.5	159.9	91.2	174.0	90.8
	Post	188.8	70.5	179.7	120.0	184.3	97.2
Iron (mg)	Pre	4.4	2.5	4.7	3.7	4.5	3.1
	Post	4.6	2.7	5.1	3.6	4.9	3.2

change significantly post intervention in both the groups. (Table 4.127) Average protein intake was significantly higher post intervention in experimental group compared to control group. (P<0.01) (Table 4.127)

Mean percent RDA 2010 and EER/EAR 2020 were calculated to study the changes in dietary adequacy in with reference to these recommended requirements post intervention. The data revealed that dietary adequacy in terms of mean percent RDA 2010 significantly increased for energy (45±10.6 Kcal to 51±13.3 Kcal, p<0.001) and protein (64±21.5 gm to 74±20.3 gm, <0.01) in experimental group. No change was reported in control group. Similar change was also observed with respect to the newer recommendations, i.e.- EER and EAR 2020. Iron and calcium intakes did not show significant change post intervention in both the groups. (Table 4.128)

Washout Effect of NHE on Nutritional Status of Thin Children

Nutrition Health Education as a strategy may bring about changes in knowledge and practices in children. However, it is important to make sure that the positive changes are sustainable. Data was collected after a washout period of 2 months to understand if the changes brought about by imparting NHE to thin adolescents could sustain or not. Data on anthropometry, morbidity, physical work capacity, cognitive scores, haemoglobin levels as well as practices and perceptions regarding MDM, sanitation and hygiene were collected on a total of 170 children.

Washout effect on Nutritional Status of Thin Children- Anthropometric Profile

Mean weight was seen to be increasing from baseline to post intervention and post to washout data collection in experimental group while no change was seen in control group. Mean height was reported to be increasing from pre, post to washout data in both the groups. BMI increased from 13.1±0.9 Kg/m2 at baseline to 13.4±1.4 post intervention and 13.5±1.4 at washout data point in experimental group. It increased from 13.1±0.8 Kg/m2 at baseline to 13.2±0.9 kg/m2 at post intervention but it decreased to 12.8±0.9 Kg/m2 after the washout in the control group. (Table 4.129)

Table 4.128 Impact of NHE on Dietary Adequacy among Thin Children

		Experimental (N=39)		Control (N=36)		Total (N=76)	
		Mean	SD	Mean	SD	Mean	SD
Percent RDA 2010							
Energy (Kcal)	Pre	45.4	10.6	45.3	17.2	45.3	14.1
	Post	51.5	13.2	45.5	17.5	48.5	15.7
Protein (gm)	Pre	64.6	21.4	60.6	22.8	62.7	22.0
	Post	73.7	20.3	61.2	23.2*	67.6	22.5
Calcium (mg)	Pre	23.4	11.2	20.0	11.4	21.8	11.3
	Post	23.6	8.8	22.5	15.0	23.0	12.1
Iron (mg)	Pre	17.8	11.2	19.7	17.3	18.7	14.4
	Post	18.6	11.0	21.1	16.4	19.8	13.9
Percent EER/EAR 2020							
Energy (Kcal)	Pre	44.3	10.4	44.3	16.8	44.3	13.8
	Post	50.3	13.0	44.5	17.2	47.5	15.4
Protein (gm)	Pre	96.0	31.6	90.2	33.9	93.2	32.7
	Post	109.6	30.2	90.9	34.3*	100.5	33.4
Calcium (mg)	Pre	27.6	12.6	23.8	13.8	25.7	13.2
	Post	27.9	10.5	26.9	18.8	27.5	15.0
Iron (mg)	Pre	30.6	19.5	33.7	30.0	32.1	25.0
	Post	32.1	19.0	36.1	28.6	34.0	24.1

