

Himanshu Pathak · W. S. Lakra
A. Gopalakrishnan · K. C. Bansal *Editors*

Advances in Agri-Food Systems

Volume II



 Springer

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ISBN 978-981-96-0762-4 ISBN 978-981-96-0763-1 (eBook)
<https://doi.org/10.1007/978-981-96-0763-1>

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Preface

The technological advancements and innovation have played a pivotal role in increasing agricultural production and productivity. The genomic technologies for improved seeds, novel and smart technologies for the development of functional foods, enhancing horticultural yield are driving the sector to new heights. The agri-food system is in fact the lifeline for humanity. The sustainability has become a major challenge. It is becoming more critical with the emerging challenges of climate change and ecological and environmental disasters.

The National Academy of Agricultural Sciences is an apex scientific organization of agricultural science experts. We organized the XVI Agricultural Science Congress in Kochi from October 10–13, 2023, with the Theme “Transformation of Agri-Food Systems for Achieving Sustainable Development Goals.” The senior experts from diverse fields were invited to deliver talks on various topics of national and international relevance. The 21 chapters in this book are contributed by these lead authors. The chapters include major areas such as Crop Breeding, Seed Protection, Horticulture, Food Security, Genomic Editing, and Nutrition. The book provides new insights and knowledge in addressing the advances in agri-food system to meet the Sustainable Development Goals 2030. We hope that this publication will be valuable and useful for researchers, academicians, agri professionals, and policymakers.

We gratefully acknowledge the contribution of the distinguished authors. We also appreciate the contribution and help of Rashmi Singh, Editorial Manager at NAAS, for her assistance during the preparation and processing of this document.

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Cost of Diversification of Food Diets Through ICDS and PM-POSHAN: A Case of Telangana

12

Surabhi Mittal, Manika Sharma, Dylan Walters,
and Mini Varghese

Abstract

In India, Social Safety Net Programs (SSNPs) like the Public Distribution System (PDS), PM-POSHAN, and Integrated Child Development Scheme (ICDS), are a one-stop platform to meet a significant portion of the daily dietary requirements of the most vulnerable households, who also complement these meals through food purchased from markets and their own production. While staple foods continue to remain the focus of the PDS platform, there is a significant opportunity to leverage PM-POSHAN and ICDS for greater nutritional outcomes through a more diverse basket of nutritious food.

Nutrition International carried out a series of analyses (public health and nutrition (PHN), economic, platform, and political) that aimed to develop a set of recommendations and options for the government to consider in terms of the most feasible path for pursuing dietary diversification with the goal of reducing the nutrition gap. In this chapter, we present the detailed economic analysis and the overall recommendations to help develop a diversified diets in ICDS and PM-POSHAN for the state of Telangana. The objective of the economic analysis was to estimate the cost of diversifying and to identify which of the meal's

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options recommended by PHN analysis are most feasible from the perspective of cost, consumer preference, and availability. The analyses were undertaken separately for each of the population groups—pregnant women, lactating mothers, children between 7 months and 3 years, children between 4 and 6 years under the ICDS and primary and upper primary school children under PM-POSHAN.

The economic analysis estimated the cost of a diet (meal per day per beneficiary) for each of the target population groups under different diet and policy scenarios. Further, the economic feasibility of these scenarios was analysed based on the current allocated budget of the SSNPs.

The study found that in Telangana, there is an opportunity to diversify food baskets and meals by introducing millets, a variety of pulses and food groups like milk, fruits, and green leafy vegetables under ICDS and PM-POSHAN. Although, there is low economic feasibility of dietary diversification given the current allocated budgets. To meet the goal of reducing nutritional gaps, an increase in additional financial allocation will be required to achieve the minimum diet diversity under SSNPs.

Keywords

Cost of diet · Dietary diversification · Nutrition · Social safety net programs · Telangana

12.1 Introduction

The introduction of the National Food Security Act in 2013 by the Government of India (GoI) has transformed the nature of food security in the country from state welfare to a fundamental right. Together, the Social Safety Net Programs (SSNPs) like Public Distribution System (PDS), the Integrated Child Development Scheme (ICDS), and PM-POSHAN (School Mid-Day Meal Program) deliver the food grains as a legal entitlement to more than 70% of the bottom of the pyramid population. Although these SSNPs have considerably improved people's access to basic food in the country, gaps exist in optimal nutrition provision. India continues to perform poorly on crucial nutrition indicators—nearly 15% (195 million) of the Indian population is undernourished (FAO 2019), of which 20 million are children under six (CRY 2023). The latest NFHS 5 (2021) data show minimal improvement in stunting, wasting, and underweight children under 5 years. It also reports an increase of almost 9 percentage points in anaemia among children. Malnutrition in India manifests itself in terms of triple burden—underweight especially among poor, hidden hunger (deficiency in micronutrients), and overweight.

Over time, policies have changed their focus from hunger elimination or food security to nutrition sufficiency and security. The GoI has started supplying fortified

rice containing iron, folic acid, and vitamin B12 in ICDS and PM-POSHAN schemes and aspirational districts for PDS. One other important strategy is to introduce a more diversified diet among households. This means all members of a household consume an increased number of food groups, which, in turn, increases their uptake of both macro and micronutrients. Dietary diversification is an intervention or set of interventions aimed at improving nutritional status of the target population by satisfying their nutritional needs.

Dietary diversification is a promising means to improve health indicators such as anaemia, stunting, and other manifestations of undernutrition. Moreover, it helps curb the intergenerational transmission of malnutrition and undernutrition. Altogether, improved public health paves the way for a better-abled labour force and improved economic growth. These multiplied effects, moreover, will be sustained and continuous.

Focused dietary diversification through SSNPs can help reach the large part of the population that are already the beneficiaries of these programs. While staple foods continue to remain the focus of the PDS platform, there is a significant opportunity to leverage PM-POSHAN and ICDS for greater nutritional outcomes through a more diverse basket of nutritious food. It, therefore, becomes important to study and propose ways to use fortified foods and diversify the present meals under SSNPs to improve diet diversity and provide balanced nutritious food to beneficiaries.

This chapter develops a set of recommendations and options for the government to consider in terms of the most feasible path for pursuing dietary diversification with the goal of reducing the nutrition gap. In this chapter, we present the detailed economic analysis that estimates the cost of diversifying the meals in ICDS and PM-POSHAN for all age groups of beneficiaries and gives recommendations to help develop a diversified diet for the state of Telangana. The major objective of the study was to develop a set of recommendations and options for the government to consider in terms of the most feasible path for pursuing dietary diversification with the goal of reducing the nutrition gap. The goal is to reduce the nutrition gap by the introduction of economically feasible, diversified food groups in the diet of SSNP beneficiaries.

12.2 Methods and Tools

12.2.1 Coverage

The state of Telangana was chosen for the study as a pilot state based on selected indicators that were crucial to undertake the dietary diversification analysis. The most crucial elements were availability of the recent household consumption data. This data was available for the state of Telangana for the year 2016–17 (Kumar et al. 2017), while at the national level, 2011 data was only available. The other important indicator was the political willingness of the government to innovate, good performance of the two SSNPs under consideration, poor malnourishment indicators, low consumption diet diversity, and high production crop diversity.

