



Review of Supplementary Nutrition Program (SNP) Food Models in states to Support Nutrition of Young Children

Disclaimer: The analysis presented in the publication was put together based on information gathered through secondary sources like online search, desk review, information from stakeholders, telephonic interviews with government functionaries including grassroots functionaries. The information was collected in initial days of COVID-19 Pandemic

1. Background

India has high rates of under nutrition and its burden is higher among low socio-economic groups especially children under 5 years of age, adolescent girls, pregnant and lactating women. Burden of malnutrition during developmental years is critical for a child's overall growth and development. Stunting in early life can have long-term effects on health, physical and cognitive development, learning and earning potential, thereby placing an immense human and economic toll at the individual, household, community and national level. According to Comprehensive National Nutrition Survey (CNNS, 2016-18), about 34.7%, 33.4% and 17.3% children are stunted, underweight and wasted respectively along with high rate of anaemia (41%), zinc deficiency (19%) and Vitamin A deficiency (17.6%)¹. Micronutrient deficiencies are an important cause of morbidity and mortality in pre-school children and majority of households especially in rural and urban slum area cannot afford or access sufficient nutritious foods^{2,3}. In this context, Ministry of Women and Child Development has implemented Supplementary Nutrition Program (SNP) through Anganwadi services platform under Integrated Child Development Services (ICDS) Scheme. Under the scheme, Supplementary nutrition is provided primarily to bridge the gap between the Recommended Dietary Allowance (RDA) and the Average Daily Intake (ADI) of the 0-6 year's old children along with pregnant and lactating women.

The nutritional needs of a child in the first 6 months are met by effective breastfeeding. However, as the child grows further, the nutrient requirements of the child are not fully met by breastmilk. Thereby the young children stand at increased risk of malnutrition from six months onwards, when complementary feeding needs to be started. The provision of supplementary nutrition by ICDS for pre-school children is an important approach to prevent malnutrition and improve the nutritional status of young children.

Under the latest revised Nutritional and Feeding norms of SNP (w.e.f February 2009), State Governments/UTs have been requested to provide 300 days of supplementary food to the beneficiaries in a year. It entails more than one meal (500Kcal and 12-15g protein)

¹ CNNS. (2018). Comprehensive National Nutrition Survey. Poshan Abhiyan. Ministry of Health and Family Welfare, Government of India

² Beesabathuni, K., Kumari, P., & Bajoria, M. (2020). Take-Home Rations Compendium - Sight and Life. Sight and Life. Retrieved 10 December 2020, from https://sightandlife.org/blog/library_item/take-home-rations-compendium/.

³ Jose, Shyma. (2016). Economic Growth, Poverty and Malnutrition in India. *Ekonomik Yaklasim*. 27. 29. 10.5455/ey.35902.

to the 3-6 years old children who visit AWCs. This includes morning snacks in the form of milk/banana/egg/seasonal fruits/micro-nutrient fortified food followed by a hot cooked meal (HCM). For the children below 3 years of age, Take Home Rations (THRs) in the form of pre-mixes/ready-to-eat food or dry rations are provided. Severely underweight children of 6 months-6 years are provisioned to receive 800Kcal and 20-25g protein through either increased dry ration or pre-mixes or micronutrient fortified food as THR⁴. It is important to mention here that severely underweight children are defined based on low weight for age but not weight for height as recommended to identify SAM and/or MAM cases.

2. Introduction:

Community-based supplementary feeding provision and nutritional information to caregivers have been essential and universalised service under ICDS program in India. Supplementary feeding program is aimed to ameliorate the impact of food insecurity. The supplementary nutrition services delivered to children (6 months - 6 years) involve both hot cooked meals and take-home rations. However, in spite of significant increase in access to food grains and initiation of Supplementary Nutrition Program (SNP) through integrated child development scheme (ICDS) since 1970s, India has continued to bear a heavy burden of child malnutrition till date. Several studies^{5, 6} have assessed the functional gaps that directly affect the performance of ICDS including reach and delivery of services. However, the type and quality of the food provision has received relatively lesser attention which needs review in the context of utilisation of THR. As its name says, the ration provisioned for a preschool beneficiary is taken to home. In that case, the actual intake by the children particularly for children under 12 months of age is frequently found

⁴ <https://icds-wcd.nic.in/icds.aspx>

⁵ Kaur, S., Gupta, R., Khan, I. D., Jindal, A. K., Prajapati, S., Makkar, A., & Rajmohan, K. S. (2018). Infrastructure, resources, services evaluation and gap analysis of integrated maternal and child development services in India. *International journal of medicine and medical research*, (4, Iss. 2), 67-71.

⁶ Chakrabarti, Suman, Kalyani Raghunathan, Harold Alderman, Purnima Menon, and Phuong Nguyen." India's Integrated Child Development Services Programme; Equity and Extent of Coverage in 2006 and 2016." *Bulletin of the World Health Organization* (Apr 1, 2019). <https://www.ncbi.nlm.nih.gov/pubmed/30940984>

lesser than the recommended as it gets shared by the family members^{7,8}. Another issue with the ICDS norms for THR is the identical regimen across the age group and nutritional status though requirements of macro and micro nutrients vary widely across the age group and normal to malnourished children⁹. Usually in majority of states the nutritional support to malnourished children is provided through increased quantities of either dry ration or pre-mixes as THR. Though similar food product model could be advantageous to cater normal and undernourished children from a program delivery point of view, but certain value addition into the THR product is also needed to satisfy exclusive nutrient requirements of malnourished children. Therefore, this document aims to review the strengths and limitations of the SNP food models in different states in India

There is dearth of critical reviews on THR in literature. Very recently published review on THR by WFP as well as the Take Home Ration compendium by TINI and Sight and Life provided an insight into the larger dimensions of THR. This analysis attempted to review the nutritional adequacy of food models of supplementary nutrition program including both Take Home Ration and Hot Cooked Meal. Since the SNP models are widely used to provide nutrition support to SAM/ MAM children apart from the normal ones, review of SNP's strength and limitation to meet the nutritional requirements of not only normal children but also the malnourished children are highly required to further strengthen the program. Identification of SAM children and accordingly distribution of nutritious food to them, when considered as one of the thrust area of Rastriya Poshan Maah (National Nutritional Month) 2021, review of the food models becomes even more relevant in today's context to coordinate with the national nutrition policy priorities. The Coalition for Food & Nutrition Security (CFNS) has undertaken a detailed analysis of the food models with the following objectives and documented the findings in a report. The summary of the findings and key discussion points have been presented in this policy brief.

