Dash, Antaryami, Pranab Kumar Chanda, Sharmistha Das, Atefh Ali, Debashmita Bhaumik, Md Masud Rana, and Neha Santwani. 2022. "Making Nutritious Diets More Affordable: Findings from a Cost of Diet Assessment in West Singhbhum, Jharkhand, India." *World Nutrition*, September, 3–11. https://doi.org/10.26596/wn.20221333-11.

Research

Making Nutritious Diets More Affordable: Findings from a Cost of Diet Assessment in West Singhbhum, Jharkhand, India

Antaryami Dash[1], Pranab Kumar Chanda[1], Sharmistha Das[1], Atefh Ali[1], Debashmita Bhaumik[1], Md Masud Rana[2], Neha Santwani[1] [a]

[1] Save the Children, India, [2] Save the Children, UK

Keywords: cost of diet, India, food affordability, nutrition programs, food expenditures, cost of food, nutritious diet, social protection

https://doi.org/10.26596/wn.20221333-11

World Nutrition 2022;13(3):3-11

Background

India bears a disproportionate burden of undernutrition. Access to an affordable, nutritious diet is one of the critical challenges. There is a need to assess the cost of a nutritious diet and find ways to understand and minimise the affordability gap through a comprehensive approach.

Objective

The present study was conducted in the West Singhbhum district of Jharkhand, India. Its objective was to find out the cost of various diets, and their affordability, based on households' accounting for their total food expenditure, and assessing the coverage of essential governments' nutrition-specific interventions to use a model for suggesting ways to minimise the affordability gap. We also estimate the potential impact of nutrition-sensitive programmes on household food affordability.

Methodology

The study employed the Cost of the Diet (CotD) methodology, a mixed-method, cross-sectional assessment, where the research team conducted surveys in 16 markets, 12 focus group discussions (FGDs) and 96 individual interviews (IDIs). Additionally, 434 household-level surveys were conducted to understand income, expenditure patterns in the localities and uptake of key nutrition-sensitive interventions. Secondary information from the 68th round of the National Sample Survey 2012 were used to assess rural Jharkhand's non-food expenditure (NFE). Data were analysed primarily using the Save the Children's Cost of the Diet software version 2.5.2.

Results

The cost of the diet increased with an increase in the diet quality – from a basic energy-only diet costing INR 33,892 ($505.85) per year for a standard household with 6 members to a food-habit nutritious diet (FHAB) costing INR 70,627 ($1054.13) per year. More than half of the sampled households could not afford a nutritious diet. The poorest quartile was spending 56.8% of income on food, compared to 33.7% for the richest quintile.

Conclusion

The cost of a FHAB diet should be used as a benchmark to track the progress of beneficiary groups in upcoming socio-economic assessments. Changes in the affordability gap should be observed to assess whether new initiatives have worked. Optimal coverage of existing nutrition-specific and nutrition-sensitive programmes has the potential to reduce the proportion of family income spent on the FHAB nutritious diet by up to 30%.

[a] **Corresponding author:**
Neha Santwani, S-27/1A, First Floor, DLF Phase 3, Sector 24, Gurgaon, India
Mail ID: nehasantwani@gmail.com

INTRODUCTION

India has made significant progress in improving child survival over the past two decades, but progress on nutrition indicators has been less than satisfactory. As a result, India has the highest burden of undernutrition globally, with about 30% of the world's stunted children and nearly 50% of the severely wasted children under the age of five (IIPS 2016). In India, in 2019, 32.1% of children under five years old were underweight, 35.5% were stunted, and 19.3% suffered from wasting (IIPS 2016).

Jharkhand is one of the high-burden states in India, where the prevalence of childhood undernutrition is more than the national average (IIPS 2016; Singh Yadav and Kumari 2022). Diet has emerged as a prominent direct cause of undernutrition in the state. Improving nutritional intake, thus, is critical to reducing the burden of undernutrition. While child undernutrition has multiple causes, inadequate dietary intake by children is among the most immediate (Ghosh-Jerath et al. 2018). Household food security is dependent on two main factors: the availability of food, which may be grown, raised, bought, traded, or gathered from the wild and the physical and economic access to sufficient amounts of food to meet all nutritional needs at all times (Darmon and Drewnowski 2015). While it has been commonplace to blame undernutrition on people's ignorance of what foods to eat, the main obstacle to access is usually economic in circumstances where foods are available ("The State of Food Security and Nutrition in the World 2020" 2020; "The State of Food Security and Nutrition in the World 2021" 2021). People may be unable to afford a diet that meets their needs for energy and nutrients even if they know what foods to eat or aspire to eat. Of all the barriers to food access, cost and affordability are among the most important, particularly concerning nutritious food. Existing literature (Kachwaha et al. 2020; Save the Children UK and Save the Children India 2014; Rana et al. 2019) from developing countries have shown that income levels, food variety in local markets, and food habits are essential determinants of consuming nutritious diets, although evidence of costs and preferences associated with recommended diets of pregnant women and children is limited, particularly in India.

OBJECTIVES

This study aimed to assess the degree to which economic constraints might prevent impoverished households in the West Singhbhum district of Jharkhand from accessing a nutritious diet. The study expressly set out to answer the following questions:

- What is the minimum cost of a nutritionally adequate and culturally acceptable diet for typical households?
- Is a culturally acceptable nutritious diet affordable to the target population?
- If a nutritious diet is not affordable, what can potentially be done to reduce the affordability gaps?