Table 12.1 Coverage of beneficiaries under SSNPs

Telangana State SSNPs	Population group covered in analysis	Telangana coverage (in number)
ICDS (Integrated Child Development Scheme)	Pregnant women, lactating mothers, children of 7 months, 3 years, and 4–6 years	Women: 4,68,362 Children 6 month–6 years: 17,39,592
PM-POSHAN/Mid-Day Meal (MDM) ^a	Primary school children (7–9 years); upper primary children (10–15 years)	Primary: 1122000 Upper-primary: 668000

Source: ICDS statistics is for June 2021 (Kachwaha et al. 2021); PM-POSHAN statistics are for enrolment year 2021–22 (Telangana Minutes—2022-23.pdf (education.gov.in))

Note: ^aIn Telangana PM-POSHAN is extended to class 9–10th (16–18 Years) as well, but it is not accounted in the public health nutrition (PHN) analysis

In Telangana we focused on the ICDS and PM-POSHAN due to the high reach and coverage of these programs. This study is undertaken in the State of Telangana, as the ICDS, and PM POSHAN programs have good coverage and reach (Table 12.1). The analyses were undertaken separately for each of the population groups—pregnant women, lactating mothers, children between 7 months to 3 years, and children between 4 and 6 years under the ICDS, primary and upper primary school children under PM-POSHAN (Table 12.1).

Integrated Child Development Services (ICDS) is a Central Government program in India that provides nutritional meals, preschool education, primary health-care, immunization, health check-ups, and referral services to children under 6 years of age and pregnant and lactating mothers. ICDS serves two critical target groups: children (6 months to 6 years) and pregnant and lactating mothers (PLM). Women and children remain the most vulnerable populations whose intake of crucial micro- and macronutrients is systemically poor, which is reflected in the poor health indicators of these groups. Currently, the ICDS menu is also limited to staples like rice with some vegetables. States with the One Full Meal Programme for PLM have introduced some new items like milk and eggs. Telangana is one of the few states that has proactively tried to improve and innovate under ICDS through state-sponsored schemes such as Balamrutham¹ or Take-Home Ration² for children under 3 years, and Aarogya Lakshmi,³ which provides hot cooked meals to pregnant and lactating women at the centre. Under ICDS, supplementary nutrition is provided to beneficiaries for 300 days in a year. The Anganwadi Centre is run by an Anganwadi teacher supported by the Anganwadi helper. Children of 3 to 6 years as part of pre-school get a hot meal of rice, dal, vegetables, egg, and Nutri snacks/chana dal/daily

¹ Balamrutham is a weaning food preparation consisting of wheat, chana dal, milk powder, oil and sugar. The mixture is fortified and provides 50% of iron, calcium, vitamins required by children as RDA. The daily recommended quantity is 100 gms which is given to children 3–5 times every day. For children below 1 year, Balamrutham can be served as porridge mixed with hot water and for older children, it can be given in the form of ‘Laddu’. Balamrutham is distributed in packets of 2.5 Kg per child per month.

² <https://wdcw.tg.nic.in/Balamrutham.html>

³ https://wdcw.tg.nic.in/Aarogya_Lakshmi.html

Table 12.2 Details of meals served and its cost under ICDS by beneficiaries, Telangana

Beneficiary group	Menu		
	Item	Quantity	Cost (INR)
Children (6 months–3 years)	Balamrutham (Roasted wheat, Bengal gram, Milk powder, sugar & oil)	100 gm	4.58
	Egg (4 per week)	30 gm (1 egg)	2.24
Children (3–6 years)	Rice	75 gms	0.30
	Red Gram Dal	15 gm	1.05
	Boiled Egg	30 gm (1 egg)	3.50
	Oil	5 gm	0.33
	Vegetables	25 gm	0.95
	Nutri Snacks	20 gm	0.83
Pregnant & lactating mothers (PLM)	Rice	150 gm	0.60
	Red gram dal	30 gm	2.55
	Boiled egg	30 gm (1 egg)	4.20
	Oil	16 gm	1.10
	Milk	200 gm	5.6
	Vegetables	50 gm	2.10

Source: <https://wdcw.tg.nic.in/>. Accessed in February 2024

at the Anganwadi centre itself (Table 12.2). Since the Anganwadi centre is closed on Sundays, children are given an extra egg on Wednesday to compensate for it. Pregnant and lactating women get ‘one full meal’ under Arogya Lakshmi with one egg, 200 ml of milk, rice, dal, and vegetables every day. The women beneficiaries are spot fed at the Anganwadi centre and meals are cooked by the Anganwadi helper. To compensate for Anganwadi centre closure on Sunday, women are given egg curry on Wednesday, along with one extra boiled egg. Similarly, to compensate for milk, women are given curd once a week along with their regular glass of milk.

PM POSHAN (MDM)-Mid-Day Meal Scheme was launched by the Government of India to resolve issues of lack of nutrition, food security, and access to regular education. The programme provides free lunch on school-working days for children in primary and upper primary classes in government and others supported under Sarva Shiksha Abhiyan (SSA). Telangana State has extended the MDM programme to children studying in high schools (Classes IX & X) with 100% state funds. The Mid-Day Meal Scheme has been renamed Pradhan Mantri Poshan Nirman (PM-POSHAN) in September 2021. The PM-POSHAN scheme in Telangana is implemented by the Department of Education. Meals are provided through Manna Trust, a non-profit organization that is the implementation agency in the Hyderabad Metropolitan Area, and through SHG groups in all other schools across the state. In some districts, the meals are being provided by charitable organizations like the Sathya Sai Trust or Akshaya Patra.

The school PM-POSHAN scheme aims to provide one nutritious meal per day for 225 days the year. The hot cooked meal consists of rice with sambar or dal with green leafy vegetables (Table 12.3). Some schools⁴ give veg biryani with vegetables like carrots and peas once a week. The students are also given 3 eggs per week; in schools where children do not eat eggs, bananas are given instead.

12.2.2 Methodology

The analysis presented in the study focused on defining the ‘what’ and the ‘how’ of diversification along with identifying economic feasibility of the dietary diversification with the goal of reducing nutrition gap. The economic analysis is based on the recommendations from the public health and nutrition (PHN) analysis that looked at both food and nutrient adequacy (Annexure A.1) to reach the recommendation of a nutritious diet (Annexure A.2). The PHN analysis identified which food items are most promising from a public health perspective. And how much of that food should be included within the food basket? The PHN analysis recommended packages are based on analysis of food consumption and nutrient intake (at home + through SSNPs) i.e. intake assessment across age groups and comparing the consumption to recommended guidelines for dietary and nutrient intake i.e. gap assessment based on public health nutrition perspective. Estimated average requirement (EAR) of nutrients has been used as recommended guideline for nutrient intake. This has been done as EAR is the recommended unit of nutrient requirement for assessing the health and nutritional status of the population (ICMR-NIN 2020). PHN analysis used proportion of households reporting consumption from the 2016–17 household consumption data (Kumar et al. 2017) as a proxy for cultural acceptability of specific food items.