Objectives of the study were:

⁷ Bajpai, N., & Wadhwa, M. (2019). The Status of Initiatives Dealing with the Challenges of Nutrition in India. Core.ac.uk. Retrieved 10 December 2020, from <https://core.ac.uk/download/pdf/223240703.pdf>.

⁸ Ministry of Health and Family Welfare (MoHFW), Government of India, UNICEF and Population Council. 2019. Comprehensive National Nutrition Survey (CNNS) National Report. New Delhi.

⁹ World Food Program (2019). Review of Take Home Rations under Integrated Child Development Services in India.

- To assess the gap between requirement and delivery of nutrients by SNP Food models under ICDS (Take Home Ration (THR)/hot cook meals) for normal and malnourished children (SAM and MAM).
- To assess the strength and limitations of SNP Food models (Take Home Ration (THR)/hot cook meals) to manage children with normal nutritional status and children with malnutrition (SAM and MAM) in a sustainable way.

3. Methodology

The information regarding the details on SNP food models was collected through–

- Online search at various state government's webpage to gather information about state specific policy recommendations about SNP food models.
- desk research to identify relevant published articles and reports on Take Home Ration.
- telephonic interviews within CFNS network as well as government and grassroots functionaries to collect information
- Questionnaire based survey with stakeholders at different states.

The information was collected in initial days of COVID-19 Pandemic, and therefore the analyses reflect the gaps based on food products used in each of the food model during pre-Covid times which might have altered during and after pandemic.

The study evaluated the nutrient composition of the SNP food models. The collected data was segregated according to the type of SNP food models, type of beneficiary (normal/SAM/MAM) and age group of the beneficiary for each state. Based on the objectives of this report, the following analysis was conducted:

- Quantitative Analysis of each SNP food model for each state
 - Nutritive calculation
 - Nutritive value compared against the recommended guidelines for normal child
 - Nutritive value compared against the recommended guidelines for SAM/MAM child
- Qualitative Analysis of each SNP Food Models across the states

- Protein content
 - Carbohydrate Content
 - Fat Content
 - Vitamin and Mineral Content
- Nutritive value compared against the requirement in young children and older children.

The analysis of the state data of SNP food models is based on the following:

1. Nutrient composition was determined using Indian Food Composition Tables (IFCT), 2017¹⁰ for the following nutrients: Energy (Kcals), Protein (g), Total Fat (g), CHO (g), Total Dietary Fiber (g), Total free sugars (g), Thiamine(mg) B1, Riboflavin(mg) B2, Niacin (mg) B3, Total B6 (mg), Total Folates (mcg), Total Ascorbic Acid (mg), Retinol (mcg), β - Carotene (mcg), Vitamin D (Plant source) (mcg), Vitamin D (Animal source) (mcg), Vit E(mg), Vit K1 (mcg), Vitamin K2 (mcg), Calcium (mg), Iron (mg), Magnesium (mg), Manganese (mg), Phosphorus (mg), Potassium (mg), Selenium (mcg), Sodium (mg), Zinc (mg), Omega 6 (mg) (Linoleic + Arachidonic acid), Omega 3 (mg) (alpha-linolenic + Docosahexaenoic acid)
2. Nutrient comparison was done against the nutrient requirements of normal child based on the WCD norms¹¹ and RDA guidelines, 2020¹²
3. Comparison of nutrient composition against the nutrient requirements of malnourished children based on nutrient requirement for SAM¹³ and MAM¹⁴ children.

¹⁰ Longvah, Thingnganing & Ananthan, Rajendran & Bhaskar, K & Venkaiah, K. (2017). Indian food Composition Tables.

¹¹ MWCD. (2009). Revised Nutritional and Feeding Norms for Supplementary Nutrition in ICDS scheme. Ministry of Women and Child Development, Government of India

¹² ICMR-National Institute of Nutrition. (2020). Nutrient Requirements for Indians. Indian Council of Medical Research. https://www.nin.res.in/nutrition2020/RDA_short_report.pdf

¹³ WHO, W., & UNSCN, U. (2007). Community-based Management of Severe Acute Malnutrition: a joint statement by the World Health Organization, the world food Programme, the United Nations system standing committee on nutrition and the United Nations Children's fund. Geneva: World Health Organization, World Food Programme, United Nations System Standing Committee on Nutrition, United Nations Children's Fund.

¹⁴ WFP. (2021). Technical Specifications for Ready-to-Use Supplementary Food RUSF

The nutrient evaluation of supplementary nutrition food models (including their combinations) provided to normal children¹⁵ and malnourished children¹⁶ was studied respectively in the states and compared with the respective references.

Limitations:

1. Information was collected through secondary sources and online available documents
2. Field level verification due to Covid was not possible
3. Uniform and complete information such as all ingredients and recommended portion size for each of the food models of every state's SNP model were not available
4. Changes in the food model due to Covid – 19 pandemic related constraints could not be considered in the document.

4. Results & Discussions

Data on supplementary food delivery models could be obtained for 11 states; Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Telangana and Uttar Pradesh. The information about the food models can be referred to in the supplemental documents (**Annexures 1**). A mix of models for the provision of THR was observed across the states. The THR provision follows ICMR guidelines. However, information on THR content, quantity, frequency and nutrient content is not uniformly available for all the states. Each state is following different protocols for providing nutritional support in form of THR/RTE to SAM and MAM children.

The ingredients of THR are predominantly a combination of cereal, legume, oil, and sugar. The following section presents the quantitative analysis of the nutrient value of calories, macronutrients and micronutrients of the different food models and includes

¹⁵ Contents of SN are not consistent throughout the month. Hence for analysis purpose, different combinations of a given provision were assessed (with or without a component).

¹⁶ For states where age group unclear, the nutrients are compared against the recommended guidelines for 6 months to 6 years of age children.

a comparison of supplementary nutrition with RDA for normal children and nutrient requirements for SAM and MAM children. The food models for normal children were compared with MWCD provision norms¹⁷ and RDA guidelines whereas sugar provision was compared with dietary guideline for Indians¹⁸. The food models for the management of malnourished children were compared with WHO recommendations for SAM and MAM children respectively (Table 1-4). Each of the table presents the analysis of states for which respective information was available.