Table 4.129 Washout Effect on Mean Anthropometric Measurements of thin children

	Data Point	Experimental (N=106)		Control (N=64)		Total (N=170)	
		Mean	SD	Mean	SD	Mean	SD
Weight (KG)	Pre	24.2	4.6	23.1	3.5	23.8	4.2
	Post	25.3	5.5	23.9	3.7	24.8	4.9
	WO	26.2	5.2	23.6	3.8	25.2	4.9
Height (cm)	Pre	135.0	9.5	132.2	8.1	134.0	9.1
	Post	136.7	9.7	134.1	8.0	135.7	9.1
	WO	138.6	9.5	135.5	7.9	137.4	9.0
BMI (Kg/m^2)	Pre	13.1	0.9	13.1	0.8	13.1	0.9
	Post	13.4	1.4	13.2	0.9	13.3	1.2
	WO	13.5	1.4	12.8	0.9	13.2	1.3

WO- Washout

Comparison of mean anthropometric indices at baseline post intervention and after washout is given in Table 4.130. WAZ was seen to be decreasing in both the groups from baseline to data collection post washout period. This decrease in mean WAZ despite an increase in mean weight after intervention and after a 60 days washout period was mainly because of the very small number of children below 10 years of age. Mean HAZ remained unchanged in both the groups. BAZ increased from -2.9±0.7 at baseline to -2.8±0.8 post intervention in experimental group but again decreased to -2.9±1.0 after washout period. It remained unchanged from pre (-2.9±0.6) to post intervention (-2.9±0.7) in control group but decreased after washout period (-3.4±0.8).

Prevalence of stunting showed slight increase in both the groups from pre to washout data collection. (Table 4.132) Underweight did not change after two months intervention period in experimental group whereas it decreased in control group. All the children below 10 years of age were underweight after washout period. (Table 4.132) All the children enrolled for the study of impact of NHE were thin. One fifth of the children shifted to normal category post intervention, with a higher shift (11.3%) in experimental group than control group (6.3%). However, number of normal children according to BAZ decreased 9.4% post intervention to 7.6% at the time of washout data collection. The shift was higher in control group (6.3% to 31.1%) as compared to experimental group (11.3% to 10.4%). (Table 4.133)

Effect of Washout on MDM consumption

A small increase in number of children eating MDM in experimental group was reported from pre to post intervention. However, this decreased to 91.5% children consuming MDM after washout period. There was no change in number of children consuming MDM at school in control group across all the data collection points. A total of 23.4% children in experimental group reported increased frequency of MDM consumption from pre to post. Almost equal number of children reported increase in MDM consumption frequency per week from post intervention to after washout period. Control group showed only 7.9% shift post intervention to washout data. However, a 4.8% reduction

Table 4.130 Washout Effect on Mean Anthropometric Indices of Thin Children

	Data Point	Experimental (N=106)		Control (N=64)		Total (N=170)	
		Mean	SD	Mean	SD	Mean	SD
WAZ	Pre	-2.8	.9	-2.7	0.7	-2.8	0.8
	Post	-2.9	1.1	-2.6	0.7	-2.8	0.9
	WO	-3.2	0.6	-2.7	0.5	-3.0	0.6
HAZ	Pre	-1.6	1.0	-2.0	1.1	-1.8	1.1
	Post	-1.6	1.0	-2.0	1.1	-1.8	1.0
	WO	-1.6	1.0	-2.0	1.1	-1.8	1.0
BAZ	Pre	-2.9	0.7	-2.9	0.6	-2.9	0.7
	Post	-2.8	0.8	-2.9	0.7	-2.9	0.8
	WO	-2.9	1.0	-3.4	0.8	-3.1	1.0

WO- Washout

Table 4.131 Washout effect on Underweight among Children

	Data Point	Experimental			Control			Total		
		N	n	%	N	n	%	N	n	%
Normal	Pre	22	4	18.2	11	1	9.1	33	5	15.2
	Post	11	2	18.2	9	3	27.3	20	5	25
	WO	6	-	-	4	-	-	10	-	-
Underweight	Pre	22	6	27.3	11	5	45.5	33	11	33.3
	Post	11	2	18.2	9	2	22.2	20	4	20
	WO	6	1	16.7	4	3	75	10	4	40
Severe underweight	Pre	22	12	54.5	11	5	45.5	33	17	51.5
	Post	11	7	63.6	9	4	44.4	20	11	55
	WO	6	5	83.3	4	1	25	10	6	60