Table 12.3 Details of meals served and its cost under PM-POSHAN by beneficiaries, Telangana

Food item	Primary		Upper primary & high school	
	Cost (INR)	Quantity	Cost (INR)	Quantity
Food grains (Wheat/rice/coarse grain)	Free of cost	100 gm	Free of cost	150 gm
Pulses	1.38	20 gm	2.00	30 gm
Vegetables	0.92	50 gm	1.48	75 gm
Oil & fat	0.58	5 gm	0.87	8 gm
Eggs/Banana ^a	5	3 per week	5	3 per week

Source: <https://schooledu.telangana.gov.in/MDM/>. Accessed in February 2024

^ahttps://www.mdm.nic.in/mdm_website/Files/PAB/PAB-2019-20/PAB_2019-20_minutes/Telangana.pdf

⁴The government has a suggestive menu that is followed by most schools, but the Joint Review Mission has further suggested some new items that can be given so as to have some deviations in weekly menus.

Further, the economic analysis uses a cost of recommended diet (CoRD) methodology to identify which of these food items are most feasible from the perspective of supply (cost & availability); also, we ensured that the analysis accounted for consumer acceptability through indicators of locally produced food and looking into the consumption pattern of the population. Political economy and ease of integration into SSNP were also identified through interaction and discussion of results with the key stakeholders. The economic analysis computed the cost of meal per day per beneficiary and presents different diet and policy scenarios. These scenarios were then analysed for economic feasibility based on the available current allocated budget and the potential increase in budgets required to meet the nutrition requirements of the targeted population groups.

The analysis has recommended a diversified SSNP food package that is nutritionally, economically, and logistically feasible and presents what constraints and investment opportunities exist to ensure that the beneficiaries under the SSNPs get a diversified nutritious meal.

Cost of Recommended Diet (CoRD) This approach estimates the cost of consuming a nutritious recommended diet defined by country's food based dietary guidelines (FBDG). Developed as part of the Indicators of Affordability of Nutritious Diets in Africa project, funded by an Innovative Methods and Metrics for Agriculture and Nutrition Actions (IMMANA) grant from UKAid, in 2017. First published: World Bank Dizon and Herforth 2018.

Daily cost per individual per meal/day is computed as follows.

$$\text{Cost on } i \text{ th item} = \text{Quantity (in gms)} \times \text{Price (Rs per gm)}$$

$$\text{Cost of Meal} = \sum \text{Cost of } i \text{ th items, where } i = \text{all items in the meal}$$

Large-scale operational, infrastructure cost is not accounted for in this analysis (it is assumed to be fixed as the present time cost). The economic feasibility is assessed by comparing the cost of meals with budget allocations.

12.2.3 Data

The Telangana consumption survey data of 2016–17 (Kumar et al. 2017) is used to understand the consumption pattern of the population and identify the list of possible food items that are commonly consumed. Only food items that were consumed by more than 50% of households were considered for inclusion. We assumed that ICDS and PM POSHAN should provide 40% of the recommended intake of food groups and nutrients. The findings of PHN analysis reveal that in the state of Telangana, the food baskets offered by these programs are failing to provide even 40% of the recommended daily intake of several micronutrients while providing more than 40% of the estimated average requirement (EAR) of calorie intake for

most population groups. The food groups included in the analysis were those for which recommendations are provided by the national dietary guidelines. For instance, national guidelines do not provide data for the food groups ‘Nuts & Oilseeds’ and ‘Condiments’, and hence these were not included in the analysis.

The prices for items that are already being served in ICDS and PM-POSHAN are considered as given in Tables 12.2 and 12.3. For new recommended food items, the quantity of food items consumed and prices are taken from the Telangana 2016 consumption data. The budget data of each SSNP is the cost allocated by SSNP for each beneficiary meal per day as available SSNP documents online. For current food groups (FGs) and items, SSNP details give item-wise cost of meal; based on this, per gm cost is computed. For new FG (fruits and vegetables), rural average price of the respective identified fruits and vegetables is computed from the Telangana 2016 consumption data.

$$\text{Price (Rs/gm)} = \text{Consumption data (monthly per capita)} / \text{Value spent (Rs)}$$

For new FG (Milk), the same price is assumed for the other SSNP. PM-POSHAN milk price is taken as same as that in ICDS.

Identifying alternative fruits and vegetables was based on choosing commodities that are consumed by more than 50% of the households in the Telangana Food Consumption Survey 2016. Also, vertical spread across 31 districts was seen and identified additional F&V of 40% consumption based on district-level data of all districts of Telangana.

Millets are made as a part of cereals category. To estimate the share of millets in total cereal consumption, the actual millets consumption data is used as consumption average by rural urban households. The share of millet consumption in total of rice PDS and millet consumption is computed (14%) and proportionately weighted by the price of millets. Price for millets is computed as average for major millets (Jowar, Bajra, Ragi) (Avg Procurement price = 27.88 Rs/Kg). These form 95% of production in Telangana.

Fruits and vegetables are a complicated category as seasonality is high in this category. Thus, average prices were considered based on the currently provided fruits and vegetables under the SSNPs and the proposed diversified categories.

12.2.4 Scenarios

The initial calculations of CoRD were done based on the recommendations of the PHN analysis. The computed cost was much higher than the allocated budget. Thus, the alternative scenarios were developed to compute CoRD for each of the scenarios that will help to improve the dietary diversification by adding food groups with the aim to reduce the nutrition gap and also reduce the cost of the diet. The different scenarios are presented in Table 12.4.

12.3 Results

The public health nutrition (PHN) analysis recommended a series of diversified food packages across SSNPs for specific population groups, based on analysis of food consumption and nutrient intake and comparing the consumption to recommended guidelines for dietary and nutrient intake i.e. gap assessment. The key finding is that all age groups have a higher intake of cereals and millets and pulses and flesh foods than the recommended national dietary guidelines. Indian diets are generally lacking in milk and milk products, vegetables and fruits across all age groups, as compared to national dietary guidelines. PHN analysis recommended moderate reduction in the quantity (in grams) of rice (Cereals & Millets) and red gram dal and eggs (Pulses and Flesh Foods). Details of recommendations are presented in Annexure A.2. A reduction in the quantity of oil and sugar provided through SSNP packages has been suggested wherever they exceed the established benchmark of meeting 40% daily recommended intake. Milk to be added in packages (for children between 4 and 6 years and adolescents 10 and 15 years) where it was not provided. The quantity of vegetables that are provided in the current packages has been increased to meet the recommended benchmark. In addition, fruits are recommended to be added for all population groups.

Taking these recommendations into account for the economic analysis, the cost of a meal per day per beneficiary was computed under different diet and policy scenarios (see Table 12.4) using the Cost of Recommended Diet (CoRD) tool. The cost of recommended diet analysis results is presented in Table 12.5.