The analysis highlighted that while most states met and even exceeded macronutrient provision (MWCD 2009) for 6m-3y and 3-6y old normal children, micronutrient delivery is a concern. No states other than UP has been found to meet provision norms for calcium and Vitamin A across the age groups (i.e 50% of RDA¹⁹). In case of iron contents, Bihar, Jharkhand and Odisha were not able to meet both MWCD provision and recommended dietary allowance for 1-3y children. When adequacy of these nutrients present in supplementary nutrition for SAM/MAM management was investigated, 100g THR/ premixes were found to have lower energy density in comparison with WHO recommendations for 100g of food for SAM or MAM primarily due to low fat content. Iron, zinc, calcium, vitamin A contents also remained far below than the minimum level suggested in ready-to-use - for SAM²⁰ or MAM²¹ children.

Table 1: Comparison of nutrient compositions of supplementary food (THR/premixes) given for normal children aged 6 m-3 y with norms

¹⁷ MWCD. (2009). Revised Nutritional and Feeding Norms for Supplementary Nutrition in ICDS scheme. Ministry of Women and Child Development, Government of India

¹⁸ ICMR. (2011). Dietary guidelines for Indians: a manual. Hyderabad: National Institute of Nutrition, ICMR: 91.

¹⁹ MWCD. (2009). Revised Nutritional and Feeding Norms for Supplementary Nutrition in ICDS scheme. Ministry of Women and Child Development, Government of India

²⁰ WHO, W., & UNSCN, U. (2007). Community-based Management of Severe Acute Malnutrition: a joint statement by the World Health Organization, the world food Programme, the United Nations system standing committee on nutrition and the United Nations Children's fund. Geneva: World Health Organization, World Food Programme, United Nations System Standing Committee on Nutrition, United Nations Children's Fund.

²¹ WFP. (2021). Technical Specifications for Ready-to-Use Supplementary Food RUSF

Normal Children (6m-3y)											REFERENCE			
Nutrients	Unit	TL	AP	BH	CH	GJ	JH	OD	RJ	UP	WCD norms		RDA 2020	
											6m-3y	6-12 m	1-3y	
Energy	Kcal	447.7	1251	563.3	641	515	609	408	734	1535	500	660	1110	
Sugar	G	20	-	1.7	-	-	27.9	11.7	2.5	-	-	10*	15*	
	% Energy	17.9	-	1.21	-	-	18.3	11.47	1.3	-	-	-	-	
	% CHO Energy	46.7	-	1.6	-	-	27.6	16.2	2	-	-	-	-	
CHO	G	42.8	-	106.7	-	88.9	101.2	72.4	127.5	-	-	95	100	
	%Energy	38.3	-	75.8	-	69	66	71	69	-	-	-	-	
Protein	G	14.3	39.2	25.8	19.9	12.3	19.7	14.7	35.1	52	12 – 15	10.5	12.5	
	% Energy	12.8	12.53	18.32	12.4	10	13	14.41	19	13.55	-	-	-	
Fat	G	13.5	42.6	2.46	-	12.3	12.9	5.85	7.4	-	-	-	-	
	% Energy	27.1	30.65	3.93	-	21	19	12.9	9	-	-	35	35	
Protein from Dairy source	G	3.6	0	0	-	0	0	0	0	3.12	-	-	-	
	% Protein	25.1	0	0	-	0	0	0	0	6	-	-	-	
Potassium	Mg	-	-	524	-	-	1363.6	346.4	1385.4	-	-	1100	1750	
Magnesium	Mg	-	-	58.63	-	-	163	70.6	213.8	-	-	75	90	
Iron	Mg	9.5	-	5.83	-	-	4.5	3.2	9.6	17.8	6	3	8	
Zinc	Mg	-	-	3.2	-	-	2.8	2.5	6.4	-	-	2.5	3.3	
Calcium	Mg	379.4	-	61.26	-	-	83.1	38.1	79	592.8	200	300	500	

Vitamin A	µg	252	-	33	-	-	0	49.5	0	592. 8	200	350	390
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TL= Telangana, BH=Bihar, CH= Chhattisgarh, GJ= Gujarat, JKH= Jharkhand, OD= Odisha, RJ= Rajasthan, UP=Uttar Pradesh,

Note: Table compiles available information of full provision of THR given to normal children (approximate per day). *Sugar norms are cited from Dietary guideline for Indians, ICMR. RDA for CHO for 6-12 months stipulates minimum intake of CHO from both human milk and complementary foods. Above WCD 2009 norms cite micronutrient provision for only 1-3 years;

Table 2: Comparison of nutrient compositions of supplementary food given to normal children aged 3-6 yrs with reference norms

Nutrients	Unit	Normal Children (3-6 y)					REFERENCE			
		THR/Premixes		Hot Cooked Meals			WCD Provision		RDA 2020	
		Rajasthan	UP	Odisha	Telangana	MP	1-3y	4-6y	1-3y	4-6y
Energy	Kcal	734	639	709	460	681	500	500	1110	1360
Sugar	g	2.5	-	0.85	0.95	2.7	-	-	15	20
	% Energy	1	-	0.48	0.83	1.6	-	-	-	-
	% CHO Energy	2	-	1.2	1.3	2.3	-	-	-	-
CHO	g	127.5	-	70.5	71	114.7	-	-	100	100
	%Energy	69	-	39.7	61.7	67.4	-	-	-	-
Protein	g	35.1	21.1	13.3	17.9	24	12 – 15	12 –15	12.5	16
	% Energy	19.1	13.2	7.5	15.6	14.1	-	-	-	-
Fat	g	7.4	-	40.8	10.7	12.3	-	-	-	-
	% Energy	9	-	51.8	20.93	16.3	-	-	35	25

Protein from Dairy source	g	0	0.8	0	0	0	-	-	-	-
	% Protein	0	3.8	0	0	0	-	-	-	-
Potassium	mg	1385.4	-	238.8	494.3	886.4	-	-	1750	2250
Magnesium	mg	213.8	-	29.6	59.5	203	-	-	90	125
Iron	mg	9.6	27	2	3	9.1	6	9	8	11
Zinc	mg	6.4	-	1.8	2.3	4.5	-	-	3.3	4.5
Calcium	mg	79	600	25	76.9	176.6	200	200	500	550
Vitamin A	µg	0	600	49.5	99	0	200	200	390	510

Note: Table compiles available information of full provision given to normal children (approximate per day. Sugar norms are cited from Dietary guideline for Indians, ICMR.