WO- Washout

Table 4.132 Washout effect on Stunting among Children

	Data Point	Experimental (N=106)		Control (N=64)		Total (N=170)	
		n	%	n	%	n	%
Normal	Pre	63	59.4	33	51.6	96	56.5
	Post	65	61.3	34	53.1	99	58.2
	WO	65	61.3	34	53.1	99	58.2
Stunting	Pre	36	34.0	19	29.7	55	32.4
	Post	34	32.1	16	25.0	50	29.4
	WO	33	31.1	17	26.6	50	29.4
Severe stunting	Pre	7	6.6	12	18.8	19	11.2
	Post	7	6.6	14	21.9	21	12.4
	WO	8	7.5	13	20.3	21	12.4

WO- Washout

Table 4.133 Washout effect on Thinness among Children

	Data Point	Experimental (N=106)		Control (N=64)		Total (N=170)	
		n	%	n	%	n	%
Normal	Pre	-	-	-	-	-	-
	Post	12	11.3	4	6.3	16	9.4
	WO	11	10.4	2	3.1	13	7.6
Thinness	Pre	61	57.5	38	59.4	99	58.2
	Post	51	48.1	32	50.0	83	48.8
	WO	49	46.2	20	31.3	69	40.6
Severe thinness	Pre	45	42.5	26	40.6	71	41.8
	Post	43	40.6	28	43.8	71	41.8
	WO	46	43.4	42	65.6	88	51.8

WO- Washout

in number of children consuming MDM 5-6 days a week was seen in experimental group whereas control group showed no change. (Table 4.134)

An increase in number of children who said that they liked the food served under MDM was reported from baseline (88.7%) to post intervention (98.1%), in experimental group. However, this number decreased after washout period to 91.5%. (Table 4.135)

Percentage of children reporting that they do not eat MDM at school as they do not like the food served under MDM to them or they prefer going home to eat food increased from post to washout data in experimental group. (Table 4.136)

Around three fourth of the children (77.4%) in experimental group and 81.3% in control group considered MDM beneficial at baseline. This number increased to 86.8% post intervention but was similar to baseline values as the values were not significant. Control group also showed a similar pattern of change but the percent improvement post intervention was lower than that reported in experimental group. A higher drop than experimental group was reported from post intervention to washout data. (Table 4.137) Improvement in health and growth was the most commonly reasons identified by children (27.6%). It increased to 47.6% post intervention with a significantly higher increase in experimental group. A decrease in number of children identifying this benefit of MDM after washout period was reported in both the groups. However, it was still significantly higher in experimental group than control group. Number of children saying that MDM provides good nutrition to them increased from pre-intervention to post intervention and from post intervention to post washout period. (Table 4.138)

Practices and perceptions regarding Sanitation and Hygiene

Most of the children reported that they considered hand-washing as an important hygiene practice at baseline, post intervention and post washout period. However, significantly higher number of children said that practicing good hand-washing practices can help prevent illnesses at washout compared to baseline as well as post intervention. (Table 4.139) Most of the children in both the group were washing their hands after eating and after using toilet as

Figure 4.11 Shift in Thinness among Subject in Experimental Group across the Data Points

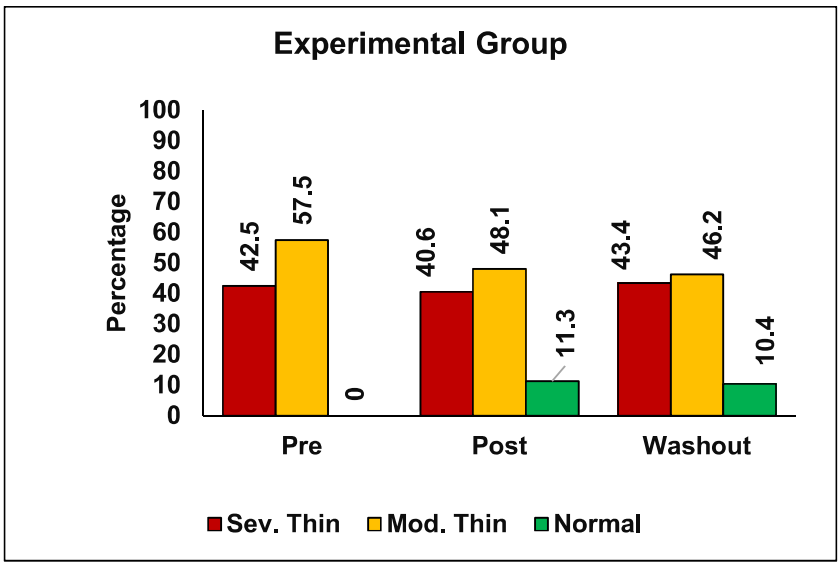


Figure 4.12 Shift in Thinness among Subject in Control Group across the Data Points