The meals provided at the Anganwadi centres under ICDS already have a certain amount of diversity as they include eggs, pulses, grains, milk (for pregnant and lactating women), leafy, and non-leafy vegetables. The state education department is already providing pulses, grains, vegetables, leafy vegetables, and eggs under the PM-POSHAN program. For children under ICDS and PM-POSHAN, there is opportunity to add fruits like bananas and introduce milk. Procurement and distribution of bananas exist as they are being given to children in some schools who do not eat eggs. Milk supply chain and packaging in tetra packs exist for pregnant and lactating women in ICDS, and that can be further extended to children. The

Table 12.4 Alternative scenarios for economic analysis

Scenarios	Nutrition neutral	Nutrition positive
Diet scenario		Nutrition feasible as per PHN analysis (S1)
Policy scenario	Reducing nutrition gap- no reduction in eggs (S2) (Reduced milk and fruit quantity to meet economic feasibility) ^a	With FG diversification—Introduction of millets in cereals group (S3) and diversifying pulses (S4) Minimum Diversification—Current scenarios and new FG added (Fruit and Milk) (S5)

Note: S0: the current SSNPs diets

^aIn this scenario, we do have reduced milk and fruit quantity from the PHN recommended quantities to meet economic feasibility

Table 12.5 Cost of recommended diet calculated under alternative scenarios, Telangana

Unit: Cost: Rs/beneficiary/Day						
Scenario	Baseline	Nutrition efficient scenario	Alternative scenario (Reducing nutrition gap)			Minimum diversified
Population group	Current (S0)	PHN diversified (S1)	(S2)	S2 + millets (S3)	S2 + millets + pulses (S4)	S0 + Milk and fruits (S5)
<i>ICDS</i>						
Pregnant women	20.80	24.63	25.91	26.31	26.27	22.32
Lactating mothers	20.80	27.56	27.56	27.96	27.92	23.84
Infants	7.21	7.58	8.57	8.57	8.57	9.77
Children	7.26	13.87	12.82	12.97	13.01	11.22
<i>PM-POSHAN</i>						
Primary school children	6.13	16.37	13.74	13.74	13.80	10.09
Upper primary school children	8.21	19.82	17.19	17.19	17.30	12.17

Source: Authors calculations

nutrigardens available at the Anganwadi centres provide an opportunity to introduce a greater variety of leafy and other vegetables like spinach, okra, and beans to the meals cooked at the centre. Millets are a part of the routine diets in most parts of the state and can be introduced in the Anganwadi menu as well for PLM and children. Ragi (finger millets)-based dishes like Ragi Malt and Ragi Sankati are some easy ways to introduce millets in the diet. Some other minor millets can also be introduced in the form of porridge or upma.

The S1 scenario presents the cost calculations as per the PHN recommendations (details in Annexure A.2), except that only bananas are considered for the fruit group. Since fruits are the most expensive category, the average cost of all the three recommended fruits (apple, pomegranate, and banana) posed challenge of higher fruit group prices, availability as seasonality is an issue, and also it is difficult to distribute pomegranate or apple as per the recommended grams. Also, during the stakeholder interactions, it was noted that in some schools, bananas are being distributed, which is most affordable among the fruit group category and also available throughout the year. Thus, our cost calculations only accounted for banana as the commodity in the food group category. The PHN analysis also recommended that the number of eggs in PLM be reduced and be compensated for by addition of pulses and millets. But the stakeholder interactions did reconfirm that reduction in eggs will not be acceptable by the beneficiaries, and thus S2 scenario calculations were undertaken.

In the S2 scenario, banana is added, and no reduction in quantity of egg is incorporated. There is a slight increase in the cost for the S2 calculations due to eggs. In the S3 calculations, the millets are added in the cereal group category, and in S4 scenario, pulses like moong are also added to the conventional red gram dal. These scenarios are considered alternative scenarios, which aim at diversifying the existing food group categories by adding millets and more pulses. Pulses form an important part of this dietary diversification and mission to enhance nutritional security in the country and are seen to play an important role in developing a sustainable and healthy food system (FAO 2016). Also, it is important to diversify within the pulse groups as the households do have demand for different pulses, and if some of these can be met through the SSNP then it will add to their nutrition (Kumar et al. 2023).

Scenario S2, S3, and S4 are scenarios that help in reducing the nutrition gap. For children aged 3–6 years under ICDS and all children under PM-POSHAN, the milk is not part of the package. Milk is recommended by PHN analysis and added to the other scenarios S2–S4.

Another scenario S5 is computed, which is termed the minimum diversified scenario. In this scenario, we only focus on increasing the number of food groups in the present meals without changing the quantities in the current SSNP meals. Thus, the fruit and milk food group categories are introduced wherever they were not part of the original meal plan to help suggest diversified diets in the SSNP.

The cost calculations for all these scenarios are presented in Table 12.5. The milk and fruits are the main components that have the least to highest costs in each of the categories. Each population group benefits from the diversification of the diets, but since these programs are funded by the government, the existing budgets allocated are the upper limit seen as for the feasibility of the recommended diversification.

For all the population groups (except ICDS-Infant) under the SSNP, the S5 scenario has the lowest cost in which new food groups like milk and fruit (banana) are added to the current meals. It is only for the ICDS infant category that the PHN analysis recommended diet has the lowest cost among all the other scenarios (Table 12.5).

All the costs of recommended diets are above the current allocated budget as presented in Table 12.6. During the stakeholder interactions, it was noted that the given budgets are due for revision by 8–10% to match the inflation; thus, in this table, we present the predicted budget based on a 10% inflation. Further another 10% increase to advocate for diversification. Thus, the economic feasibility of scenarios S1–S5 is compared with current allocated budget of the SSNP (ICDS and PM-POSHAN) per beneficiary per day. The feasibility is also tested in case there is an increase in the budget (10% and 20% increase scenario). These are presented graphically in Figs. 12.1 and 12.2, and also the gaps are presented in Table 12.7.

In Table 12.7, we present the budgetary gaps of different cost scenarios from the current allocated budgets. ICDS pregnant women group will need a 10–20% increase in current budget allocation to meet wither the minimum or PHN diversified scenario costs (S5). For the lactating mothers population group, we need a 15% increase in the current allocated budget to attain minimum diversified diet (S5). For

Table 12.6 Calculations of available budget and potential suggested budget increase, Telangana

SSNP/ Population groups	Current allocated budget (Rs/ beneficiary/day)	Budget after Inflation linked budget increase 10% (Rs/beneficiary/ day)	Budget after diversification linked additional budget increase 10% (Rs/beneficiary/ day)
<i>ICDS</i>			
Pregnant women	20.80	22.88	25.17
Lactating mothers	20.80	22.88	25.17
Infants	7.21	7.93	8.73
Children	7.26	7.99	8.78
<i>PM-POSHAN</i>			
Primary school children	6.13	6.74	7.42
Upper primary school children	8.21	9.03	9.93

Source: Authors calculations

the infants under ICDS, the PHN diversified scenario can be attained with a 5% increase.

For children under ICDS and under PM-POSHAN, the minimum diversified diets cost more than 50% higher than the current allocated budgets. Milk is the main food group that adds to these increased costs.