Table 3: Comparison of nutrient quality of THR/Premixes (per 100g) given to MAM and SAM children aged 6m-3y with reference guidelines

Nutrient	Unit	SAM/MAM (6m-3y)									REFERENCES			
											WHO recommendations			
		CH	BH	MH	GJ	RJ	UP	JKH	MP	TL	For SAM Per 100 g		For MAM Per 100 g	
											Min	Max	Min	Max
Energy	Kcal	820	332	375	440	333	427	285	389.4	460	520	550	510	560
Sugar	G	-	1	14.9	-	1.2	-	8.1	12.7	20	26	27.5	25.5	28

	% Energy	-	1.2	15.9	-	1.4	-	11.4	13.1	17	0	20	0	20
	% CHO Energy	-	1.6	26.4	-	2	-	18.7	25.6	40	-	-	-	-
CHO	g	-	64	56.2	76	59.5	-	43.4	49.7	50	-	-	-	
	%Energy	-	77	60	69.1	71.5	-	60.8	51	97.8	-	-	-	
Protein	G	25.5	15	11.8	10.5	15	14.4	10.6	12.1	11	13	16.5	11	16
	% Energy	12.4	18.1	12.6	9.5	18.1	13.5	14.8	12.4	10	10	12	8.63	11.4
Fat	G	-	1	10.8	10.5	3.0	-	7.2	15.2	22.1	26	36	26	36
	% Energy	-	3.2	25.9	21.5	8.2	-	22.7	35.1	43	45	60	45.9	57.9
Protein from Dairy	G	-	0	0	-	0	0.9	0	1.40	4.8	6.5	8.25	3.6	-
	% Milk protein	-	0	0	-	0	6	0	11.5	43.4	50	50	32.7	22.5
Potassium	Mg	-	296	465.4	-	579.2	-	584.2	473.8	-	1100	1400	800	1400
Magnesium	Mg	-	34	112.3	-	97.4	-	76.4	92.6	-	80	140	150	225
Iron	Mg	-	3	3.6	-	4.2	4.9	2.2	3	9.1	10	14	10	14
Zinc	Mg	-	2	2.3	-	2.8	-	1.5	1.93	6.3	11	14	11	14
Calcium	Mg	-	37	50.9	-	35.2	164.7	34.1	48.8	419	300	600	535	750
Vitamin A	µg	-	13	0	-	0	164.7	0	0	200.1	800	1100	700	1600

CH= Chattisgarh, BH=Bihar, MH= Maharashtra, GJ= Gujarat, RJ= Rajasthan, UP=Uttar Pradesh, JKH= Jharkhand, MP= Madhya Pradesh, TL= Telangana,

Note: All provisions cite nutrient value/100g. Above table cites SAM food model for all states except Jharkhand where food model caters to both SAM & MAM children. The SAM food models are compared with WHO recommendations for SAM and MAM respectively.

Table 4: Comparison of nutrient quality of supplementary food (per 100g) given to MAM and SAM children for 3-6 yrs with reference guidelines

Nutrients	Unit	SAM/MAM (3-6 yrs)				REFERENCE			
						WHO recommendations			
		THR/Premixes			HCM + THR	For MAM Per 100 g		For SAM Per 100 g	
		UP	Odisha	Rajasthan	Telangana	Min	Max	Min	Max
Energy	Kcal	426	329	333	344.2	510	560	520	550
Sugar	g	-	14.87	1.19	8	25.5	28	26	27.5
	% Energy	-	15.86	1.43	9.3	0	20	0	20
	% CHO Energy	-	22.3	2	17.7	-	-	-	-
CHO	g	-	58.3	59.5	45.2	-	-	-	-
	%Energy	-	71	71.5	52.5	-	-	-	-
Protein	g	14.1	10.9	15	10.5	11	16	13	16.5
	% Energy	13.2	13.2	18.1	12.2	8.63	11.43	10	12
Fat	g	-	5.2	3	12.5	26	36	26	36
	% Energy	-	14.3	8.2	32.7	45.88	57.86	45	60
Protein from Dairy	g	0.5	0	0	1.84	3.6	-	6.5	8.25
	% Milk protein	3.8	0	0	17.5	32.7	22.5	50	50
Potassium	mg	-	275.5	579.2	-	800	1400	1100	1400
Magnesium	mg	-	66.3	97.4	-	150	225	80	140
Iron	mg	18.00	2.4	4.19	4.5	10	14	10	14
Zinc	mg	-	1.9	2.85	3.2	11	14	11	14
Calcium	mg	400	26	35	189.4	535	750	300	600
Vitamin A	µg	400	0	0	115	700	1600	800	1100

Note: All provisions cite nutrient value/100g. Above table cites state THR given to only SAM children except Telangana's food model catering to both SAM and MAM children.

4.1 Protein Content of Food Models for Normal and malnourished Children

Most of the SNP food models are a combination of cereal and pulse used both for normal and SAM and MAM children. The protein quantity is though sufficiently meeting or sometimes exceeding the protein requirements for both normal and malnourished

children but the protein quality in terms of DIAAS value of the food models is varying. The food models have lower Digestible Indispensable Amino Acid Score (DIAAS) value of around 60-70%. Low DIAAS value of the food models indicates that even though high quantities of protein are supplied to the children, optimum quality of protein required for their growth is not delivered. The sources of protein of different states for normal and SAM and MAM children are showcased in Table 5 and 6.

Table 5. Source of protein in the food models for normal children across all states:

State	Eggs	Milk	Milk Powder	Soya Flour	Soya chunks	Defatted Soya grit	Cereal + Pulses	Groundnuts
Andhra Pradesh	x	X	x	✓	x	x	✓	X
Bihar	✓	X	x	x	✓	x	✓	X
Chhattisgarh	NA	NA	NA	NA	NA	NA	NA	NA
Gujarat	x	X	x	✓	x	x	✓	X
Jharkhand	x	X	x	x	x	x	✓	✓
Madhya Pradesh	x	X	✓	✓	x	✓	✓	X
Maharashtra	x	X	x	✓	x	x	✓	✓
Odisha	✓	X	x	x	x	x	✓	✓
Rajasthan	x	X	x	x	x	x	✓	X
Telangana	✓	X	x	x	x	x	✓	X
Uttar Pradesh	x	X	✓	✓	x	x	✓	✓

Table 6. Source of protein in the food models for MAM and SAM children across all states:

State	Eggs	Milk	Milk Powder	Soya Flour	Soya chunks	Defatted Soya grit	Cereal + Pulses	Groundnuts
Andhra Pradesh	X	X	x	✓	x	x	x	X
Bihar	✓	X	x	x	✓	x	✓	X
Chhattisgarh	NA	NA	NA	NA	NA	NA	NA	NA
Gujarat	X	X	x	✓	x	x	✓	X
Jharkhand	X	X	x	x	x	x	✓	✓
Madhya Pradesh	X	X	✓	✓	x	✓	✓	X
Maharashtra	X	X	x	✓	x	x	✓	✓
Odisha	✓	X	x	x	x	x	✓	✓
Rajasthan	X	X	x	x	x	x	✓	X
Telangana	✓	✓	Skim Milk Powder	x	x	x	✓	X
Uttar Pradesh	X	X	✓	✓	x	x	✓	✓

Soya as flour or processed chunks has been found to be commonly used in many state's SNP food models. Use of Soya as flour or processed chunks though may improve the protein quality with its high DIAAS value of 73²², however, the best source of protein according would be milk protein concentrate (DIAAS value 85) or skim milk powder (DIAAS value – 81)

4.2 Caloric Value of the Supplementary Nutrition food Model for normal and malnourished (SAM & MAM) children

The calorific value of supplementary nutrition for normal children in both age groups adequately met or exceeded the recommended guidelines for energy across the states.