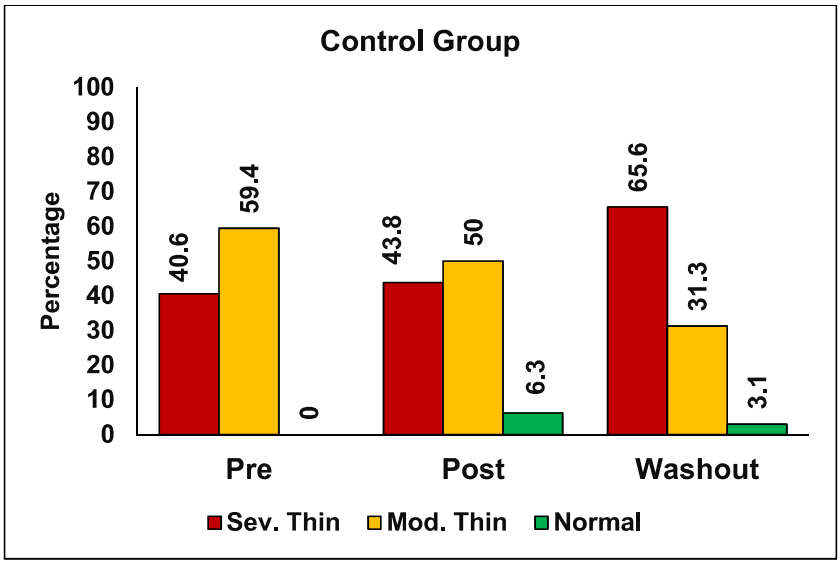


Table 4.134 Washout Effect on Frequency of MDM Consumption

	Data Point	Experimental (N=106)		Control (N=64)		Total (N=170)	
		n	%	n	%	n	%
Number of children consuming MDM	Pre	103	97.2	62	96.9	165	97.1
	Post	104	98.1	62	96.9	166	97.6
	WO	97	91.5	62	96.9	159	93.5
Frequency of MDM Consumption							
1 Day/ week	Pre	11	10.4	4	6.3	15	8.8
	Post	4	3.8	4	6.3	8	4.7
	WO	5	4.7	4	6.3	9	5.3
2 Days/ week	Pre	6	5.7	4	6.3	10	5.9
	Post	14	13.2	5	7.8	19	11.2
	WO	3	2.8	3	4.7	6	3.5
3 Days/ week	Pre	7	6.6	1	1.6	8	4.7
	Post	6	5.7	2	3.1	8	4.7
	WO	6	5.7	3	4.7	9	5.3
4 Days/ week	Pre	3	2.8	5	7.8	8	4.7
	Post	8	7.5	3	4.7	11	6.5
	WO	12	11.3	8	12.5	20	11.8
5 Days/ week	Pre	29	27.4	7	10.9	36	21.2
	Post	25	23.6	6	9.4	31	18.2
	WO	31	29.2	13	20.3	44	25.9
6 Days/ week	Pre	46	43.4	41	64.1	87	51.2
	Post	46	43.4	42	65.6	88	51.8
	WO	39	36.8	28	43.8	67	39.4
Sometimes	Pre	1	0.9	0	0.0	1	.6
	Post	1	0.9	0	0.0	1	.6
	WO	1	0.9	3	4.7	4	2.4
Never	Pre	3	2.8	2	3.1	5	2.9
	Post	2	1.9	2	3.1	4	2.4
	WO	9	8.5	2	3.1	11	6.5
Number of Children with Increased Frequency of Consumption							
Pre to Post		25	23.6	0	0	25	14.7
Post to Washout		24	22.6	7	10.9	31	18.2
Pre to Washout		26	24.5	7	10.9	33	19.4

