

LIST OF TABLES

Table 2.1	Prevalence of Undernutrition across the World	18
Table 2.2	Prevalence of Undernutrition in various parts of India	22
Table 2.3	Prevalence of Under Nutrition in Various Parts of Gujarat	25
Table 2.4	Global Prevalence of Anaemia	32
Table 2.5	Prevalence of Anaemia across the World	33
Table 2.6	Prevalence of Anaemia across India	36
Table 2.7	Prevalence of Anaemia in Vadodara	37
Table 2.8	Studies on Impact of Micronutrient Fortified Products on School Children	42
Table 2.9	Different types of Food for Education programs and their pros and cons	48
Table 2.10	Impact of Intervention on Various Outcomes	58
Table 2.11	Mid day meals in India-A historical perspective	64
Table 2.12	State Wise Coverage of the Akshay Patra Foundation	81
Table 2.13	Nutritive Value of 50g of Fortified Flour	83
Table 3.1	List of Schools Covered for the Study	88
Table 3.2	Tools Used For Data Collection For Formative Research	91
Table 3.3	CIAF Classification Of Children With Anthropometric Failure	96
Table 3.4	Haemoglobin Concentrations (mg/dl) for the Diagnosis of Anaemia and Assessment of Severity according to the World Health Organization	98
Table 3.5	Tools used for data collection for Process Evaluation	100
Table 3.6	Indicators used for kitchen evaluation	100
Table 3.7	Indicators for process evaluation of MDMP	103
Table 3.8	Tools & Sample used for Impact data collection	103
Table 4.1.1	Number of Children Enrolled in the Selected Schools	115
Table 4.1.2	Infrastructure and Basic Facilities in Schools (N=16)	116
Table 4.1.3	Implementation of MDM and Health Care Facilities (N=16)	118
Table 4.1.4	Number of Children Covered in the Selected Schools	120
Table 4.1.5	Age Wise Distribution of Children (N, %)	121
Table 4.1.6	Socio Demographic Profile of The Children (N, %)	123
Table 4.1.7	Education of the Parents of the Enrolled Children (N, %)	124
Table 4.1.8	Occupation of the Parents of the Enrolled Children (N, %)	126
Table 4.1.9	Information about Children Consuming MDM Food	127
Table 4.1.10	Food Item Liked Most by the Children	128
Table 4.1.11	Mean Weights of the Children Cross Tabulated by Age & Gender (Mean \pm SD, Kg)	130
Table 4.1.12	Mean Heights of the Children Cross Tabulated by Age & Gender (Mean \pm SD, Z scores)	131
Table 4.1.13	Mean BMI of the Children Cross Tabulated by Age & Gender (Mean \pm SD, Kg/m ²)	132
Table 4.1.14	Mean WAZ of the Children According to WHO 2007 Growth Standards Cross Tabulated by Age & Gender (Mean \pm SD, Z scores)	134
Table 4.1.15	Mean HAZ of the Children According to WHO 2007 Growth Standards Cross Tabulated by Age & Gender (Mean \pm SD, Z scores)	135