12.4 Challenges for Dietary Diversification

During the consultation with stakeholders, it was found that in Telangana, dietary diversification in SSNPs is strongly backed by political and administrative willingness. There is an opportunity to diversify food baskets and meals by introducing millets, variety of pulses, and perishable foods (e.g. milk, fruits, green leafy vegetables) in ICDS and PM-POSHAN. The state is already giving fortified rice in ICDS since January 2022 and in PM-POSHAN since June 2022 to increase micronutrient intake in ICDS and PM-POSHAN beneficiaries. The existing supply chain systems are to an extent ready to accommodate new items like milk. Digitalization in the supply chain and payment systems in Telangana further strengthens the opportunity that the existing system provides for introducing diversified food items under SSNPs. Though some sensitization on the demand side is required to generate awareness on nutritional benefits and increase acceptance of diverse food items.

Officials were reluctant to reduce the quantity of rice or eggs from the midday meal under PM-POSHAN and ICDS, and thus the alternative scenarios were

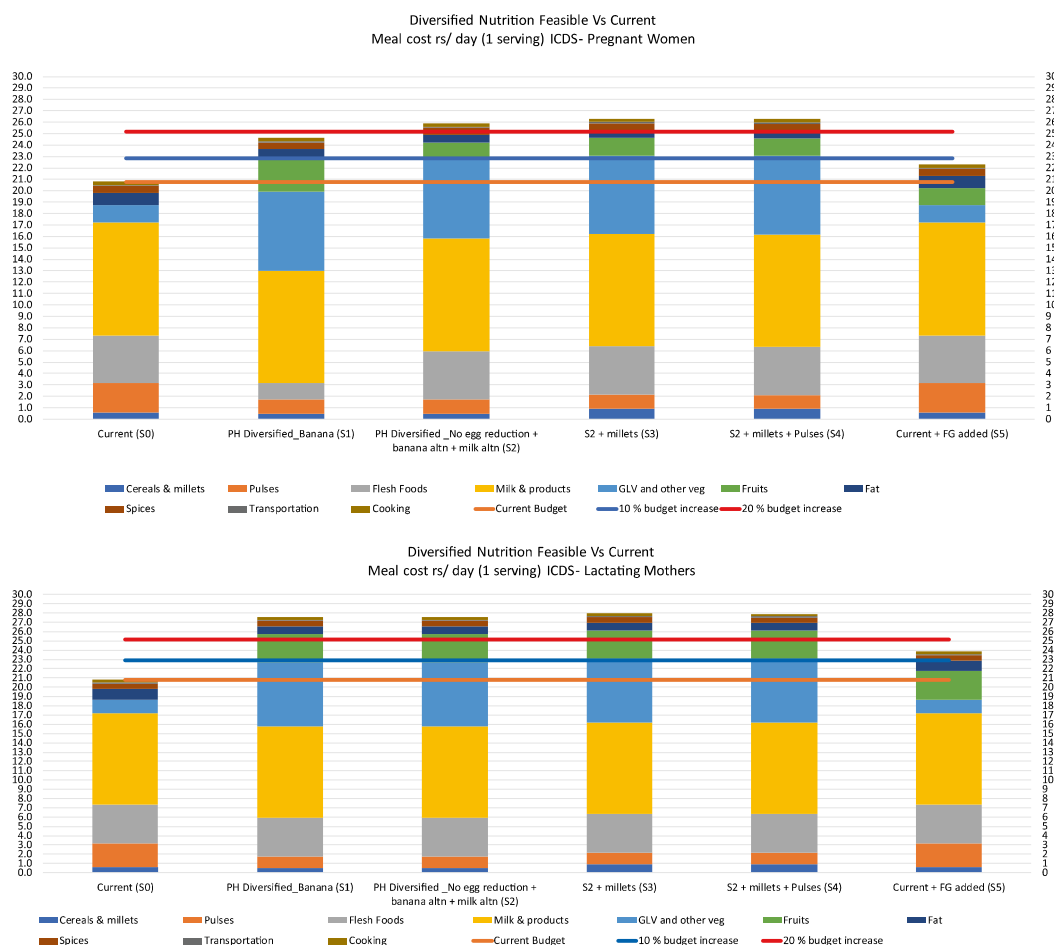


Fig. 12.1 Diversified nutrition feasibility scenarios in relation to the budget allocations for ICDS, Telangana. (Source: Authors calculations)

developed for the computation of costs. Increasing quantities of vegetables or adding milk and fruits (for all students) will increase the financial burden and would require support from the central government.

The other main challenge to diversify will be short shelf life of pulses and millets, and thus additional costs might be required at the Anganwadi centres and schools to ensure quality during storage. Considerable financial burden on the state to supply pulses and millets, and since the millet production in the state is declining, the state will have to rely on other states for millet procurement until cultivation revives. Millets also require additional time effort for preparation, and this may require an increase in resources at ICDS centres and in school kitchens. Investment in behaviour change communication will also be required to increase nutrition literacy and awareness amongst communities to increase millets consumption.

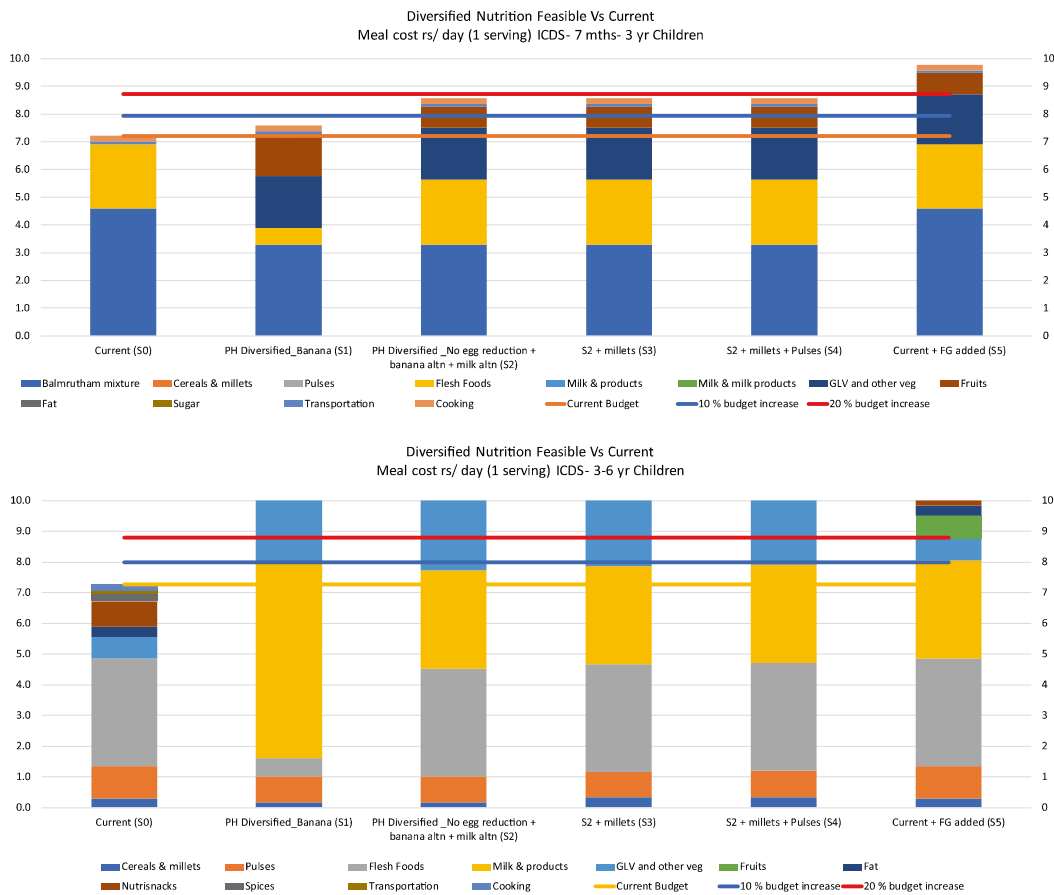


Fig. 12.1 (continued)