MATERIALS AND METHODS

This study employed the Cost of the Diet (CotD) research method. The CotD is an innovative method and software (Deptford et al. 2017a) developed by Save the Children to estimate the amount and combination of local foods needed to provide a typical family with a diet that meets their average needs for energy and their recommended intakes of protein, fat and micronutrients (Deptford et al. 2017b; "About Cost of the Diet" n.d.). The CotD software achieves this by applying linear programming and selecting a combination of locally available food items that meet the macro- and micro-nutrient (total 13 nutrients) needs of one or more individuals at the lowest possible cost (Deptford et al. 2017b). This subsequently allows the users to estimate whether this diet is affordable to the population of interest by comparing the cost of the diet and non-food expenditure with income. The software also allows users to create models to estimate the potential effect of various public health interventions, such as food supplementation, fortification, and cash transfer on the affordability of a nutritious diet.

We used a mixed-method (i.e. both qualitative and quantitative) cross-sectional design. Data for the analysis was gathered both from secondary sources as well as through primary data collection.

POPULATION CHARACTERISTICS

The respondents were the mothers of the households who are the primary caregivers and take care of household food preparations. They belong to marginalized tribal communities, where women are mostly illiterate (56%) or completed a primary level of education (17%), whose primary occupations are household work (59%) and cultivation and allied agriculture (29%). The community mainly comprises of nuclear families (81%) with an average household size of 5.4 and an average household annual income equivalent to 1228 USD (Save the Children 2020).

Data collection (see Figure 1): During primary data collection, food availability, price, and seasonal variation data were collected from 16 local markets. In addition, dietary habits interviews were conducted among 96 adults using a food frequency questionnaire. 12 focus group discussions (FGDs) were conducted to understand cultural norms, intra-household food distributions, and misconceptions around food. Primary data were collected between November 2019 and December 2019 in the West Singhbhum district of Jharkhand State, India. Two socio-economic-cum-livelihood zones, Chaibasa and Tonto, were selected for data collection, thought to be typical for the district.

To estimate a realistic diet cost, the analysis took into account the typical food consumption habits, cultural practices and food taboos in the assessment area. During the individual interviews, a food frequency questionnaire was administered that contained all the food items listed in the market survey questionnaire. The tool was field tested before the survey. The purpose of this exercise was to assess the frequency (per week) of consumption of all food items on the list, if available or in season.

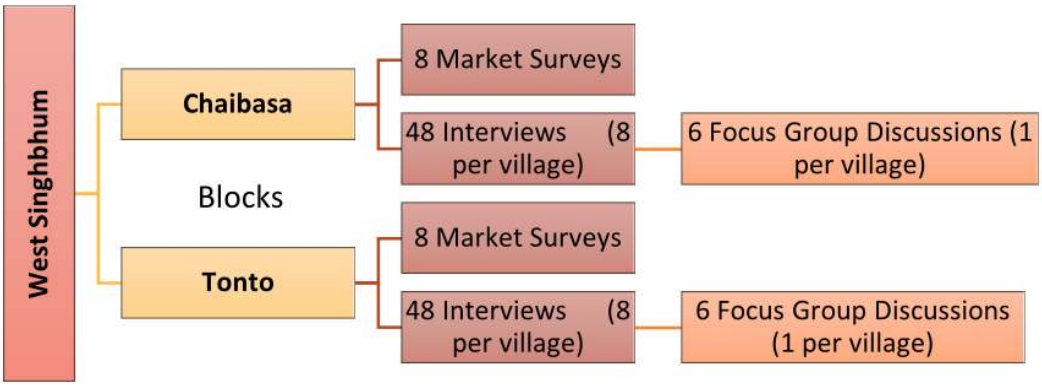


Figure 1. Data collection plan

FGDs were conducted with the same women who took part in the interviews using a semi-structured questionnaire. These FGDs validated the compiled responses from the interviews and also covered food preferences, taboos, beliefs, intra-household food distribution, access to markets, and home-grown or naturally available free food items.

DATA ANALYSIS

Data were analysed using the CotD software. The software contains the energy and nutrient content of foods; the energy and nutrient specifications of different types of individuals; the portion sizes of foods; and currency conversion factors (Deptford et al. 2017b). During the analysis, primary data were presented to a linear programming solver within the software, which in combination with the internal databases, estimated the amount and combination of local foods that were needed to provide the target individuals and households with a diet that meets their average needs for energy and their recommended intakes of protein, fat and micronutrients.

Data were manually added from the National Institute of Nutrition's food composition table for all food items not already available in the software (Longvah et al. n.d.). Individual nutrient requirements were based on those of similar people listed within the CotD software (Food and Agriculture Organization of the United Nations 2010; "Protein and Amino Acid Requirements in Human Nutrition: Report of a Joint FAO/WHO/UNU Expert Consultation" n.d.; FAO 2001; *Vitamin and Mineral Requirements in Human Nutrition*, n.d.).

The CotD analysis is primarily based on a typical household with a household size assumed as six (Save the Children 2020); a man, a woman, the mother-in-law and three children including, one child below 23 months. The detailed composition of the family is given in Table 1. The family composition was based on the CotD standard six-member family.