²² Mathai, J. K., Liu, Y., & Stein, H. H. (2017). Values for digestible indispensable amino acid scores (DIAAS) for some dairy and plant proteins may better describe protein quality than values calculated using the concept for protein digestibility-corrected amino acid scores (PDCAAS). *British Journal of Nutrition*, 117(4), 490-499.

However it was lower than the recommended norms for malnourished children. The energy is primarily sourced from carbohydrate in almost all the states and use of sugar/jaggery in high quantity is quite rampant. The following table (table 7) reflects the presence of sugar in different food models.

Table 7: Presence of free sugars in the Food models of the states

State	Sugar given in THR		Jaggery given in THR		Sugar given in Premix packets		Jaggery given in Premix packets	
	Normal	SAM/MAM	Normal	SAM/MAM	Normal	SAM/MAM	Normal	SAM/MAM
Andhra Pradesh	x	X	x	x	✓	✓	x	X
Bihar	x	X	x	x	x	x	x	X
Chhattisgarh	NA	NA	NA	NA	NA	NA	NA	NA
Gujarat	x	X	x	x	✓	✓	x	x
Jharkhand	x	X	✓	✓	x	x	x	x
Madhya Pradesh	x	X	x	x	✓	✓	x	x
Maharashtra	x	X	x	x	✓	✓	x	x
Odisha	✓	✓	✓	✓	✓	✓	✓	✓
Rajasthan	x	X	x	x	x	x	x	x
Telangana	✓	✓	x	x	x	x	x	x
Uttar Pradesh	x	x	x	x	✓	✓	x	x

Contribution of added sugar for calorie supply is found to reach even 20% whereas Indian Association of Paediatrics (IAP) provisioned the free sugars consumption <5% of total energy intake by young children²³. The majority of food models are thus failing to conform to the guideline for free sugar intake and state wise data shows high presence of free sugar usage in premixes (Figure 1). The total energy from free sugar in premix is scoring alarming high for the states Odisha, Jharkhand, Madhya Pradesh.

²³ Gupta, P., et al. (2019). Indian Academy of Pediatrics Guidelines on the Fast and Junk Foods, Sugar Sweetened Beverages, Fruit Juices, and Energy Drinks. Indian Pediatrics, 56(9), 849-863.

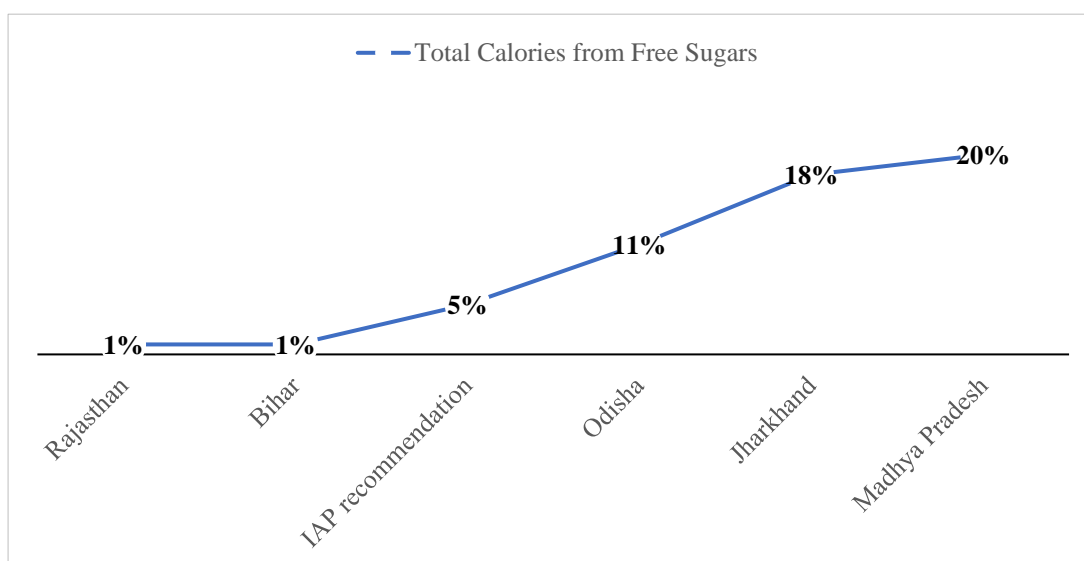


Figure 1: Total percent calories provided from free sugars in the food models compared against the IAP recommended guidelines for normal children

4.3 Fat Content of the Food Models for Normal, MAM & SAM Children

As fat and oils are concerned, all the states are found to use various types of oils and even vanaspati in some cases. Though the dietary composition of n6:n3 ratio for children >2 years for prevention of nutrition-related chronic disease should be between 5:1 to 10:1, Maharashtra food model has found to have the n6:n3 ratio between 10:1 – 20:1 whereas Jharkhand, Odisha and Rajasthan had ratios above 20:1. The type of oil used in different state food models is presented in Table 8.

Supplementary food models have higher usage of vegetable oils and lack of nuts and oilseeds, animal fat like eggs, milk and its products lead to high omega 6 and low omega 3 content among food models.