Table 4.1.16	Mean BMIZ of the Children According to WHO 2007 Growth Standards Cross Tabulated by Age & Gender (Mean \pm SD, Z scores)	136
Table 4.1.17	Mean WAZ of the Children According to CDC 2000 Growth Standards Cross Tabulated by Age & Gender (Mean \pm SD, Z scores)	137
Table 4.1.18	Mean HAZ of the Children According to CDC 2000 Growth Standards Cross Tabulated by Age & Gender (Mean \pm SD, Z scores)	138
Table 4.1.19	Mean BAZ of the Children According to CDC 2000 Growth Standards Cross Tabulated by Age & Gender (Mean \pm SD, Z scores)	139
Table 4.1.20	% Prevalence of Undernutrition (Z score<-2SD) in Children	140
Table 4.1.21	% Prevalence of Undernutrition (Z score<-2SD) Cross Tabulated by Gender (N, %)	144
Table 4.1.22	Severity of Malnutrition in Children by CDC and WHO Classification (%)	145
Table 4.1.23	Gender wise Severity of Malnutrition in Children by CDC and WHO Classification (%)	146
Table 4.1.24	Age Wise Prevalence of Underweight by WHO 2007 Standards (N, %)	148
Table 4.1.25	Age Wise Prevalence of Stunting and Thinness by WHO 2007 Standards (N, %)	149
Table 4.1.26	Age wise % Prevalence of Undernutrition by WHO 2007 (Z score<-2SD) in Children	151
Table 4.1.27	School Wise Prevalence of Undernutrition in Children using WHO 2007 Growth Standards (Z score<-2SD)	152
Table 4.1.28	CIAF Classification of Children with Anthropometric Failure Cross Tabulated By Gender And Age	155
Table 4.1.29	Factors significantly associated with Weight for Age Z scores – Multiple Regression Analysis	158
Table 4.1.30	Factors significantly associated with Height for Age Z scores – Multiple Regression Analysis	158
Table 4.1.31	Factors significantly associated with BMI for Age Z scores – Multiple Regression Analysis	158
Table 4.1.32	Mean Hemoglobin Levels of the Children cross Tabulated by Age and Gender (Mean \pm SD, g/dl)	159
Table 4.1.33	Age wise % Prevalence of Anaemia among Children	161
Table 4.1.34	Frequency Distribution of Haemoglobin among Children Cross Tabulated By Age (N,%)	163
Table 4.1.35	Haemoglobin Levels Cross Tabulated with Nutritional Status of Children	165
Table 4.1.36	Prevalence of Anaemia Cross Tabulated with Nutritional Status (N, %)	166
Table 4.1.37	Gender wise Prevalence of Anaemia across the Nutritional Status (%)	167
Table 4.1.38	Correlation between Haemoglobin and different variables	168
Table 4.1.39	Prevalence of Anaemia cross tabulated by CIAF and age wise for Total Number of Children	169

Table 4.1.40	Morbidity Profile of the children	171
Table 4.1.41	Morbidity Pattern among Undernourished and Anaemic Children (N,%)	172
Table 4.1.42	Mean Weight, Height, BMI of SAM Children (Mean \pm SD)	175
Table 4.1.43	Mean Weight, Height, BMI of SAM Children Cross Tabulated By Age and gender (Mean \pm SD)	176
Table 4.1.44	Prevalence of Under Nutrition (Z-score) in Severely Thin Children (N,%)	177
Table 4.1.45	Morbidity Profile of the SAM children	178
Table 4.1.46	Mean Hemoglobin levels among SAM Children cross tabulated by Age	180
Table 4.2.1	Infrastructure facilities in the kitchen	192
Table 4.2.2	Machines available at centralized kitchen	192
Table 4.2.3	Pest control services done at the Akshay Patra Kitchen	201
Table 4.2.4	MDM Menu provided by the Akshay Patra Kitchen	201
Table 4.2.5	Role of Teachers in Supervision	219
Table 4.2.6	Nutritive Value of Wheat Based Products provided By the Akshay Patra Kitchen (per 1 piece)	225
Table 4.2.7	Nutritive Value of Rice based Recipes provided By the Akshay Patra Kitchen (Per 100 gm)	226
Table 4.2.8	Nutritive Value of Dal based Recipes provided By the Akshay Patra Kitchen (Per 100 gm)	227
Table 4.2.9	Nutrient Intake of MDM (Mean and as Percent RDA) for the Children	229
Table 4.2.10	Mean Nutrient Intake of Children for Macro Nutrients (MEAN \pm SD)	230
Table 4.2.11	Mean Nutrient Intake of Children for Micro Nutrients (MEAN \pm SD)	231
Table 4.2.12	Nutrient Intake of Children consuming MDM Cross Tabulated by Gender and Standard	233
Table 4.2.13	Distribution of Children Based on Gradations of % RDA of Nutrients	237
Table 4.3.14	Mean Nutrient Intake According to Weekly Menu	238
Table 4.2.15	Mean Nutrient Intake According to Weight for Age Z scores	240
Table 4.2.16	Mean Nutrient Intake According to Height for Age Z scores	241
Table 4.2.17	Mean Nutrient Intake According to BMI for Age Z scores	242
Table 4.2.18	Attendance and Consumption Pattern of Children	243
Table 4.2.19	Month wise Consumption Pattern of MDM by School Children	245
Table 4.2.20	Weekly Consumption pattern for Mid Day Meal by School Children	245
Table 4.3.1	Distribution of Children According To Age (N, %)	260
Table 4.3.2	Socio Economic Profile of the Children (N, %)	261
Table 4.3.3	Education of Parents among the Study Population (N,%)	263
Table 4.3.4	Occupation of the Parents of Children (N, %)	264
Table 4.3.5	Information about Children Consuming Mid Day Meal Food	265
Table 4.3.6	Impact of Mid Day Meal Programme on the Nutritional Status of the Children	266
Table 4.3.7	Mean Weight of the Children Cross Tabulated by Age and	268