The affordability analysis was based on income data gathered from a 'Study on Income-Expenditure & Social Protection Schemes', conducted alongside the CotD assessment. Data on non-food expenditure (NFE) were taken from the 68th round of the National Sample Survey Office survey (NSSO, GOI 2013).

Table 1. The size and composition of the typical household/family used for the CotD analysis

Household member (type)	Kcal per day
1 x Child (either sex) 12-23 months	907
1 x Child (either sex) 4-5 years	1301
1 x Female 13-14 years	2,575
1 x Man, 30-59y, 50 kg, moderately active	2,750
1 x Woman, 30-59y, 45 kg, moderately active (1 x Lactation, 7-12 months)	2,760
1 x Woman, >60y, 45 kg, moderately active	2,050
Total Energy Requirement of the family/ household	12,343

LIMITATIONS OF THE COST OF THE DIET SOFTWARE AND METHOD

The CotD method and software have the following limitations:

- As the actual requirement for micronutrients for any given individual cannot be known, the software sets the Recommended Nutrient Intake (RNI) at 2SD (Standard Deviation) above the mean, to minimize the risk of deficiency. This means that when the composition of the foods selected by the CotD software completely meets the RNIs of the family, the nutritional needs of 97 per cent of all individuals will be exceeded.
- Though the software can identify a 'diet' providing the recommended amounts of macro and micronutrients from a relatively small number of foods, it assumes that that particular diet will be consumed by the family members daily at every meal, which can be unrealistic.
- The CotD software does not take into consideration the need for a number of nutrients including vitamin D, iodine, essential amino acids and essential fatty acids. Vitamin D is omitted because requirements can be met by making vitamin D in skin exposed to ultraviolet light. Iodine is not included because the

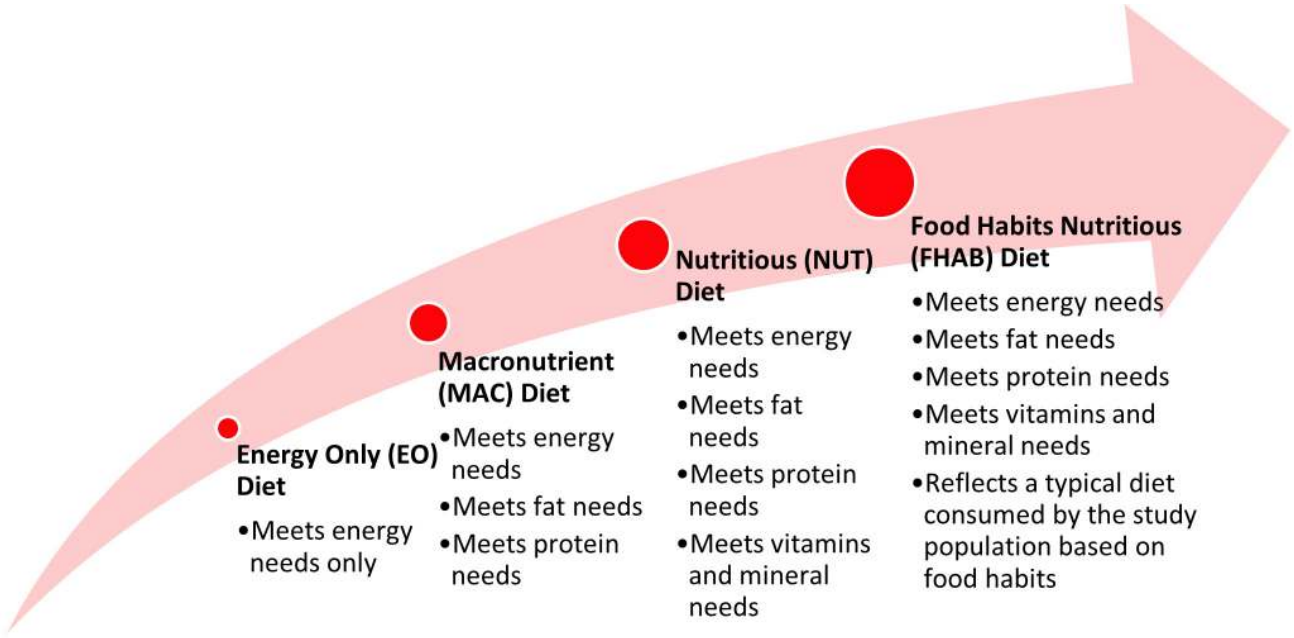


Figure 2. Information on different diet categories

amount in foods depends on the soil on which plants are grown or animals are reared, so no data are available in the food tables. And most food tables do not provide data on essential amino acids or fatty acids.

- The CotD method does not consider the additional energy, protein and nutrients needed by someone who is sick or convalescing.

Another critical aspect to keep in mind while interpreting the CotD results is intra-household food distribution. The CotD software determines amounts of food for a family based on the sum of RNIs, but often food is distributed within a household based on other criteria, including individual energy needs.

RESULTS

The cost of four diets was estimated: (i) Energy Only (EO) Diet; (ii) Macronutrient (MAC) Diet; (iii) Nutritious (NUT) Diet; and (iv) Food Habits Nutritious (FHAB) Diet.

The cost of the diet increases with an increase in the diet quality – from a basic EO diet costing INR 33,892 ($505.85)[1] per year for a standard 6-member household to a FHAB diet costing INR 70,627 ($1054.13) per year. The FHAB diet includes more diversified and desirable food groups factoring in local food preferences and consumption habits. Thus, a diet that meets a typical household's nutrient requirements is twice more expensive than a diet that meets only the household's energy requirements (Figures 2 and 3).

