

EDITOR'S NOTE

Issue 44 of the POSHAN Abstract Digest, brings to you yet another collection of articles on various topics pertaining to maternal and child nutrition. This issue features several studies on the nutritional status of adolescents and the relationship between maternal dietary diversity and body composition with children's health. A few studies look at coverage of nutrition and health interventions in the country, including the Anemia Mukht Bharat program and the National Rural Health mission.

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Stay safe and enjoy reading!

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Coverage of Iron and Folic Acid Supplementation in India: Progress Under the Anemia Mukht Bharat Strategy 2017–20

Joe et al. 2022. *Health Policy and Planning*: 1–10.

Improving Nutrition Budgeting in Health Sector Plans: Evidence From India's Anaemia Control Strategy

Saini et al. 2022. *Maternal and Child Nutrition* 18: e13253.

Hunger and Health: Reexamining the Impact of Household Food Insecurity on Child Malnutrition in India

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Comparison of Child Undernutrition Anthropometric Indicators Across 56 Low- and Middle-Income Countries

Gausman et al. 2022. *JAMA Network Open* 5(3): e221223.

Association of Trends in Child Undernutrition and Implementation of the National Rural Health Mission in India: A Nationally Representative Serial Cross-Sectional Study on Data From 1992 to 2015

Soni et al. 2022. *PLoS Med* 19(4): e1003957.

Iron Fortification through Universal Distribution of Double-Fortified Salt Can Increase Wages and Be Cost-Effective: An Ex-Ante Modeling Study in India

Makkar et al. 2022. *The Journal of Nutrition* 152(2): 597–611.

PEER-REVIEWED

COMMENT

Revisiting the Stunting Metric for Monitoring and Evaluating Nutrition Policies

Subramanian, S.V., Karlsson, O., and R. Kim. 2022. "Revisiting the Stunting Metric for Monitoring and Evaluating Nutrition Policies." *The Lancet* 11(2): E179-E180. doi: [https://doi.org/10.1016/S2214-109X\(21\)00504-0](https://doi.org/10.1016/S2214-109X(21)00504-0)

CORRESPONDENCE

Using Height-Adjusted Stunting Prevalence Will Fail Disadvantaged Children Worldwide

Leroy, J.L., Frongillo, E.A., and E. Borghi. 2022. "Using Height-Adjusted Stunting Prevalence Will Fail Disadvantaged Children Worldwide." *The Lancet* 10(5): E620. doi: [https://doi.org/10.1016/S2214-109X\(22\)00076-6](https://doi.org/10.1016/S2214-109X(22)00076-6)

Birth Cohort Differences in Height, Weight and BMI Among Indian Women Aged 15–30 Years: Analyses Based on Three Cross-Sectional Surveys

Deshpande, S., Kinnunen, T., and S. Kulathinal. 2021. "Birth Cohort Differences in Height, Weight and BMI Among Indian Women Aged 15–30 Years: Analyses Based on Three Cross-Sectional Surveys." *Public Health Nutrition*: 1–10. doi: <https://doi.org/10.1017/S1368980021005012>

Objective: To explore long-term trends in height, weight and BMI across birth cohorts among Indian women aged 15–30 years. **Design:** Nationally representative cross-sectional surveys. **Setting:** Data from three National Family Health Surveys were conducted in 1998–1999, 2005–2006 and 2015–2016. Height and weight were modelled jointly, employing a multivariate regression model with age and birth cohorts as explanatory variables. The largest birth cohort (born 1988–1992) was the reference cohort. Stratified analyses by place of residence and by marital status and dichotomised parity were also performed. **Participants:** 437 753 non-pregnant women aged 15–30 years. **Results:** The rate of increase in height, weight and BMI differed across birth cohorts. The rate of increase was much lower for height than weight, which was reflected in an increasing trend in BMI across all birth cohorts. In the stratified analyses, increase in height was found to be similar across urban and rural areas. Rural women born in the latest birth cohort (1998–2001) were lighter, whereas urban women were heavier compared to the reference cohort. A relatively larger increase in regression coefficients was observed among women born between 1978 and 1982 compared to women born between 1973 and 1977 when considering unmarried and nulliparous ever-married women and, one cohort later (1983–1987 v. 1978–1982), among parous ever-married women. **Conclusion:** As the rate of increase was much larger for weight than for height, increasing trends in BMI were observed across the birth cohorts. Thus, cohort effects show an important contributory role in explaining increasing trends in BMI among young Indian women.