Table 8: The type of oil provided across states in their food models

State	Palmolein oil in Premix packets		Vanaspati in Premix packets		Refined vegetable oil in premix packets		Edible oil in premix packets		Oil given with THR	
	Normal	SAM/MAM	Normal	SAM/MAM	Normal	SAM/MAM	Normal	SAM/MAM	Normal	SAM/MAM
Andhra Pradesh	✓	✓	✓	✓	x	x	X	X	✓	x
Bihar	x	x	x	x	x	x	X	X	x	x
Chhattisgarh	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gujarat	x	x	x	x	x	x	✓	✓	x	x
Jharkhand	x	x	x	x	x	x	X	x	x	x
Madhya Pradesh	x	x	x	x	✓	✓	✓	✓	✓	x
Maharashtra	x	x	x	x	x	x	✓	✓	x	x
Odisha	x	x	x	x	x	x	X	x	✓	x
Rajasthan	x	x	x	x	x	x	X	x	x	x
Telangana	x	x	x	x	x	x	X	x	✓	✓
Uttar Pradesh	x	x	x	x	✓	✓	X	x	x	x

Balanced n6:n3 polyunsaturated fatty acids (PUFAs) are beneficial for normal or SAM or MAM children as n3 fatty acids play a significant role in modulation of tissue inflammation, immune function, and overall neural development. An omega-3 rich diet is also associated

with prevention of cardiovascular diseases (CVD), several types of cancer, blood pressure and child health.

5. Conclusion & Recommendations

The supplementary nutrition program of India is one of the unique community-based program in the world. It focuses on the provision of specialised food products to supplement the diet of target populations and nutrition education as a malnutrition prevention strategy as well as for promoting growth. However, in spite of significant investment in the SNP program of integrated child development scheme (ICDS), India has continued to bear a heavy burden of child malnutrition till date. This clearly suggests that we need to examine our current approach and need to make a few changes to ensure that the supplementary nutrition provided through ICDS do not just appease hunger, but should provide sufficient , protein and micronutrients to fill the gap between habitual intake and the child's nutrient requirements.

The onset of Covid- 19 pandemic witnessed disturbances in the distribution of supplementary nutrition to the beneficiaries. In most of the states, the premix has been replaced by whole dry grains as part of the take home rations and its distribution has been erratic. Amid the pandemic related disruption in public health and nutrition service delivery system and socio-economic crisis in the households, this issue becomes even more critical. As ICDS is a great and universal platform for implementing National Food Security Act (NFSA) to ensure food security among vulnerable population, strengthening SNP food model will help to provide nutrition security as well.

Based on the analysis of the food models, this section brings forth a few key issues and subsequent recommendations to overcome them.

1. The ICDS norms for THR are found to be constant throughout the age (6-11 months vs 12-24 months) and nutrition status (normal vs SAM/MAM) of children. This is in agreement with the recent review done by World Food Program²⁴.

²⁴ World Food Program (2019). Review of Take Home Rations under Integrated Child Development Services in India.

Since the nutrient requirements vary according to the increasing age or differing with normal to malnourished children, the food model should be designed categorically to cater the varied nutritional requirements of different age groups and nutritional status.

2. The quantity of the food given to children of a wide range of age overlooks the difference in the eating capacity and age-appropriate nutrient requirements of the child. Many food models aim to achieve the nutrient requirements by increasing the quantity of the food especially for SAM children. However, practically it is not possible for the child to consume the high amount supplied ration because of small stomach capacity and malnourishment related physiological issues.

Thus, for malnourished children, modified version of regular SNP food model with high and quality is essential to cater differential nutrients requirements of SAM/MAM children.

The policy makers need to consider improving the of the SNP food models to provide adequate nutrients through reasonable portion size. An approach adapting the food models for the beneficiaries as per their age, type of foods (e.g soft, mashed foods for younger children and solid foods for older children) in line with the different recommended dietary allowances / nutritional requirements and status should be considered. High nutrient density to comply with stomach capacity of the child is very essential to follow. This will help in quantifying the rations as per their age and capacity to eat. There is a need for actual consumption studies focusing on the quantity of food available and consumed by the beneficiaries daily to design the policy guideline. This will also help in preventing loss of food due to financial appropriation and leakages.

3. The currently practiced food models of Supplementary Nutrition Programme are majorly focused on calorie and protein.

To ensure good nutrition for children, protein quality, type of fat, reduced sugar content and locally available fruits-vegetables foods to increase dietary diversity should be considered in the guideline.

4. The food models for malnourished children are also primarily cereal-pulse combinations and 38-81% energy is derived primarily from carbohydrates, 10-21% from protein and only 2-38% from fat.

On the contrary, SAM children need diet where 45-60% of total energy comes from fat, contribute 10%–12% of total energy from protein²⁵

5. The SNP food models for normal children are also predominantly a combination of cereal and pulse. Food models met or exceeded protein requirements because the quantity of supplementary food provisioned for the child is high. However, the cereal and pulse combination have a lower DIAAS. This means even with high quantities of protein supplied to the children they are not receiving optimum quality of protein required for promoting their growth.

Therefore, to achieve the optimum quality of protein with ideal amino acid composition, foods with high DIAAS value should be included to provide adequate amount of essential amino acids through a small portion size. Foods with high DIAAS value e.g., non-veg protein sources such as egg, milk products, roasted nuts and dals (groundnuts, chana, etc.) or dried fish powder based on community preference should be added as part of the food model especially for the older children to meet their higher protein requirement

The best source of protein is the milk protein concentrate (DIAAS value 85) or skim milk powder (DIAAS value – 81). Use of a good quality protein source, such as milk can complement wheat, a cereal grain limiting in lysine with a DIAAS of approximately 54 and the combo may provide amino acids according to human AA requirements.²⁶ Therefore, to achieve the optimum quality of protein with ideal amino acid composition, the child must be provided protein from animal sources and nuts having high amino acid score/ DIAAS.

²⁵ World Health Organization. (2007). Community-based management of severe acute malnutrition: a joint statement by the World Health Organization, the World Food Programme, the United Nations System Standing Committee on Nutrition and the United Nations Children's Fund

²⁶ Bailey, H. M., & Stein, H. H. (2019). Can the digestible indispensable amino acid score methodology decrease protein malnutrition. *Animal Frontiers*, 9(4), 18-23.

6. The SNP food products are high in omega 6 and added sugars, which can push children towards obesity, metabolic disorders and other NCDs. Preference in supplementary nutrition towards vegetable oils and lack of nuts and oilseeds, animal fat like eggs, milk and its products lead to high omega 6 and low omega 3 content among SNP food models.

Locally available oil seeds such as sesame seeds, garden cress seeds, mustard seeds, Niger seeds, sunflower seeds, safflower seeds should be included in the premixes or as separate sachets with the premix packets or take home rations to improve the n6:n3 ratio. Nutrition education with a special focus on use of fats and oils for cooking and inclusion of foods rich in omega-3 fatty acids should also be planned for the beneficiaries.