An analysis of the intra-household distribution of the cost of the FHAB diet for each family member expressed as a percentage of total cost reflects that lactating mothers as shown in Figure 4 represent the largest proportion of total cost (25 per cent). This means that a nutritious diet for lactating mothers costs the most in a family. In addition, the cost of an FHAB diet for an adolescent girl is equal to the cost of an adult man's diet, reflecting the increased nutritional demand during adolescence.

ESTIMATING THE AFFORDABILITY OF DIETS AND THE AFFORDABILITY GAP

In the study area, the average household annual income was INR 82,272 ($1228), with data ranging from a minimum INR 1200 ($17.9) to INR 874500±83,360 ($13065). The average annual income in each quartile varied from INR 22541.5 ($336) to INR 181,524 ($2709). Almost 50% of sample households were living in or on the edge of extreme poverty (<$1.90 per day) (Ravallion, Chen, and Sangraula 2009). The poorest quartile was spending 56.8% on food, compared to 33.7% for the richest quintile (Figure 5).

Figure 6 shows the affordability of the diets for the income quartiles. The results show that households belonging to quartiles 1 and 2 cannot afford an FHAB diet. Most households from all quartiles can only afford a portion of the FHAB, for if they bought a full FHAB diet for all members, they would not be able to meet their non-food expenditures.

1 $1- INR 67 (This is based on the exchange rate at the time of data collection, December 2019)