	Gender (Mean±SD, kg)	
Table 4.3.8	Mean Height of the Children Cross Tabulated by Age and Gender (Mean±SD, cms)	272
Table 4.3.9	Mean BMI of the Children Cross Tabulated by Age and Gender (Mean±SD, kg/m ²)	276
Table 4.3.10	Mean Weight of the Severely Thin Children Cross Tabulated By Age and Gender (Mean±SD, kg)	281
Table 4.3.11	Mean Height of the Severely Thin Children Cross Tabulated By Age and Gender (Mean±SD, cms)	285
Table 4.3.12	Mean BMI of the Severely Thin Children Cross Tabulated By Age and Gender (Mean±SD, kg/m ²)	288
Table 4.3.13	Impact of Intervention on MDM Consumers and Non-Consumers	292
Table 4.3.14	Mean WAZ of the Children According to WHO 2007 Growth Standards Cross Tabulated by Age & Gender (Mean±SD)	294
Table 4.3.15	Mean HAZ of the Children According to WHO 2007 Growth Standards Cross Tabulated by Age & Gender (Mean±SD)	295
Table 4.3.16	Mean BAZ of the Children According to WHO 2007 Growth Standards Cross Tabulated by Age & Gender (Mean±SD)	296
Table 4.3.17	Prevalence of Underweight (Z Scores <-2SD) in Children (N, %)	297
Table 4.3.18	Impact of Intervention on the Prevalence of Undernutrition (Z Scores <-2) In Children (N)	301
Table 4.3.19	% Prevalence of Undernutrition (Z score<-2SD) Cross Tabulated by Gender (N)	304
Table 4.3.20	Prevalence of Underweight According To WHO 2007 Growth Standards (N, %)	305
Table 4.3.21	Prevalence of Stunting according to WHO 2007 Growth Standards (N, %)	306
Table 4.3.22	Prevalence of Thinness according to WHO 2007 Growth Standards (N, %)	307
Table 4.3.23	Prevalence of Undernutrition among Severely Thin children in accordance to WHO 2007 standards (N, %)	309
Table 4.3.24	Impact of Intervention on the Prevalence of Underweight (Z-Scores) among Severely Thin Children (N, %)	310
Table 4.3.25	Impact of Intervention on the Prevalence of Stunting (Z-Scores) among Severely Thin Children (N, %)	310
Table 4.3.26	Impact of Intervention on the Prevalence of Thinness (Z-Scores) among Severely Thin Children (N, %)	311
Table 4.3.27	Impact of Intervention on Prevalence of Underweight and Stunting among Severely Thin children (N,%)	309
Table 4.3.28	Age Wise Prevalence of Underweight In Accordance to WHO 2007 Growth Standards (N, %)	313
Table 4.3.29	Age Wise Prevalence of Stunting In Accordance to WHO 2007 Growth Standards (N, %)	314
Table 4.3.30	Age Wise Prevalence of Thinness in Accordance to WHO 2007 Growth Standards (N, %)	315
Table 4.3.31	School Wise Prevalence of Undernutrition in Children using WHO 2007 Growth Standards (Z score<-2SD)	316