WO- Washout

Table 4.135 Preference for Mid Day Meal among Thin Children after Washout

	Data Point	Experimental (N=106)		Control (N=64)		Total (N=170)	
		n	%	n	%	n	%
Like MDM	Pre	94	88.7	62	96.9	156	91.8
	Post	104	98.1	62	96.9	166	97.6
	WO	97	91.5	62	96.9	159	93.5
Sometimes Like MDM	Pre	1	0.9	0	0	1	0.6
	Post	0	0	0	0	0	0
	WO	0	0	0	0	0	0
Don't Like MDM	Pre	8	7.5	0	0	8	4.7
	Post	0	0	0	0	0	0
	WO	0	0	0	0	0	0
NA	Pre	3	2.8	2	3.1	5	2.9
	Post	2	1.9	2	3.1	4	2.4
	WO	9	8.5	2	3.1	11	6.5

WO- Washout

Table 4.136 Reasons for Not Consuming MDM after Washout

Reason for not eating MDM	Data Point	Experimental (N=106)		Control (N=64)		Total (N=170)	
		n	%	n	%	n	%
No answer	Pre	1	0.9	0	0.0	1	0.6
	Post	0	0	0	0	0	0
	WO	0	0	0	0	0	0
Don't like the food/ prefer going home for eating	Pre	2	1.9	2	3.1	4	2.4
	Post	2	1.9	2	3.1	4	2.4
	WO	8	7.5	2	3.1	10	5.9
Other	Pre	0	0	0	0	0	0
	Post	0	0	0	0	0	0
	WO	1	0.9	0	0	1	0.6
NA	Pre	103	97.2	62	96.9	165	97.1
	Post	104	98.1	62	96.9	166	97.6
	WO	97	91.5	62	96.9	159	93.5

WO- Washout

Table 4.137 Perceptions on Benefits of Mid Day Meal among Thin Children- Comparison between baseline, post intervention and washout data

	Data Point	Experimental (N=106)		Control (N=64)		Total (N=170)	
		n	%	n	%	n	%
MDM considered beneficial	Pre	82	77.4	52	81.3	134	78.8
	Post	92	86.8	55	85.9	147	86.5
	WO	90	84.9	51	79.7	141	82.9
MDM not considered beneficial	Pre	9	8.5	3	4.7	12	7.1
	Post	3	2.8	2	3.1	5	2.9
	WO	1	0.9	2	3.1	3	1.8
No answer	Pre	12	11.3	7	10.9	19	11.2
	Post	9	8.5	5	7.8	14	8.2
	WO	6	5.7	9	14.1	15	8.8
Not applicable	Pre	3	2.8	2	3.1	5	2.9
	Post	2	1.9	2	3.1	4	2.4
	WO	9	8.5	2	3.1	11	6.5

WO-Washout

Table 4.138 Perceived Benefits of MDM among Thin Children- Pre, Post Intervention and Washout Comparison

	Data Point	Experimental (N=106)		Control (N=64)		Total (N=170)	
		n	%	n	%	n	%
Improvement in health and growth	Pre	28	26.4	19	29.7	47	27.6
	Post	56	52.8	25	39.1	81	47.6
	WO	48	45.3	29	45.3	77	45.3
Provides nutrition	Pre	13	12.3	7	10.9	20	11.8
	Post	21	19.8	16	25.0	37	21.8
	WO	32	30.2	15	23.4	47	27.6
Replacement of home meal	Pre	2	1.9	2	3.1	4	2.4
	Post	1	0.9	2	3.1	3	1.8
	WO	2	1.9	0	.0	2	1.2
Better educational outcome	Pre	3	2.8	1	1.6	4	2.4
	Post	5	4.7	1	1.6	6	3.5
	WO	6	5.7	0	.0	6	3.5
Food availability	Pre	5	4.7	4	6.3	9	5.3
	Post	4	3.8	3	4.7	7	4.1
	WO	3	2.8	3	4.7	6	3.5
Like the food	Pre	3	2.8	7	10.9	10	5.9
	Post	7	6.6	6	9.4	13	7.6
	WO	3	2.8	4	6.3	7	4.1
Other	Pre	0	0	0	0	0	0
	Post	2	1.9	0	0	2	1.2
	WO	1	.9	2	3.1	3	1.8
No answer	Pre	33	31.1	19	29.7	52	30.6
	Post	15	14.2	13	20.3	28	16.5
	WO	14	13.2	8	12.5	22	12.9
Not applicable	Pre	24	22.6	11	17.2	35	20.6
	Post	2	1.9	2	3.1	4	2.4
	WO	15	14.2	8	12.5	23	13.5