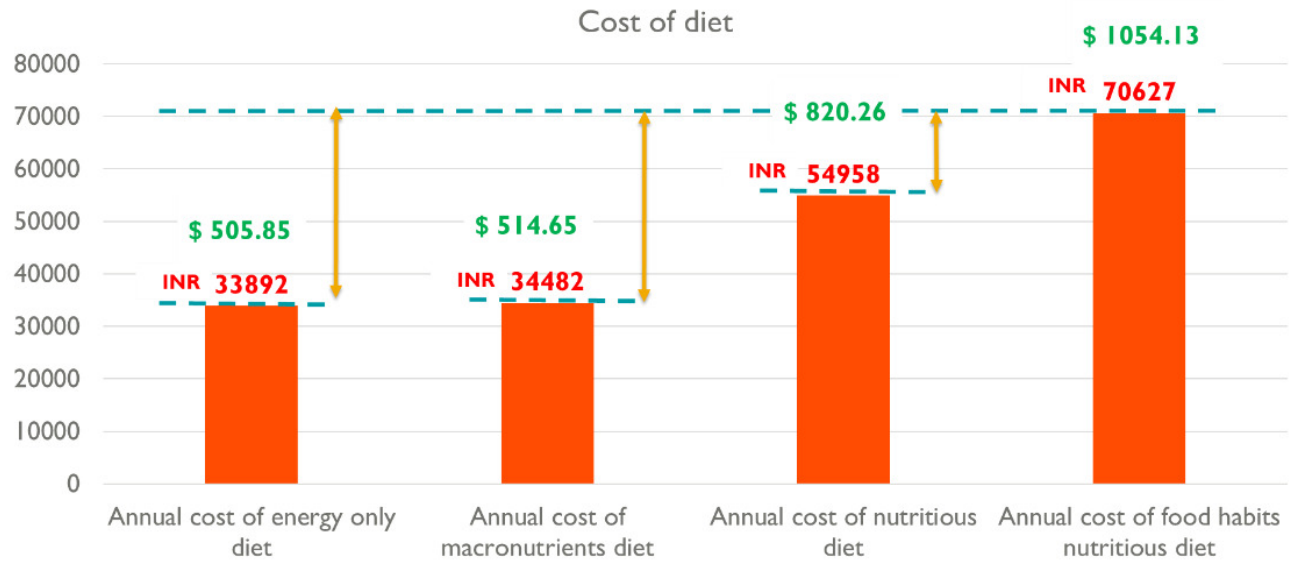


Figure 3. Annual Cost of various diets for a standard household with six members

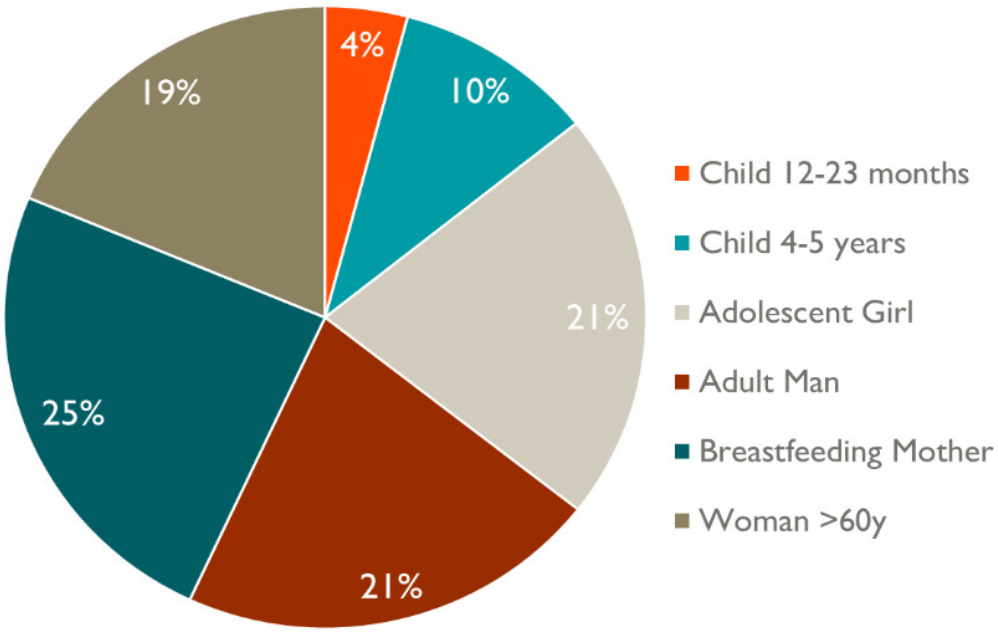


Figure 4. Intra-household distribution of cost of the FHAB diet for each individual member

EFFECT OF NUTRITION AND SOCIAL PROTECTION INTERVENTIONS ON THE COST AND AFFORDABILITY OF DIETS

To understand the likely effect of nutrition interventions on the cost and affordability of diets, the following scenarios were modelled:

- Scenario 1: Take-Home-Ration (THR) for Children and Pregnant/Lactating Women (PLW)
- Scenario 2: Public Distribution System (PDS) for Family
- Scenario 3: Iron Folic Acid Supplementation (IFA) for Children, Adolescents and PLW
- Scenario 4: Eggs (5 per week) for Children (proposed)
- Scenario 5: THR+PDS
- Scenario 6: THR+PDS +IFA
- Scenario 7: THR + PDS + IFA + Eggs

Table 2 depicts the standard norms and optimization assumed for each of the above-mentioned models. For each, universal optimization was assumed.

As shown in Figure 7, the cost of the FHAB diet can be reduced by 13% through optimal nutrition supplementation

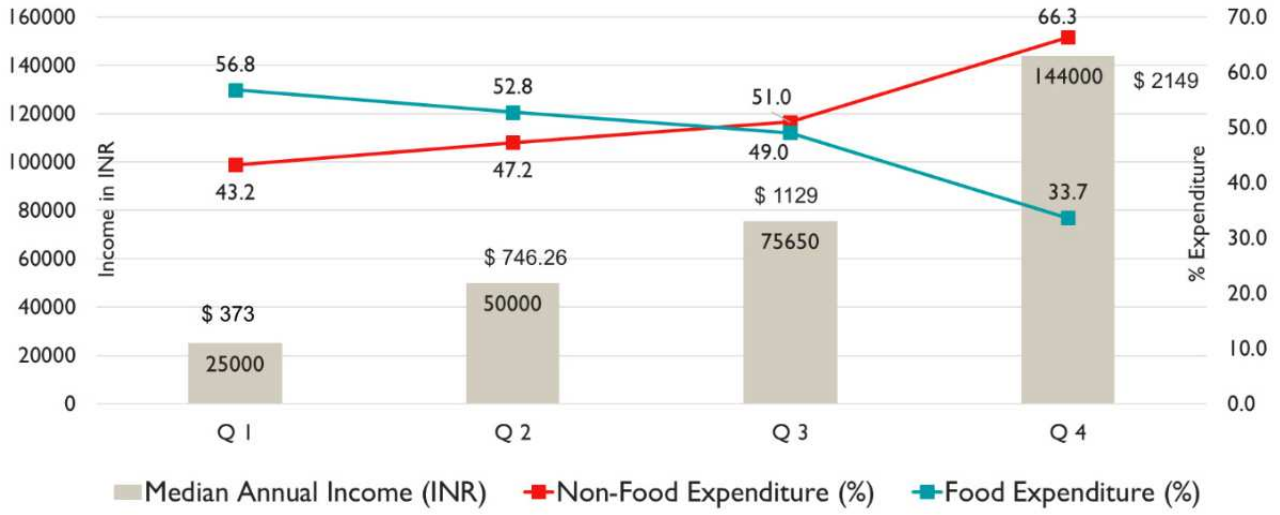


Figure 5. Total income and non-food expenditure of households by income quartiles