Table 4.3.32	CIAF Classification of Children with Anthropometric Failure Cross Tabulated By Gender And Age	318
Table 4.3.33	Impact of Intervention on CIAF Classification of Children with Anthropometric Failure (N,%)	319
Table 4.3.34	Cross tabulation of CIAF classification according to WHO (N,%)	319
Table 4.3.35	Impact of Mid Day Meal on the Hemoglobin Levels of the Children (MEAN \pm SD, g/dl)	321
Table 4.3.36	Age wise Mean Hemoglobin Levels of Severely Thin Children (Mean \pm SD)	325
Table 4.3.37	Age wise % Prevalence of Anemia among Children	327
Table 4.3.38	Cross Tabulation of Anemia	330
Table 4.3.39	Haemoglobin Levels Cross Tabulated with Nutritional Status of Children	331
Table 4.3.40	Prevalence of Anaemia Cross Tabulated With Nutritional Status (%)	332
Table 4.3.41	Prevalence of Anaemia cross tabulated by CIAF	333
Table 4.3.42	Impact of Intervention on the Prevalence of Anemia among Severely Thin Children (N, %)	335
Table 4.3.43	Impact of Intervention on the Prevalence of Anemia among Severely Thin Children (N, %)	335
Table 4.3.44	Morbidity Profile of the children	336
Table 4.3.45	Impact of Mid Day Meal Programme on Morbidity Profile of the Children (N, %)	337
Table 4.3.46	Morbidity Profile of the Severely Thin Children Before and After Intervention Period	337
Table 4.3.47	Impact of Intervention on Morbidity Profile of the Severely Thin Children	337
Table 4.3.48	School Wise Children Enrolment and Percentage difference in Enrolment	339
Table 4.3.49	Standard wise Gender Distribution of Primary School Children Enrolled in 2008-09	341
Table 4.3.50	School Wise Mean Attendance and % Attendance of Primary School Children for the Academic Year (08-09) and (09-10)	343
Table 4.3.51	Impact of Mid Day Meal Programme on the Mean Attendance of Primary School Children	345
Table 4.3.52	Mean Attendance of the Children According to Standards (Mean \pm SD)	346
Table 4.3.53	Mean Attendance among MDM Consumers and Non-Consumers (Mean \pm SD)	347
Table 4.3.54	Impact of Mid Day Meal Programme on the Mean Attendance of the Severely Thin Children	347
Table 4.3.55	Academic Gender Wise Scholastic Performance of Primary School Children (N, %)	349
Table 4.3.56	Impact of MDM on Scholastic Performance of Primary School Children (N,%)	349
Table 4.3.57	Year Wise Scholastic Performance of School Children	351
Table 4.3.58	Scholastic Performance of School Children Cross Tabulated	351

	by Nutritional Status	
Table 4.3.59	Impact of MDM provided by TAPF on Scholastic Performance of Underweight, Stunted and Thin Children	352
Table 4.3.60	Impact of MDM provided by TAPF on Scholastic Performance of Severely Thin Children	352
Table 4.4.1	Opinion of Teachers regarding Mid Day Meal Programme	362
Table 4.4.2	Opinion of the Teachers regarding MDM Provided by TAPF	364
Table 4.4.3	Tasting of Food by the Teachers	367
Table 4.4.4	Problems Faced in Implementing MDM Programme	367
Table 4.4.5	Perceptions of Teachers about MDMP Provided by TAPF	368
Table 4.5.1	After the workshop changes observed by the Teachers at the Akshay Patra Foundation and at the school level	383
Table 4.5.2	Mid Day Meal Consumed by the Children	387
Table 4.5.3	Parents' Awareness Regarding Mid Day Meal Consumed by the Children	388
Table 4.5.4	Children's Discussion about MDM with their Parents	391
Table 4.5.5	Parents' Suggestions regarding improvement in MDM Menu	391
Table 5.1	Recommended recipes using various foods	410