7. Contribution of added sugar towards calories ranges from 1% to 20%. According to the IAP guidelines, free sugar shouldn't exceed above 5 % of total energy intake of that day. This is aligned with the recommendation by WHO based on the moderate quality evidence on the relationship between free sugars intake and body weight and dental caries²⁷. Indian Association of Paediatrics (IAP) guidelines recommends no consumption of free sugars for normal children below 2 years of age.²⁸ Sugars are generally added to improve palatability of products but raises concerns as it provides 'empty calories'²⁹, or calories with little associated nutrients. For instance, a study observed that high intake of free sugar (> 20% of energy) diluted the micronutrient intake among children and adolescents³⁰. During the early years of developing food choices and behaviors, once the children are exposed to sweet senses on tongue, it becomes difficult to sensitize the young children to the other tastes and non-sweetened healthy foods. Hence, regulating the sugar provision especially for <2 years old children is important. Excessive consumption of sugars has been linked with several metabolic abnormalities and adverse health outcomes as well. Studies among children showed an association between the consumption (or high consumption) of added sugars and adverse cardiovascular health factors such as elevated diastolic BP, triglyceride, very low-density

²⁷ World Health Organization. (2015). *Guideline: sugars intake for adults and children*. World Health Organization.

²⁸ Gupta, P., et al. (2019). Indian Academy of Pediatrics Guidelines on the Fast and Junk Foods, Sugar Sweetened Beverages, Fruit Juices, and Energy Drinks. *Indian Pediatrics*, 56(9), 849-863.

²⁹ Lustig, R. H., Schmidt, L. A., & Brindis, C. D. (2012). The toxic truth about sugar. *Nature*, 482(7383), 27-29.

³⁰ Wong, T. H. T., Mok, A., Ahmad, R., Rangan, A., & Louie, J. C. Y. (2019). Intake of free sugar and micronutrient dilution in Australian children and adolescents. *European journal of nutrition*, 58(6), 2485-2495.

lipoprotein cholesterol, insulin resistance.^{31, 32} Given the literature evidence on the adverse effects of free sugar, use of added sugar in premix is a matter of high concern. According to an NNMB survey, the average consumption of sugar among 1-3 year old children is 10g/day³³.

Restrict the use of free sugar in THR/premix for feeding children especially below 2 years of age is thus highly essential. Sugar in THR needs to be replaced with increased amount of good quality proteins and fats. This will ensure the caloric requirement is met. Also inclusion of seasonal fruits and vegetables will improve the quality of carbohydrate introduced to the child and replace free sugars.

8. Diversity of food model is another critical aspect. Provision of egg as good quality of protein as well as fruits and vegetables as source of micronutrients are not widely practiced. Seasonal green leafy vegetables are promoted in hot cooked meals of Madhya Pradesh and Telangana whereas potato is given in THR to beneficiaries in Jharkhand.

Socio-cultural food habits within the state should be considered and the food model should include locally available and seasonal fruits and vegetables to improve the diversity and micronutrient status of the beneficiaries. Fresh and dried vegetables must be included as part of THR and HCM. Additionally powder of dried vegetables, Moringa leaves, curry leaves, seed powder can be distributed with the THR. Keeping their traditional food habits in mind, nutrition education and recipe cooking demonstrations should be planned to create and spread awareness on the consumption of locally available/seasonal fruits and vegetables to improve the dietary diversity.

³¹ Sharma, S., Roberts, L. S., Lustig, R. H., & Fleming, S. E. (2010). Carbohydrate intake and cardiometabolic risk factors in high BMI African American children. *Nutrition & metabolism*, 7(1), 10.

³² Kell, K. P., Cardel, M. I., Bohan Brown, M. M., & Fernández, J. R. (2014). Added sugars in the diet are positively associated with diastolic blood pressure and triglycerides in children. *The American journal of clinical nutrition*, 100(1), 46-52.

³³ NNMB. (2012). Diet and Nutritional Status of Rural Population, Prevalence of Hypertension & Diabetes among Adults and Infant & Young child Feeding practices. Report of Third Repeat Survey. NNMB Technical Report No 26.

9. Community sensitization through the supplementary nutrition program on how to utilize the food in optimum way is very low. Awareness on the utilization of the THR in best possible way to retain the nutritional value and making it more acceptable by the child is highly required to maintain child growth and correct nutrient deficiency.

Age-appropriate recipe preparation and cooking techniques should be taught to caregivers. It essentially should deliver behaviour change on best consumption of the given food to make them palatable maintaining the desired texture, taste, appearance, and acceptability of food along with minimizing nutrient loss and improve bioavailability the nutrients. The anti-nutritional factors such as phytates and oxalates have to be reduced by applying appropriate cooking techniques such as roasting, germinating, malting, etc . Behaviour change communication on best dietary practices of food matrix interaction (e.g intake of vitamin C rich fruit and vegetable as part of meal to improve iron absorption)³⁴ is also required.

Community sensitization is mandatory about the purpose of provisioning and importance of THR to ensure consumption of ration by the targeted beneficiaries but not shared within household.

³⁴ Roy Choudhury D, Nair Krishnapillai M, Nagalla B, Vijaya Kankipati R, Ghosh S, Buwade J, Fernandez-Rao S. Guava with an institutional supplementary meal improves iron status of preschoolers: a cluster-randomized controlled trial. Ann N Y Acad Sci. 2021; 1492(1):82-95.

Annexure 1

Information about the Food Models distributing SNP to Normal and Malnourished Children from all the selected states

State	Age group	Type of Meal	THR Name & Daily Allocation
Andhra Pradesh	Not Mentioned	Premix packets	Modified Therapeutic Food (110g), Upma Mix(90g), Halwa Mix (90g)
Bihar	6-36m normal	Dry Ration	Rice (100g), Pulse-Masoor (50g), Eggs (8/month) (50), Soya chunks- Bari (20g);"For those who don't have eggs"
	6-36m SUW/SAM		Rice (150), Pulse-Masoor (70), Eggs (12/month) (50), Soyachunks- Bari (35);"For those who don't have eggs"
Chhattisgarh	6-36m normal and SUW/SAM are Not Mentioned	Premix	Composition Unknown. For Normal and MAM (125g) For SAM (200g)
Gujarat	6 m - 3 y	Premix	Balshakti (117g)
	3-6 y	HCM	Dal dhokli, Veg pulaw, Channa
	6-36m SAM	Premix	Balshakti (167g)
	36-72m SAM	HCM	Sukhadi (not mentioned)
Jharkhand	6-72m	HCM	Rice (50g), Pulse-Toor (30g), Groundnut-Roasted (30g), Jaggery (30g), Potato (100g)
	Malnourished & SAM Children	Dry Ration	Rice (75g), Pulse-Toor (35g), Groundnut-Roasted (50g), Bengal gram-Roasted (25g), Jaggery (25g), Potato (100g) /day
Madhya Pradesh	6 months - 3 yrs	Premix	Halwa Premix (86g), Baal Aahar Premix (86g)