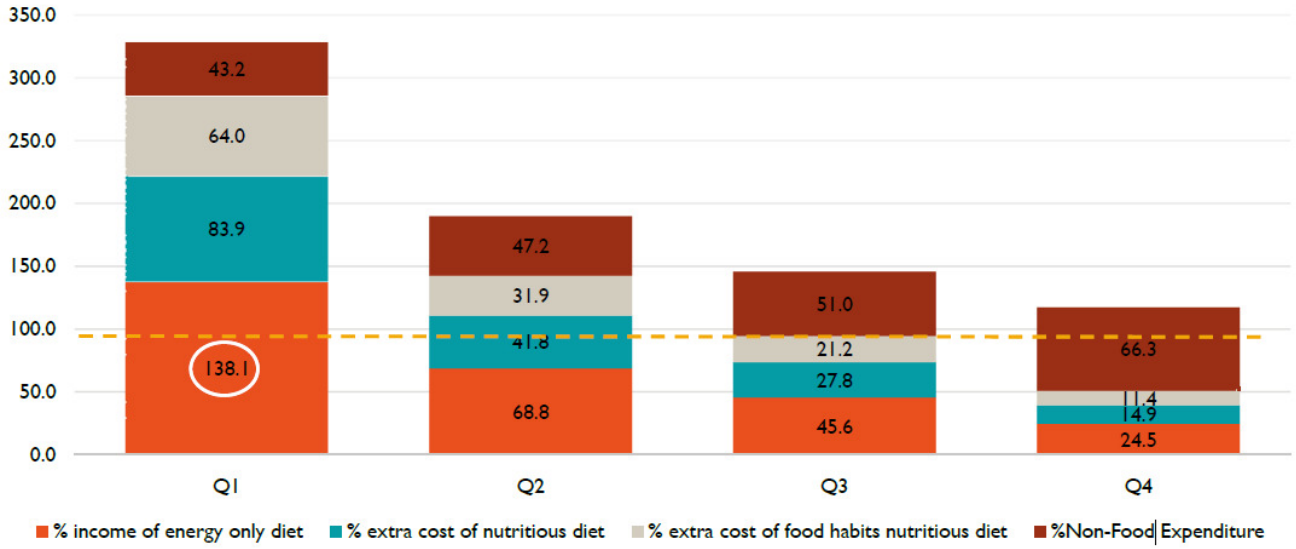


Figure 6. Estimated affordability of different diet types and non-food expenditure by income quartiles

with a take-home ration for children and lactating women. There is a reduction of nearly 25% in the cost of the FHAB diet if the uptake of PDS services is utilized optimally. Similarly, with universal uptake of all interventions, i.e. supplementation of THR, PDS, IFA and the proposed supplementation of Eggs, there would be a 40% reduction in the cost of FHAB.

To understand the likely effect of social protection interventions along with nutrition interventions on the affordability of diets, the following scenarios were modelled:

- Scenario 1: Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA) (MINISTRY OF LAW AND JUSTICE G of I 2005) + THR + PDS + IFA + Eggs
- Scenario 2: MNREGA + Old Age Pension Scheme + THR + PDS + IFA + Eggs
- Scenario 3: MNREGA + Old Age Pension Scheme + Livelihood Mission Benefits + THR + PDS + IFA + Eggs
- Scenario 4: MNREGA + Old Age Pension Scheme + Livelihood Mission Benefits + Child Grant + THR + PDS + IFA + Eggs

To estimate the potential impact of social protection interventions on the affordability of the diet, support or allowance was added to the annual income of households (Table 3). This model assumes: (i) the household will receive the allowance every month, and (ii) the received amount will be spent on household food purchases only.

As shown in Figure 8, universal uptake of nutrition interventions like Public Distribution System, Take Home Ration, IFA supplementation, Supplementation of Eggs, etc. and/or social protection interventions such as MNREGA, Pension, Livelihood schemes, etc. can lead to as much as a

Table 2. Standard norms considered for modelling the potential effect of nutrition

Interventions considered for modelling	Standard norms
IFA[a] for Children	20 mg Iron 100 mcg Folic Acid per day
IFA for PLW	60 mg Iron 500 mcg Folic Acid per day
IFA for Adolescent girl	100 mg Iron 500 mcg Folic Acid per day
THR[b] for Children	Pigeon Pea, roasted 30 g per day Potato 100g per day Rice 50g per day Roasted Peanut 30g per day Jaggery, sugarcane, 30g per day
THR for PLW	Pigeon Pea, roasted 30 g per day Potato 125g per day Rice 100g per day Roasted Peanut 40g per day Jaggery, sugarcane, 25g per day
Egg in Supplementary Nutrition Program (SNP)	5 eggs per week
Public Distribution System (PDS)	Rice 21 kg (Rs.1/kg) Wheat 14 kg (Rs.1/kg) Sugar 3 kg (Rs 24/kg)