LIST OF FIGURES

Figure 1.1	Fighting Hunger Worldwide	2
Figure 1.2	Causes of Iron Deficiency Anaemia	5
Figure 2.1	Prevalence of Undernourished Population in the World (Millions) in 2014-16	11
Figure 2.2	Conceptual Framework of Malnutrition	27
Figure 2.3	Causes of Anaemia	38
Figure 2.4	Relationship between SFP and potential outcomes and impacts on school children	50
Figure 2.5	Potential Benefits of School Feeding Programme	52
Figure 2.6	School Feeding Beneficiaries Around the World	53
Figure 3.1	Map of Schools Selected From Urban Vadodara (Zone Wise)	87
Figure 3.2	Experimental Plan for Phase I: Formative Research	90
Figure 3.3	Experimental Plan for Phase 2: Process Evaluation	99
Figure 3.4	Experimental Plan for Phase 3: Impact Evaluation	106
Figure 3.5	Experimental Plan for Phase 4: Workshop on MDM Programme for Municipal School Teachers of Urban Vadodara	108
Figure 3.6	Experimental Plan for Phase 5: KAP of Teachers, Parents and Children	111
Figure 4.1.1	Prevalence of Underweight in Children by CDC & WHO	142
Figure 4.1.2	Prevalence of Stunting in Children by CDC & WHO	142
Figure 4.1.3	Prevalence of Thinness in Children by CDC & WHO	143
Figure 4.1.4	Prevalence of Undernutrition in Children by CDC & WHO	143
Figure 4.1.5	Age Wise Prevalence of Underweight (%)	148
Figure 4.1.6	Age wise Prevalence of Stunting (%)	150
Figure 4.1.7	Age wise Prevalence of Thinness (%)	150
Figure 4.1.8	Classification of Children with Anthropometric Failure (%)	156
Figure 4.1.9	Prevalence of Anemia among Children	160
Figure 4.1.10	% Prevalence of Anemia among Children across the Age	164
Figure 4.1.11	% Prevalence of Anaemia across the Gender	164
Figure 4.1.12	Prevalence of Severe Acute Malnutrition in Boys & Girls	174
Figure 4.1.13	Age wise Prevalence of SAM (Severely Thin) Children	174
Figure 4.1.14	Prevalence of Anemia among SAM Children	181
Figure 4.2.1	Dough Maker	193
Figure 4.2.2	Sukhadi Maker	193
Figure 4.2.3	Vegetable Cutter	193
Figure 4.2.4	Dal Couldron	193
Figure 4.2.5	Rice Cleaning Machine	194
Figure 4.2.6	Rice Couldron	194
Figure 4.2.7	Roti Making Machine	194
Figure 4.2.8	Masala Grinder	195