Are Early Childhood Stunting and Catch-Up Growth Associated With School Age Cognition?—Evidence From an Indian Birth Cohort

Koshy, B., Srinivasan, M., Gopalakrishnan, S., Mohan, V.R., Scharf, R., Murray-Kolb, L., John, S., Beulah, R., Muliylil, J., and G. Kang. 2022. "Are Early Childhood Stunting and Catch-Up Growth Associated With School Age Cognition?—Evidence From an Indian Birth Cohort." *PLoS ONE* 17(3): e0264010. doi: <https://doi.org/10.1371/journal.pone.0264010>

Background: Millions of children worldwide especially in the Asian subcontinent are vulnerable to early childhood stunting. There are contradictory reports of the association between catch-up

growth in childhood and school age cognition. **Methods:** A community-based birth cohort recruited between 2010 and 2012 from urban slums in Vellore, India was followed up until 9 years of age. From regular anthropometric measurements, stunting status for each individual child was calculated at 2, 5 and 9 years. Cognition was assessed at 9 years of age using the Malin's Intelligence Scale for Indian Children (MISIC). Children were divided into groups based on stunting at each time point as well as catch-up growth, and a regression model was utilised to evaluate their association with cognition at 9 years. **Results:** Among 203 children included in this analysis, 94/203 (46.31%) children were stunted at 2 years of age, of whom 39.36% had a catch-up growth at 5 years of age, and 38.30% at 9 years. Around 10% of the cohort remained stunted at all time points. In the multivariable analysis, children who were stunted at 2, 5 and 9 years had a significantly lower verbal and total intelligence quotient (IQ) scores by 4.6 points compared to those who were never stunted. Children with catch up growth following stunting at 2 years had higher cognition scores than those who were persistently stunted throughout the childhood. **Conclusions:** This study showed persistent stunting in childhood was associated with lowering of 4–5 IQ points in childhood cognition at 9 years of age. Recovery from early life stunting in children with catch up growth prevented further lowering of cognition scores in these children compared to persistently stunted children. Nutritional supplementation during late infancy and early toddlerhood in addition to continuing nutritional supplementation programmes for preschool and school children can improve childhood stunting and cognitive abilities in vulnerable populations.

Prevalence and Determinants of Undernutrition Among Adolescents in India: A Protocol for Systematic Review and Meta-Analysis

Parida, J., Jena Samanta, L., Badamali, J., Singh, P.K., Patra, P.K., Mishra, B.K., Pati, S., Kaur, H., and S.K. Acharya. 2022. "Prevalence and Determinants of Undernutrition Among Adolescents in India: A Protocol for Systematic Review and Meta-Analysis." *PLoS ONE* 17(1): e0263032. doi: <https://doi.org/10.1371/journal.pone.0263032>

Background: Undernutrition is one of the serious health problems among adolescents in India where 253 million adolescents are in the age group of 10–19 years. Since adolescents represent the next generation of adults, it is important to understand the nutritional status of adolescents. Even though several studies have been carried out in different states in India on adolescent undernutrition (stunting, wasting /underweight), there is no study or review that estimated the national pooled prevalence of adolescent undernutrition and its determinants. Therefore, this review aims to determine the pooled prevalence and determinants of undernutrition (stunting, underweight/wasting) among Indian adolescents. **Methods:** A systematic review of eligible articles will be conducted using preferred reporting items for systematic reviews and meta-analysis (PRISMA) guidelines. A comprehensive searching of the literature will be made in Pub Med, EMBASE, SCOPUS, Google, Google Scholar, and Cochrane databases. The quality of the articles included in the review will be evaluated using the Newcastle-Ottawa Scale (NOS) for observational studies in meta-analyses. The pooled prevalence and odds ratio of the associated risk factors or determinants with their 95% confidence interval will be computed using STATA version 16 software. The existence of heterogeneity among studies will be assessed by computing p-values of Higgins's I² test statistics and Cochran's Q-statistics based on chi-square with a 5% level of significance among reported prevalence. Sensitivity analysis and subgroup analysis will be conducted based on study quality to investigate the possible sources of heterogeneity. Publication bias will be assessed through visual examination of funnel plots and objectively by Egger's regression test. This review protocol has been registered at PROSPERO (CRD42021286814).: **Discussion:** By collecting and summarizing information on adolescent undernutrition can be a step towards a better understanding of the prevalence of nutritional status of Indian adolescents and how the associated factors influence the prevalence of undernutrition. This review will provide directions for further research and healthcare practitioners.

This summarized finding at the national level will provide impetus to build nutritional strategies and proper healthcare services to fight against undernutrition among the most ignored population.