[a] Iron and folic acid
[b] Take home ration

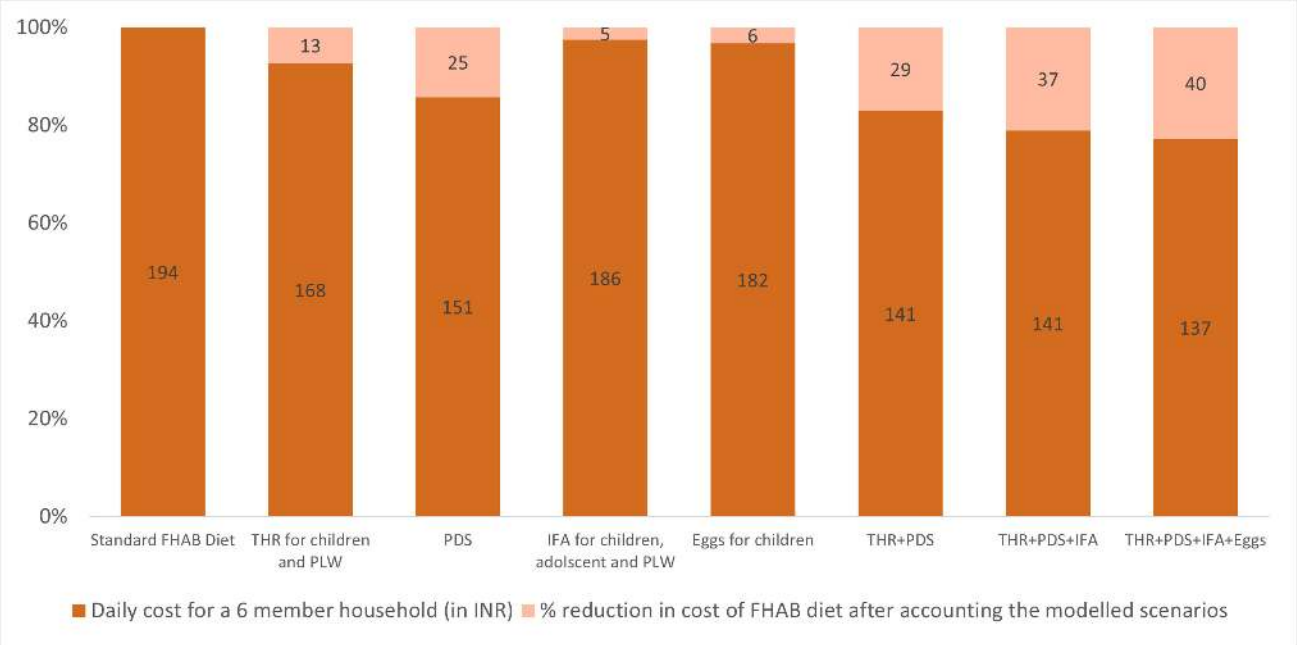


Figure 7. Potential effect of modelling on the estimated cost of FHAB diets by scenarios

30% decrease in percentage income spent on the FHAB diet, thereby reducing the affordability gap.

DISCUSSION

India has witnessed a substantial improvement in the coverage of nutrition-specific interventions between 2006 and 2016 (IIPS 2016). However, the coverage is still sub-optimal. Save the Children's found that only 59% of the targeted eligible population accessed PDS in the three months before the survey (Save the Children 2020). Access to MNREGA was 10%. Though progress has been made by mobilising the local community, formation of groups and capacity building on livelihood skills, only 2% have reported having received tangible benefits (cash/kind) from Jharkhand State Livelihood Promotion Society (JSLPS) or Project Johar. Poor coverage of schemes translates into under-utilisation of funds, affecting the resource allocation for the subsequent fiscal year.

The present study applied the cost-of-diet (CotD) approach to the Indian context to fill critical gaps in knowledge related to the affordability, availability, and accessibility of nutritious diets. We found that the cost of the diet increases with the improvement in the diet quality– from

Table 3. Standard norms considered and optimization assumed for modelling the potential effect of social protection scheme

Interventions considered for modelling	Standard/Suggested norms	Optimization assumed for modelling
MNREGA	202 INR per day for 90 days for quartiles 1 and 2.	Universal
Old Age Pension Scheme	600 INR per month for 12 months for quartile 1	Universal
Livelihood Mission Benefits	1000 INR per month for 12 months for quartiles 1 and 2 (estimated)	Universal
Child Grant	500 INR per month per child for 2 children for 2 years (A proposition)	Universal



Figure 8. Potential effect of nutrition interventions and social protection schemes on estimated affordability gaps for Quartile 1

a basic energy-only diet costing INR 92/day ($ 1.37) for a standard household with six family members to a food-habit nutritious diet costing nearly INR 194 per day ($2.9). These findings are similar to those of Menon et al. in Uttar Pradesh (Kachwaha et al. 2020). This corroborates the classic economic theory known as Engel's Law (Zimmerman 1932). The cost of the FHAB diet should be used as a benchmark to track the progress of beneficiary groups in upcoming socio-economic assessments and to observe changes in the affordability gap to assess how well new initiatives have worked.

Government programmes for key nutrition-specific interventions can potentially reduce the cost of the food-habit nutritious diet by 30%. Consumption of iron folic acid (IFA) tablets in the recommended quantity by pregnant and breastfeeding women should help fulfil the folic acid requirement, and potentially reduce diet costs by another 4%. Therefore, we need to increase the momentum to deliver these interventions with quality as envisaged under the POSHAN Abhiyaan ("POSHAN Abhiyaan - PM's Overarching Scheme for Holistic Nourishment| National Portal of India" n.d.) and Anemia Mukt Bharat ("Anemia Mukt Bharat | A Programme by Ministry of Health and UNICEF" n.d.). Key Nutrition-Sensitive Social Protection Schemes, which have the potential to improve household income like PM-MVY ("Pradhan Mantri Matru Vandana Yojana (PMMVY) SCHEME IMPLEMENTATION GUIDELI NES" 2017), and MNREGA need to revisit their benefit size and optimal coverage.

The global COVID-19 pandemic has had an unprecedented effect on nutrition, escalating both the immediate and underlying causes of nutrition. We plan to conduct another assessment to study the effect of the pandemic on the availability, cost and affordability of a nutritious diet, and to plan improved strategies to combat undernutrition.

Submitted: June 26, 2022 BRT, Accepted: September 25, 2022 BRT

This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CCBY-4.0). View this license's legal deed at http://creativecommons.org/licenses/by/4.0 and legal code at http://creativecommons.org/licenses/by/4.0/legalcode for more information.

REFERENCES

"About Cost of the Diet." n.d. Accessed August 25, 2022. https://www.heacod.org/en-gb/Pages/AboutCotD.aspx.

"Anemia Mukt Bharat | A Programme by Ministry of Health and UNICEF." n.d. Accessed August 25, 2022. https://anemiamuktbharat.info/.