12.5 Conclusion

The study found that in Telangana, there is an existing high micronutrient gap from the recommended nutrient level. There is also high political willingness for dietary diversification and possible infrastructural feasibility (e.g. for milk). Thus, there is an opportunity to diversify food baskets and meals by introducing millets, a variety of pulses, and food groups like milk, fruits, and green leafy vegetables under ICDS and PM-POSHAN. Inclusion of milk, fruits, and vegetables in programs like ICDS and PM POSHAN would not only serve the purpose of providing supplementary nutrition but would also play a role in shifting culinary behaviour towards a balanced diet.

The analyses under this study conclude that there is need to diversify the SSNPs and help reduce the gap in food and nutrient intake for the beneficiaries across different population groups. We recognize that meals under SSNPs are a part of daily dietary intake and can only influence nutritional status to a limited extent.

The economic feasibility is challenged by current financial allocations under these programs. A 15–20% increase in budget will allow to provide diversified diets to pregnant and lactating women and infants, but for all other population groups in

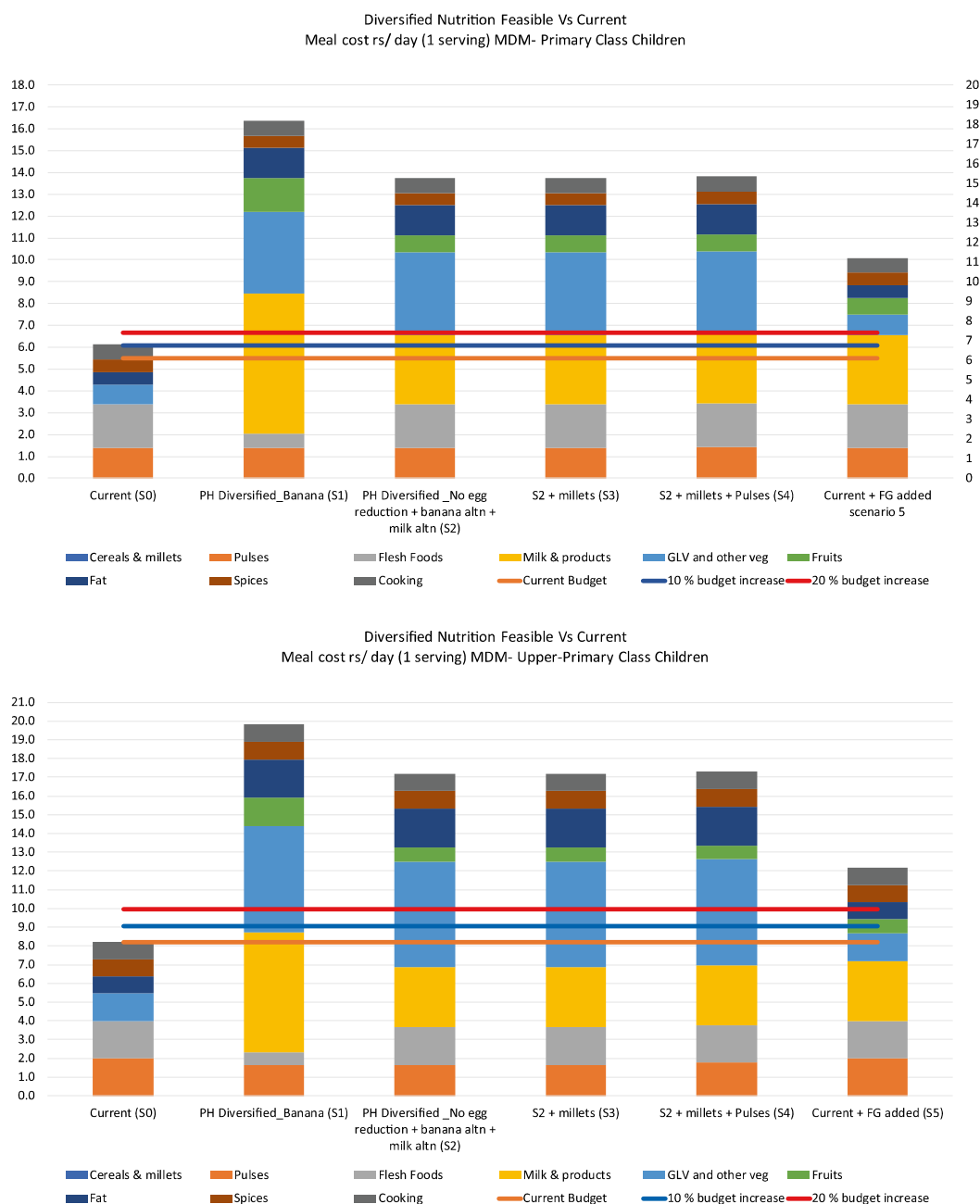


Fig. 12.2 Diversified nutrition feasibility scenarios in relation to the budget allocations for PM-POSHAN, Telangana. (Source: Authors calculations)

SSNP, a substantial increase in budgets will be required. A substantial increase in budgets would also be required to meet the nutrition requirements of the targeted population groups. Though the key challenge to diversifying will be balancing the demand for diversified foods with their availability and planning for required investments to meet budgetary gaps.

Telangana State is already a frontrunner in nutrition initiatives and can emerge with systemic and holistic strengthening of the SSNPs as a champion for dietary

Table 12.7 Budgetary gaps of different cost scenarios from the current allocated budgets

	Nutrition efficient scenario	Alternative scenario			Minimum diversified
Groups	PHN Diversified (S1)	Reducing nutrition gap (S2)	S2 + millets (S3)	S2 + millets + Pulses (S4)	S0 + Milk and fruits (S5)
	Budgetary gaps in %				
ICDS					
Pregnant women	18.4	24.5	26.5	26.3	7.3
Lactating mothers	32.5	32.5	34.4	34.3	14.6
Infants	5.1	18.8	18.8	18.8	35.5
Children	91.0	76.6	78.7	79.1	54.5
PM-POSHAN					
Primary school children	167.0	124.2	124.2	125.2	64.6
Upper primary school children	141.4	109.4	109.4	110.7	48.2

Source: Authors calculations

Note: The figures in bold signified the most affordable diversified meals in different SSNP and population groups

diversification in country. Thus, before implementation of any dietary diversification initiative, the state should conduct a detailed study to understand the farming patterns as well as consumption patterns. For dietary diversification to be successful, it is critical to align it with local preferences and availability. This, combined with awareness raising and nutrition literacy among beneficiaries, can together meet long-term goals of nutritional security.