Figure 4.2.9	Vegetable Washer	195
Figure 4.2.10	Storage Facilities	197
Figure 4.2.11	Wearing of headgear & hand gloves	199
Figure 4.2.12	Cleaning and Washing of Utensils	199
Figure 4.2.13	Good ventilation facilities	199
Figure 4.2.14	Cleaning of kitchen after cooking	199
Figure 4.2.15	Cleaning of grains, spices and vegetables	200
Figure 4.2.16	Menu for Monday and Thursday	203
Figure 4.2.17	Menu for Tuesday	204
Figure 4.2.18	Menu for Wednesday	205
Figure 4.2.19	Menu for Friday	206
Figure 4.2.20	Menu for Saturday	207
Figure 4.2.21	Rice Making Process	208
Figure 4.2.22	Dal and Sabji Making Process	209
Figure 4.2.23	Sukhadi Making Process	210
Figure 4.2.24	Transportation of Food	211
Figure 4.2.25	Components of spot observations	215
Figure 4.2.26	Sitting Arrangement during MDM Consumption	218
Figure 4.2.27	Responsibility of Serving	218
Figure 4.2.28	Disposal of Plate Waste	220
Figure 4.2.29	Leftover Food Management	221
Figure 4.2.30	Regular Water Supply in School	221
Figure 4.2.31	Cleanliness of Serving Vessels & Spoon	223
Figure 4.2.32	Cleanliness of Dining Area	223
Figure 4.2.33	Hand Washing by Children	224
Figure 4.2.34	Material Used for Hand Washing	224
Figure 4.2.35	Energy Intake of the Children	232
Figure 4.2.36	Protein Intake of the Children	232
Figure 4.2.37	Summary of MDM Intake by Children as Compared to % RDA	236
Figure 4.2.38	Monthly MDM Consumption Pattern by Children	246
Figure 4.2.39	Weekly MDM Consumption Pattern by Children	246
Figure 4.3.1	Peak Weight Velocity of the Children	271
Figure 4.3.2	Peak Height Velocity of the Children	271
Figure 4.3.3	Impact of Intervention on Mean Weight (Kg) of Severely Thin Children	279
Figure 4.3.4	Impact of Intervention on Mean Weight (Kg) of Severely Thin Boys and Girls	279
Figure 4.3.5	Impact of Intervention on Mean Height (cms) of Severely Thin Children	284
Figure 4.3.6	Impact of Intervention on Mean Height (cms) of Severely Thin Boys and Girls	284
Figure 4.3.7	Impact of Intervention on the Prevalence of Underweight (Z Scores <-2) In Children	298
Figure 4.3.8	Impact of Intervention on the Prevalence of Stunting (Z Scores <-2) In Children	299
Figure 4.3.9	Impact of Intervention on the Prevalence of Thinness (Z Scores <-2) In Children	300
Figure 4.3.10	Prevalence of Severity of Undernutrition	305

Figure 4.3.11	Prevalence of Severity of Stunting	306
Figure 4.3.12	Prevalence of Severity of Thinness	307
Figure 4.3.13	Summary of Anthropometric Indices	320
Figure 4.3.14	Percent Prevalence of Anaemia among Children after one year of Intervention	326
Figure 4.3.15	Gender Wise Percent Prevalence of Anaemia	328
Figure 4.3.16	Impact of Mid Day Meal on the Percent Prevalence of Anaemia among Children	328
Figure 4.3.17	School Wise Ratio of Girls: Boys	341
Figure 4.3.18	Mean Attendance of School Children	345
Figure 4.3.19	Standard Wise Mean Attendance Rate of the School Children	346
Figure 4.4.1	Designation of Teachers Participated in Workshop	361
Figure 4.4.2	Teachers Perception about Most Liked Food Item By the Children	365
Figure 4.5.1	Impact Seen in Children Due to Mid Day Meal given by Akshay Patra Kitchen	380
Figure 4.5.2	Impact of MDM provided through TAPF on Attendance and School Enrolment	380
Figure 4.5.3	Children's Interest towards Education after MDM	382
Figure 4.5.4	Teachers Feedback Regarding Improvement Needed in TAPF Kitchen	382
Figure 4.5.5	Teachers' Perception Regarding Improvement seen in Children's Health Due to MDM	385
Figure 4.5.6	Children's liking towards Mid Day Meal Provided	385
Figure 4.5.7	Parents' Perception about Improvement in their children's health after Mid Day Meal Programme	389
Figure 4.5.8	Parents' Opinion regarding the Akshay Patra Foundation	389