	3-6 y	HCM	Breakfast : Rice (35gms), Daliya (50gms), Dal (15gms), Green leafy vegetables (10gms), Oil (5gms), Salt & other ingredient (As per taste)
			Meal : 2 chapati(Wheat)(50gms), Dal (20gms), Green leafy vegetables (50gms), Oil (5gms), Salt & other ingredient (As per taste)
	6 m - 3y SAM	Premix	Halwa Premix (86g), Baal Aahar Premix (86g), Halwa premix (86g), Baal Aahar Premix (86g), Khichdi Premix (86g), Halwa Premix (86g), Baal Aahar Premix (86g), Khichdi Premix (172g), Halwa Premix (172g), Baal Aahar Premix (86g), Khichdi Premix (172g)
Odisha	7-36m	Premix packets + Dry Ration	Wheat and Rice Chhatua (73g), Suji (33g) & Egg (12/month)
	3-6 y	HCM	Rice 80 (gm), Dal (30 gm), Egg (5/week), Oil (38g)
	3-6 y SAM	Premix packets + Dry Ration	Wheat and Rice Chhatua (147 gm), 1 pc of Egg, Besan Laddu (1.650 gm)
Rajasthan	6 m - 6 y normal	Dry Ration	Wheat (50 g), Rice (50 g), Chana Daal A Grade (120g)
	6 m - 6 y SAM	Dry Ration	Wheat (80 g), rice (60g),120 g chana dal (120g)
Maharashtra	Age Not Mentioned SAM	Premix	Fortified Blended Sheera Premix (130g), Fortified Blended Sheera Premix (Paustik) (130g), Fortified Nutri-rich Sevai (130g), Fortified Blended Upma (130g)
Telangana	6-36m normal	THR	Balaamrutham (100g), 16eggs/month
	6-36m SAM/MAM/SUW*		Balaamrutham (100g), additional 1 egg, Milk (100mL), Mimi meal with 5g oil
	3-6 y	HCM	Rice (75gm), red gram dal (15gm), chana dal (15 gm), green leafy vegetables (15gm), eggs (1 no.) &

			oil (5g) for meal and Nutri Snacks (20gm)/ Channa dhal (15g)
	3-6y SUW/SAM/MAM*	HCM+THR	Rice (75gm), dal (red gram) 15 g, green leafy vegetables (15 gm), balamruthan (50 gm), eggs 1 no. and additional 9 eggs in a month, milk (100 ml) & oil (10 gm) with meal
Uttar Pradesh	6 m - 3y normal	Premix	Weaning Food (120g), Meetha Daliya (120g), Namkeen Daliya (120g)
	3-6 y normal	Premix	Laddoo Premix (50g), Meetha Daliya (50g), Namkeen Daliya (50g)
	6 m - 3 y SAM	Premix	Weaning Food (200g), Meetha Daliya (200g), Namkeen Daliya (200g)
	3 - 6 y SAM	Premix	Laddoo Premix (75g), Meetha Daliya (75g), Namkeen Daliya (75g)

*Guideline is modified with Balamrutham+

Premix Packets Details:

- Upma Mix (Ready to cook) – Roasted Wheat Rawa, Roasted Soya Rawa, Refined Palmolein Oil, Iodised Salt, Black Gram Dal, Mustard seeds and Dried Red Chillies
- Halwa Mix (Ready to cook) – Roasted Wheat Rawa, Roasted Soya Rawa, Sugar, Vanaspati, and Cardamom Powder
- Balshakti – Wheat, maize, soya, gramflour , Oil & sugar
- Fortified Blended Sheera Premix – Whole Wheat-65 gm, Soyabean-10 gm, Bengal Gram-15 gm, Sugar-30 gm, Edible oil-06 gm, Ground nut-04 gm, Total-130 gm

- Fortified Blended Sheera Premix (Paustik) – Whole Wheat-53 gm, Soyabean-15 gm, Green Gram (Mung)-16 gm, Sugar-35 gm, Edible oil-08 gm, Ground nut-03 gm, Total-130 gm Paustik
- Fortified Nutri-rich Sevai – Whole wheat-92 gm, Soyabean-12 gm, Bengal Gram (Chana)-08 gm, Edible Oil-12 gm, Spices-06 gm, Total-130 gm
- Fortified Blended Upma – Whole Wheat-86 gm, Soyabean-10 gm, Bengal Gram-10 gm, Sugar-05 gm, Edible oil-10 gm, Ground nut-04 gm, Spices-05 gm
- Weaning Food – Wheat (35), Sugar (25), Soya (15), Vegetable oil (10), Milk Powder (5), Ragi (5) Vitamin & Mineral Premix (5)
- Meetha Daliya – Wheat (40), Sugar (25), Soya (11), Vegetable oil (10), Milk Powder (8), Ragi (5) Vitamin & Mineral Premix (1)
- Namkeen Daliya – Wheat (30), Sugar (12), Soya (10), Vegetable oil (16), Ragi (5) Vitamin & Mineral Premix (1), Groundnut (6), Toor Daal (16), Masala Mix (4)
- Laddoo Premix – Wheat (40), Sugar (25), Soya (15), Vegetable oil (5), Groundnut (5), Chana (10)
- Halwa Premix – Roasted Wheat Flour (50.4), Roasted Soya flour (16.8); (DEFATTED), Shakkar (19.2), Roasted Besan (9.6), Milk Powder (12), Refined vegetable oil (15) (600g - 1 packet/week)
- Baal Aahar Premix – Roasted Wheat Flour (57.6), Roasted Soya flour (16.8); (DEFATTED), Shakkar (19.2), Milk Powder (14.4), Refined vegetable oil (12) (600g - 1 packet/week)
- Khichdi Premix - Rice (58.75), Defatted Soyagrit (17.5), Moong Daal(31.25), Masala (2.50), Edible oil (15) (600 g - 1 packet/week)
- Chhatua Packet - 2200gms Rice/ Wheat: 1531.25 gms, Gram (Buta) 306.25 gms, Groundnut 229.61 gms & sugar 382.81 gms

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