Acknowledgement We acknowledge the funds received by BMGF India to undertake this study as part of the bigger study. Also, we would like to thank our colleagues at Nutrition International and MSC for support in undertaking this analysis.

Annexure

Annexure 1: Assessment of Food and Nutrition Gap by the Public Health and Nutrition (PHN) Analysis

Assessment of Gaps in Food Intake from Diet

Examining the overall diet of the population, that is food consumed at home, which includes food provided via PDS, plus food provided by the other two SSNPs almost all population groups consume more than the daily recommended quantity of

cereals and millets (Table 12.8). All PM POSHAN beneficiaries and almost all ICDS beneficiary groups are consuming more than the recommended quantity of pulses and flesh foods. However, beneficiaries only covered by PDS, adult males, adult NPNL women and older adolescents, consume approximately 35–45% of the recommended daily quantity. Children of all age groups consume less than 20% of the daily recommended amount of milk and milk products, adult men and women consume around 30% of the recommended intake, and pregnant women and lactating mothers consume about 65% of the recommended intake for this food group. All population groups consume less than 50% of the daily recommended amounts of roots & tubers and fruits, and 30% or less of the recommended intake of green leafy vegetables. Pregnant women and lactating mothers consume slightly more than the recommended daily amount of fats, with other population groups consuming between 30% and 64% of the recommended quantity.

Assessment of Gaps in Nutrient Intake from Diet

All population groups, except for older adolescent boys, have a protein intake that is higher than their recommended daily intake (Table 12.9). In general, most population groups do not have an adequate intake of micronutrients. Calcium and thiamine intakes are less than the daily recommended amount for all population groups, except for 1–3 year-old children. Only 1–6 year-old children have an iron intake that meets their daily requirement, with pregnant women meeting only 37% of the recommended intake. All population groups, except adolescent boys, have a vitamin A intake that is below the requirement, with the intake of lactating mothers, older adolescent girls, NPNL women and adult men being less than 50% of the recommendation. Riboflavin intake is below the recommended daily intake for all population groups. Folate intake is less than 50% of the recommendation for pregnant women, older adolescents, and adult men, but is adequate or close to adequate for children 1–3 year, 4–6 year, 7–9 year, and 10–12 year.

Assessment of Food and Nutrient Gaps in SSNP Food Baskets

The supplementary nutrition package provided by ICDS in Telangana currently does not include milk/milk products, fruits, and vegetables for 1–6-year-old children or fruits and vegetables for pregnant and lactating mothers. Consequently, the current package is not able to cover daily requirements for calcium, vitamin A, vitamin C and folate. School meals provided by PM POSHAN do not provide the recommended amount of milk and milk products, fruits and vegetables resulting in gaps in calcium intake of school going children.

Annexure 2: Modification in Food Basket as per PHN Analysis and Scenarios of Economic Analysis

Modifications to food baskets to diversify diets- Potential modifications to the food baskets provided by ICDS and PM POSHAN to improve dietary diversity among the population are shown in Annexure Table 12.10.

Table 12.8 Percent of recommended food intake from overall diet^a, by SSNP and population group

SSNP	Target Beneficiaries	Cereals & Millets	Pulses & Flesh Foods	Milk & Milk Prod.	Roots & Tubers	GLV	Other Veg	Fruits	Sugar & Jaggery	Fats & Oils
ICDS	1–3 years children	300	126	19	14	4	18	29	187	64
	4–6 years children	222	295	14	12	23	24	34	45	60
	Pregnant women	193	141	67	14	20	31	27	65	107
	Lactating women	182	75	65	19	13	39	25	55	117
PM POSHAN	7–9 years children	194	102	11	39	20	42	36	50	57
	10–12 years boys	156	118	15	45	30	26	49	50	61
	10–12 years girls	189	122	15	43	30	27	39	43	59
	13–15 years boys	120	105	14	30	30	25	47	60	48
	13–15 years girls	145	116	13	43	28	26	42	40	49

Source: Authors calculations

^aFood consumed at home plus food provided through ICDS and PM POSHAN

Table 12.9 Percent of recommended nutrient intake from overall diet^a, by SSNP and population group

SSNP	Target Beneficiaries	Protein	Calcium	Iron	Vit A	Thiamine	Riboflavin	Niacin	Vit C	Folate
ICDS	1–3 years children	347	103	103	80	105	73	90	57	86
	4–6 years children	341	66	101	97	76	50	97	78	130
	Pregnant women	131	87	37	86	64	48	94	72	40
	Lactating women	159	73	76	48	66	48	89	56	77
PM POSHAN	7–9 years children	239	60	80	79	68	48	91	81	97
	10–12 years boys	218	59	90	113	67	46	101	93	103
	10–12 years girls	214	56	63	98	73	49	97	93	99
	13–15 years boys	169	45	75	96	61	35	81	76	80
	13–15 years girls	166	43	63	88	75	41	95	78	90

Source: Authors calculations

^aFood consumed at home plus food provided through ICDS and PM POSHAN

Modifications to ICDS- For ICDS, fruits and vegetables are lacking from the current food package. Thus, adding apples, bananas and pomegranate and onion, potato, spinach, cluster beans and brinjal in the indicated amounts, per population group, would comply with addressing 40% of the recommended daily intake for these food groups for each population group. The fruits and vegetables suggested are consumed by more than 50% of Telangana households and thereby are culturally acceptable (Kumar et al. 2017). Furthermore, milk and/or milk products are also currently not being provided to children by ICDS but, given the observed gap in milk intake, cow's milk or milk powder could be included. Cow's milk is already being provided in the package to pregnant and lactating women. Finally, we have made some adjustments to the amount of 'cereals & millets', 'pulses and flesh foods', and 'fats and oils' for all beneficiary categories as the quantities provided in the current package exceed 40% of the recommended daily intake. The suggested modifications in ICDS supplementary nutrition for each beneficiary category would improve their micronutrient intake especially for calcium, vitamin A, vitamin C and dietary folate. Vitamin A intake would increase substantially for all four beneficiary groups with pregnant women and 4–6 year old children meeting nearly 100% of their daily requirement. The consumption of vitamin C would improve for all children and for pregnant women. Nevertheless, the suggested modifications would not improve the intake of iron, thiamine, and niacin for all beneficiaries. It should also be noted that these modifications would result in intakes for protein, vitamin A, and vitamin C that would be over the assumed benchmark where the food basket is to provide 40% of the recommended daily intake for these nutrients.

Modifications to PM POSHAN- The food basket does not include 'milk and milk products', 'fruits', 'vegetables' and 'fats and oils'. Increasing the quantity of vegetables—onions, potatoes, spinach, cluster beans, and brinjal—as well as the quantity of cooking oil and introducing cow milk/milk powder and fruits—apples, banana, pomegranate—in the suggested quantities would support in addressing the observed gaps. The diversified midday meal would improve the intake of vitamin A, vitamin C and dietary folate in children 7–9 year and adolescents 10–15 year. Nevertheless, as with ICDS, the suggested modification would not improve the intake of iron, thiamine, and riboflavin and the intake of these three micronutrients would still be below than 40% of the recommended daily intake, which is the benchmark this study is using. The intake of protein, vitamin A, and folate would be over 40% of the benchmark.