WO- Washout

Table 4.139 Perceptions Regarding Hand-washing: Pre, Post Intervention and Washout Comparison

	Data Point	Experimental (N=106)		Control (N=64)		Total (N=170)	
		n	%	n	%	n	%
No. of children regarding hand washing as important	Pre	105	99.1	64	100	169	99.4
	Post	105	99.1	64	100	169	99.4
	WO	106	100	64	100	170	100
Perceptions on benefits of hand-washing							
Prevents illness	Pre	46	43.4	17	26.6	63	37.1
	Post	42	39.6	22	34.4	64	37.6
	WO	78	73.6	33	51.6	111	65.3
Hygiene	Pre	57	53.8	44	68.8	101	59.4
	Post	75	70.8	46	71.9	121	71.2
	WO	51	48.1	43	67.2	94	55.3
No answer	Pre	10	9.4	8	12.5	18	10.6
	Post	3	2.8	5	7.8	8	4.7
	WO	1	0.9	2	3.1	3	1.8
Other	Pre	3	2.8	1	1.6	4	2.4
	Post	2	1.9	1	1.6	3	1.8
	WO	1	.9	1	1.6	2	1.2

WO- Washout

reported at all three data points. All the children in control groups reported that they washed their hands before eating or food handling as opposed to 91.5% children in experimental group reporting the same. This number increased to 99.1% in experimental group and was maintained after washout, too. Control group reported a slight reduction post intervention but it increased again after washout. (Table 4.140)

An increase in number of children washing their hands when coming home from outside as well as after doing household chores was reported from pre to washout data. (Table 4.140) A significantly higher increase in number of children washing their hands with soap in school was reported in experimental group than control group post intervention. This number slightly decreased in both the groups after washout period but it remained higher in experimental group than control group. The shift from baseline to post washout was significantly higher in experimental group than control group. (Table 4.141)

Almost all the children at all three data points opined that maintaining nail hygiene is important. A significantly higher number of children after washout reported that maintaining helps prevent illnesses and remain healthy. (Table 4.142) While most of the children said that they keep their nails trimmed and clean, less than half of them actually had clean and trimmed nails after washout period. (Table 4.143)

Morbidity Profile of Children- Comparison between baseline, post intervention and post washout

Reported prevalence of morbidities among children reduced from pre to post and post to washout in both the groups. Reduction was noted in all the categories of reported illnesses among children. These changes were comparable for both the groups. (Table 4.144)

Washout effect on Physical Work Capacity

Data on step test showed that mean number of steps increased from 109.8±15.1 to 115.3±16.3 to 123.2±20.0 across the three points i.e. pre, post and washout data collection in experimental group. It increased from 111.7±18.7 at pre to 117.8±21.0 post intervention. However, it remained

Table 4.140 Hand-washing Practices among Thin Children- Pre, Post and Washout Comparison