Darmon, Nicole, and Adam Drewnowski. 2015. "Contribution of Food Prices and Diet Cost to Socioeconomic Disparities in Diet Quality and Health: A Systematic Review and Analysis." *Nutrition Reviews* 73 (10): 643–60. https://doi.org/10.1093/nutrit/nuv027.

Deptford, Amy, Tommy Allieri, Rachel Childs, Claudia Damu, Elaine Ferguson, Jennie Hilton, Paul Parham, et al. 2017a. "Cost of the Diet: A Method and Software to Calculate the Lowest Cost of Meeting Recommended Intakes of Energy and Nutrients from Local Foods." *BMC Nutrition* 3 (1): 1–17. https://doi.org/10.1186/s40795-017-0136-4.

———. 2017b. "Cost of the Diet: A Method and Software to Calculate the Lowest Cost of Meeting Recommended Intakes of Energy and Nutrients from Local Foods." *BMC Nutrition* 3 (1): 1–17. https://doi.org/10.1186/s40795-017-0136-4.

FAO. 2001. "Human Energy Requirements." Rome.

Food and Agriculture Organization of the United Nations. 2010. "Fats and Fatty Acids in Human Nutrition."

Ghosh-Jerath, Suparna, Archna Singh, Tanica Lyngdoh, Melina S. Magsumbol, Preeti Kamboj, and Gail Goldberg. 2018. "Estimates of Indigenous Food Consumption and Their Contribution to Nutrient Intake in Oraon Tribal Women of Jharkhand, India." *Food and Nutrition Bulletin* 39 (4): 581–94. https://doi.org/10.1177/0379572118805652.

IIPS. 2016. "NATIONAL FAMILY HEALTH SURVEY, INDIA." http://www.rchiips.org/nfhs.

Kachwaha, S., P.H. Nguyen, M. Defreese, R. Avula, S. Cyriac, A. Girard, et al. 2020. "Community and Global Nutrition Assessing the Economic Feasibility of Assuring Nutritionally Adequate Diets for Vulnerable Populations in Uttar Pradesh, India: Findings from a 'Cost of the Diet' Analysis." https://academic.oup.com/cdn/.

Longvah, T., I. (Ira ¯ jacin ˙ kam) An_antan_, K. Bhaskarachary, K. Venkaiah, Institute of Nutrition (India), India, and Department of Health Research. n.d. "Indian Food Composition Tables." Accessed September 17, 2022. https://www.researchgate.net/publication/313226719_Indian_food_Composition_Tables.

MINISTRY OF LAW AND JUSTICE G of I. 2005. "THE NATIONAL RURAL EMPLOYMENT GUARANTEE ACT."

National Sample Survey Office, Ministry of Statistics and Programme Implementation, Government of India. 2013. "Key Indicators of Household Consumer Expenditure in India, NSS 68th Round." http://microdata.gov.in/nada43/index.php/catalog/1.

"POSHAN Abhiyaan - PM's Overarching Scheme for Holistic Nourishment| National Portal of India." n.d. Accessed August 25, 2022. https://www.india.gov.in/spotlight/poshan-abhiyaan-pms-overarching-scheme-holistic-nourishment.

"Pradhan Mantri Matru Vandana Yojana (PMMVY) SCHEME IMPLEMENTATION GUIDELI NES." 2017.

"Protein and Amino Acid Requirements in Human Nutrition: Report of a Joint FAO/WHO/UNU Expert Consultation." n.d. Accessed September 17, 2022. https://apps.who.int/iris/handle/10665/43411.

Rana, M., S. Rahman, A.A. Shovan, and M.R. Haque. 2019. "Improving Minimum Dietary Diversity for Children Aged 6-23 Months When Household Affordability Is a Major Constraint: Findings from a Barrier Analysis and Cost-of-the-Diet (CotD) Analysis in Northeast Bangladesh." *ENN, Field Exchange*. https://www.ennonline.net/fex/61/dietarydiversitybangladesh.

Ravallion, Martin, Shaohua Chen, and Prem Sangraula. 2009. "Dollar a Day Revisited." *The World Bank Economic Review* 23 (2): 163–84. https://doi.org/10.1093/wber/lhp007.

Save the Children. 2020. "Pattern of Household Income-Expenditure & Coverage of Social Protection Schemes: A Glimpse from West Singhbhum, Jharkhand, India." https://www.savethechildren.in/wp-content/uploads/2021/05/Pattern-of-Household-Income-Expenditure-Coverage-of-Social-Protection-Schemes.pdf.

Save the Children UK and Save the Children India. 2014. "A Cost of the Diet Analysis in Pindra Block, Varanasi District, India."

Singh Yadav, R., and B. Kumari. 2022. "Assessing Nutrition and Forecasting New Type of Vulnerabilities in Jharkhand Using National Family Health Survey-4." *Artha Vijnana* LXIV (1): 20–33.

"The State of Food Security and Nutrition in the World 2020." 2020. In *The State of Food Security and Nutrition in the World 2020*.

"The State of Food Security and Nutrition in the World 2021." 2021.

Vitamin and Mineral Requirements in Human Nutrition. n.d. 2nd ed.

Zimmerman, C.C. 1932. "Ernst Engel's Law of Expenditures for Food." *Q J Econ* 47 (1): 78–101. https://academic.oup.com/qje/article/47/1/78/1928220.