Table 12.10 Modifications to food baskets to diversify diet of population groups as recommended by PHN analysis and used for CoRD analysis

Population group		Current package	Daily amount/person	Modified package	Daily amount/person					
					PHN	Diversified (S1)	(S2)	S2 + millets (S3)	S2 + millets + Pulses (S4)	S0 + Milk and fruits (S5)
	Food Group	Food Item	Current (S0)							
ICDS										
Pregnant	Cereals & millets	Rice	150 g	Rice	120 g	120 g	120 g	120 g (millets added)	120 g (millets added)	150 g
	Pulses	Red gram dal	30 g	Red gram dal	15 g	15 g	15 g	15 g	15 g (moong dal added)	30 g
	Flesh foods	Egg (daily)	50 g	Egg (daily)	16.67 g (2 times a week)	50 g	50 g	50 g	50 g	50 g
	Milk & milk products	Cow's milk	200 ml	Cow's milk	200 ml	200 ml	200 ml	200 ml	200 ml	200 ml
	GLV and other veg	Onions/Potato/Spinach/Cluster Beans/Brinjal	50 g	Onions/Potato/Spinach/Cluster Beans/Brinjal	220 g	220 g	220 g	220 g	220 g	50 g
	Fat	Cooking oil	16 g	Cooking oil	10 g	10 g	10 g	10 g	10 g	16 g
	Fruits			Banana (alternative day)	80 g (daily)	40 g	40 g	40 g	40 g	40 g
Lactating	Cereals & millets	Rice	150 g	Rice	120 g	120 g	120 g	120 g (millets added)	120 g (millets added)	150 g
Mothers	Pulses	Red gram dal	30 g	Red gram dal	15 g	15 g	15 g	15 g	15 g (moong dal added)	30 g

(continued)

Table 12.10 (continued)

Population group	Food Group	Current package	Daily amount/person	Modified package	Daily amount/person				
					PHN	(S2)	S2 + millets (S3)	S2 + millets + Pulses (S4)	S0 + Milk and fruits (S5)
	Food Group	Food Item	Current (S0)		Diversified (S1)				
	Flesh foods	Egg (daily)	50 g	Egg (daily)	50 g	50 g	50 g	50 g	50 g
	Milk & milk products	Cow's milk	200 ml	Cow's milk	200 ml	200 ml	200 ml	200 ml	200 ml
	GLV and other veg	Onions/Potato/Spinach/Cluster Beans/Brinjal	50 g	Onions/Potato/Spinach/Cluster Beans/Brinjal	220 g	220 g	220 g	220 g	50 g
	Fat	Cooking oil	16 g	Cooking oil	12 g	12 g	12 g	12 g	16 g
	Fruits			Banana	80 g	80 g	80 g	80 g	80 g
Children	Cereals & millets	Rice	75 g	Rice	45 g	45 g	45 g (millets added)	45 g (millets added)	75 g
3–6 years	Pulses	Red gram dal	15 g	Red gram dal	12 g	12 g	12 g	12 g (moong dal added)	15 g
	Flesh foods	Egg (daily)	50 g	Egg (daily)	8.33 g	50 g	50 g	50 g	50 g
	GLV and other veg	Onions/Potato/Spinach/Cluster Beans/Brinjal	25 g	Onions/Potato/Spinach/Cluster Beans/Brinjal	100 g	100 g	100 g	100 g	25 g
	Fat	Cooking oil	5 g	Cooking oil	10 g	10 g	10 g	10 g	5 g
	Milk & milk products			Cow's milk	200 ml	100 ml	100 ml	100 ml	100 ml
	Fruits			Banana (alternative day)	40 g (daily)	20 g	20 g	20 g	20 g

	Food Group	Food Item	Current (S0)	PHN Diversified (S1)	(S2)	S2 + millets (S3)	S2 + millets + Pulses (S4)	S0 + Milk and fruits (S5)
Children		Nutrisnack	20 g					20 g
7 month–6 years	Balamrutham							
	Cereals & millets	Roasted wheat	55 g	24 g	24 g	24 g (millets added)	24 g (millets added)	55 g
	Pulses	Bengal gram dal	5 g	12 g	12 g	12 g	12 g	5 g
	Flesh foods	Egg (4 times a week)	33.33 g	8.33 g	33.33 g	33.33 g	33.33 g	33.33 g
		Milk powder	10 g	20 g	20 g	20 g	20 g	10 g
	Fat	Cooking oil	10 g	10 g	10 g	10 g	10 g	10 g
	GLV and other veg			60 g	60 g	60 g	60 g	60 g
	Fruits	Onions/Potato/Spinach/Cluster Beans/Brinjal						
		Banana (alternative day)		40 g (daily)	20 g	20 g	20 g	20 g
Children	PM POSHAN							
7–9 years	Cereals & millets	Rice	100 g	70 g	70 g	70 g (millets added)	70 g (millets added)	100 g
	Pulses	Red gram dal	20 g	20 g	20 g	20 g	20 g (moong dal added)	20 g
	Flesh foods	Egg (3 times a week)	25 g	8.33 g	25 g	25 g	25 g	25 g
	GLV and other veg	Onions/Potato/Spinach/Cluster Beans/Brinjal	50 g	120 g	120 g	120 g	120 g	50 g
	Fat	Cooking oil	5 g	12 g	12 g	12 g	12 g	5 g

(continued)

Table 12.10 (continued)

Population group		Current package	Daily amount/person	Modified package	Daily amount/person					
					PHN	Diversified (S1)	(S2)	S2 + millets (S3)	S2 + millets + Pulses (S4)	S0 + Milk and fruits (S5)
	Food Group	Food Item	Current (S0)			200 ml	100 ml	100 ml	100 ml	100 ml
	Milk & milk products			Cow's milk						
	Fruits			Banana (alternative day)		40 g (daily)	20 g	20 g	20 g	20 g
Adolescents	Cereals & millets	Roasted wheat	150 g	Roasted wheat		150 g	150 g	150 g	150 g	150 g
10–15 years	Pulses	Bengal gram dal	30 g	Bengal gram dal		25 g	25 g	25 g	25 g(moong dal added)	30 g
	Flesh foods	Egg (3 times a week)	25 g	Egg (3 times a week)		8.33 g	25 g	25 g	25 g	25 g
	GLV and other veg	Onions/Potato/Spinach/Cluster Beans/Brinjal	75 g	Onions/Potato/Spinach/Cluster Beans/Brinjal		180 g	180 g	180 g	180 g	75 g
	Fat	Cooking oil	8 g	Cooking oil		19 g	19 g	19 g	19 g	8 g
	Milk & milk products			Cow's milk		200 ml	100 ml	100 ml	100 ml	100 ml
	Fruits			Banana (alternative day)		40 g (daily)	20 g	20 g	20 g	20 g

Source: Authors calculations

^aDaily quantity of cereals, wheat, or millets, per person in the household assuming a household is composed of four family members

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