	Data Point	Experimental (N=106)		Control (N=64)		Total (N=170)	
Hand-washing practice							
Before eating/ food handling	**Pre**	97	91.5	64	100.0	161	94.7
	Post	105	99.1	61	95.3	166	97.6
	WO	105	99.1	63	98.4	168	98.8
After eating	**Pre**	103	97.2	62	96.9	165	97.1
	Post	105	99.1	61	95.3	166	97.6
	WO	105	99.1	63	98.4	168	98.8
After using toilet	**Pre**	104	98.1	64	100	168	98.8
	Post	106	100	64	100	170	100
	WO	105	99.1	64	100	169	99.4
When come home from outside	**Pre**	16	15.1	14	21.9	30	17.6
	Post	32	30.2	14	21.9	46	27.1
	WO	38	35.8	30	46.9	68	40
After doing household chores	**Pre**	2	1.9	8	12.5	10	5.9
	Post	6	5.7	11	17.2	17	10
	WO	9	8.5	9	14.1	18	10.6
Whenever hands get dirty	**Pre**	2	1.9	3	4.7	5	2.9
	Post	3	2.8	0	0	3	1.8
	WO	4	3.8	1	1.6	5	2.9
Other	**Pre**	5	4.7	5	7.8	10	5.9
	Post	2	1.9	1	1.6	3	1.8
	WO	3	2.8	4	6.3	7	4.1

WO- Washout

Table 4.141 Impact of NHE on Usage of Soap and Washout Effect

	Data Point	Experimental (N=169)		Control (N=102)		Total (N=275)	
		n	%	n	n	%	n
Only water at school	Pre	103	97.2	38	59.4	141	82.9
	Post	47	44.8	35	54.7	82	48.5
	WO	51	48.1	35	54.7	86	50.6
Water and soap at school	Pre	3	2.8	26	40.6	29	17.1
	Post	58	55.2	29	45.3	87	51.5
	WO	55	51.9	28	43.8	83	48.8
Only water at home	Pre	7	6.6	4	6.3	11	6.5
	Post	3	2.9	3	4.7	6	3.6
	WO	1	0.9	2	3.1	3	1.8
Water and soap at home	Pre	99	93.4	60	93.8	159	93.5
	Post	102	97.1	61	95.3	163	96.4
	WO	105	99.1	62	96.9	167	98.2

WO- Washout

Table 4.142 Perception regarding Nail Hygiene- Baseline, Post Intervention and Washout Comparison

	Data Point	Experimental (N=106)		Control (N=64)		Total (N=170)	
		n	%	n	%	n	%
No. of children regarding nail hygiene as important	Pre	102	96.2	64	100.0	166	97.6
	Post	104	99.0	63	98.4	167	98.8
	WO	106	100	64	100	170	100
Perceptions on benefits of hand-washing							
Health	Pre	59	55.7	36	56.3	95	55.9
	Post	55	52.4	30	46.9	85	50.3
	WO	87	82.1	44	68.8	131	77.1
Hygiene	Pre	57	53.8	34	53.1	91	53.5
	Post	67	63.8	32	50	99	58.6
	WO	63	59.4	49	76.6	112	65.9
Aesthetic reasons	Pre	1	0.9	1	1.6	2	1.2
	Post	12	11.4	2	3.1	14	8.3
	WO	1	0.9	1	1.6	2	1.2
Discomfort	Pre	2	1.9	5	7.8	7	4.1
	Post	31	29.5	16	25	47	27.8
	WO	3	2.8	3	4.7	6	3.5
Personal Preference	Pre	0	0	0	0	0	0
	Post	2	1.9	0	0	2	1.2
	WO	0	0	0	0	0	0
No answer/ Don't know	Pre	5	4.7	3	4.7	8	4.7
	Post	1	1	5	7.8	6	3.6
	WO	1	0.9	1	1.6	2	1.2

WO- Washout

Table 4.143 Practices regarding Nail Hygiene- Baseline, Post Intervention and Washout Comparison

	Data Point	Experimental (N=106)		Control (N=64)		Total (N=170)	
		n	%	n	%	n	%
Children reported to be keeping their nails clean and trimmed	Pre	99	93.4	64	100	163	95.9
	Post	96	90.6	62	96.9	158	92.9
	WO	96	91.4	58	90.6	154	91.1
Observation of Nails at the Time of Interview							
Trimmed and clean	Pre	44	43.6	33	51.6	77	46.7
	Post	51	49	28	43.8	79	47
	WO	41	39	33	51.6	74	43.8
Untrimmed and not clean	Pre	32	31.7	20	31.3	52	31.5
	Post	40	38.5	28	43.8	68	40.5
	WO	49	46.7	25	39.1	74	43.8
Trimmed but not clean	Pre	15	14.9	5	7.8	20	12.1
	Post	11	10.6	7	10.9	18	10.7
	WO	9	8.6	5	7.8	14	8.3
Untrimmed but clean	Pre	10	9.9	6	9.4	16	9.7
	Post	2	1.9	1	1.6	3	1.8
	WO	6	5.7	1	1.6	7	4.1

WO- Washout

Table 4.144 Morbidity Profile of Thin Children- Comparison between Baseline, Post Intervention and Washout Data

	Data Point	Experimental (N=106)		Control (N=64)		Total (N=170)	
		n	%	n	%	n	%
Presence of illness	Pre	65	61.3	34	53.1	99	58.2
	Post	58	54.7	38	59.4	96	56.5
	WO	41	38.7	29	45.3	70	41.2
Type of Illness							
cough and cold	Pre	43	40.6	17	26.6	60	35.3
	Post	34	32.1	24	37.5	58	34.1
	WO	21	19.8	14	21.9	35	20.6
Headache	Pre	24	22.6	5	7.8	29	17.1
	Post	19	17.9	4	6.3	23	13.5
	WO	12	11.3	11	17.2	23	13.5
Fever	Pre	17	16.0	5	7.8	22	12.9
	Post	16	15.1	4	6.3	20	11.8
	WO	10	9.4	8	12.5	18	10.6
Stomach-ache, vomiting, diarrhoea	Pre	12	11.3	19	29.7	31	18.2
	Post	20	18.9	16	25.0	36	21.2
	WO	14	13.2	9	14.1	23	13.5
Other	Pre	15	14.2	3	4.7	18	10.6
	Post	4	3.8	2	3.1	6	3.5
	WO	1	0.9	3	4.7	4	2.4
Duration of Illness							
≤4 days	Pre	43	40.6	22	34.4	65	38.2
	Post	45	42.5	33	51.6	78	45.9
	WO	34	32.1	21	32.8	55	32.4
5-7 days	Pre	13	12.3	9	14.1	22	12.9
	Post	8	7.5	2	3.1	10	5.9
	WO	2	1.9	5	7.8	7	4.1
>7	Pre	9	8.5	3	4.7	12	7.1
	Post	5	4.7	3	4.7	8	4.7
	WO	5	4.7	3	4.7	8	4.7

WO- Washout

unchanged after washout period in control group. Thus, step test showed no effect of NHE on physical work capacity among children with low BMI for age. (Table 4.145)

Washout effect on Cognition Scores

Mean cognitive scores among children increased from baseline to post intervention (9±3.2 to 9.8±3.2) to and post to washout data point (9.8±3.2 to 10.3±3.3). However, this shift was not statistically significant. Control group had slightly higher mean cognitive scores as compared to experimental group at all three data points. (Table 4.146) Thus, no effect of NHE was reported on mean cognition scores of children.

Hemoglobin Levels among Children after Washout

Majority of the children opted out from haemoglobin estimation after washout period. Only 15 subjects (12 in experimental and 3 in control group) gave blood sample for haemoglobin estimation. Mean Hb levels among children were 11.41±0.94 g/dl (11.25±0.96 g/dl- experimental, 12.07±0.59 g/dl-control). No significant change in haemoglobin levels of these subjects was reported after washout period indicating maintainance of Hb levels amongst the subjects studied.

Table 4.145 Washout effect on Physical Work Capacity among Children

	Data Point	Experimental (N=106)		Control (N=64)		Total (N=170)	
		Mean	SD	Mean	SD	Mean	SD
No. of steps in 3 minutes	Pre	109.8	15.1	111.7	18.7	110.5	16.5
	Post	115.3	16.3	117.8	21.0	116.2	18.2
	WO	123.2	20.0	117.0	21.2	120.9	20.6

WO- Washout

Table 4.146 Washout Effect on Cognitive Scores among Thin Children

	Data Point	Experimental (N=106)		Control (N=64)		Total (N=170)	
		Mean	SD	Mean	SD	Mean	SD
Cognitive Scores	Pre	8.4	3.4	9.9	2.7	9.0	3.2
	Post	9.2	3.1	10.7	3.1	9.8	3.2
	WO	9.7	3.5	11.4	2.8	10.3	3.3

WO- Washout