Changes in Anemia and Anthropometry During Adolescence Predict Learning Outcomes: Findings From a 3-Year Longitudinal Study in India

Nguyen, P., Walia, M., Pant, A., Menon, P., and S. Scott. 2022. "Changes in Anemia and Anthropometry During Adolescence Predict Learning Outcomes: Findings From a 3-Year Longitudinal Study in India." *The American Journal of Clinical Nutrition*, nqac028.

doi: <https://doi.org/10.1093/ajcn/nqac028>

Background: Anemia and poor physical growth during adolescence have far-ranging consequences, but limited longitudinal evidence exists on how changes in these factors relate to changes in learning skills as adolescents mature. **Objectives:** We examined the association between changes in anemia and physical growth during adolescence and learning outcomes. **Methods:** We used longitudinal data from the Understanding the Lives of Adolescents and Young Adults (UDAYA) project, which surveyed adolescents aged 10–19 years in northern India in 2015–16 and 2018–19 ($n = 5963$). We used multilevel mixed-effects logistic regression models to examine associations between changes in anemia/thinness/stunting status (four groups: never, improved, new, and persistent) and reading (ability to read a story) and math proficiency (ability to solve division problems) at follow-up.

Results: Persistent anemia and stunting were higher among girls than boys (46% vs. 8% and 37% vs. 14%, respectively), but persistent thinness was lower (7% vs. 16%). Improvement in anemia, thinness and stunting was 1.4–1.7 times higher among boys than girls. Boys who were anemic in both waves were 74% (adjusted odds ratio [AOR] 0.26, 95% confidence interval [CI]: 0.12, 0.59) and 65% (AOR 0.35, 95% CI: 0.16, 0.76) less likely to be able to read a story and solve division problems, respectively, compared to boys who were non-anemic in both waves. Persistent thinness in boys was negatively associated with both reading (AOR 0.37, 95% CI: 0.21, 0.66) and math proficiency (AOR 0.27, 95% CI: 0.16, 0.46). Persistent stunting contributed to lower reading and math proficiency in boys and girls (AORs: 0.29 to 0.46). Boys whose anemia or thinness status improved and girls whose stunting status improved had similar learning skills at follow-up as those who were never anemic/thin/stunted. **Conclusions:** Persistent anemia, thinness and short stature during adolescence was associated with poor learning. Programs targeted at adolescents should contribute to nurturing environments that foster healthy growth and learning.

Improving Underweight Mothers' Essential Newborn Care During Early Infancy: A Single-Blinded, Parallel-Randomized, Controlled Trial

Singh, N., Rao, S.S., Mithra, P., Manjrekar, P., Kamath, N., B.S. Baliga. 2022. "Improving Underweight Mothers' Essential Newborn Care During Early Infancy: A Single-Blinded, Parallel-Randomized, Controlled Trial" *The Journal of Pediatrics*. doi: <https://doi.org/10.1016/j.jpeds.2022.01.005>

Objective: To evaluate the effectiveness of using a standardized Essential Newborn Care (ENC) module taught by pediatric residents on ENC skills and growth of offspring born to underweight primigravida mothers. **Study design:** This facility-based, single-blinded, parallel, randomized controlled trial was conducted between May 2018 and March 2019. Eighty-eight underweight primigravida mothers and their vaginally delivered offspring were blindly allocated into the intervention group (IG) or control group (CG). The IG mothers received education on ENC through pictorial aids, demonstrations, and practice sessions. All mothers received information from ongoing public health programs. A trained hospital nurse, blinded to the study, assessed the mothers' neonatal care skills on the second postnatal day. The infants were followed until 6 months. Weight, length, and head circumference were measured at birth and age 6 weeks, 10 weeks,

14 weeks, and 6 months (± 1 week). **Results:** Mothers in the IG had significantly better ENC skills in all domains ($P < .001$). Their infants had a statistically significant increase in weight (at 10 and 14 weeks and 6 months), length (at 14 weeks and 6 months), and head circumference (at 6 months). Infants' z-scores indicated significant improvements in anthropometry in the IG compared with the CG. At age 6 months, the number of infants with weight < 3 rd percentile decreased in the IG (from 20 of 44 to 5 of 41) and increased in the CG (from 17 of 44 to 22 of 42) compared with birth percentiles.

Conclusions: An educational intervention to strengthen maternal ENC knowledge and skills soon after delivery improved physical growth in infants born to underweight primigravida mothers.

Regional Pattern of Child Undernutrition, Calorie Consumption, Non-Food Expenditure and Wealth in India

Khan, J., and K. Sanjay. 2022. "Regional Pattern of Child Undernutrition, Calorie Consumption, Non-Food Expenditure and Wealth in India." *Clinical Epidemiology and Global Health* 13: 100942. doi: <https://doi.org/10.1016/j.cegh.2021.100942>

Background/objective: Although, proximate and contextual determinants of malnutrition have been studied previously, there are a limited number of studies on association of calories consumption, economic wellbeing of household and measures of child undernutrition. In this context, this study examined the regional level variation in child undernutrition in terms of calories consumption, monthly per capita non-food expenditure (MPCNFE) and mean wealth score. **Methods:** This study is based upon NFHS, 2015-16 and NSS, 2011-12 datasets. Compiling the necessary information at the regional level, this study employed bi-variate cross-tabulation, correlation analysis and multivariate OLS regression analysis. **Results:** Regions where calories intake is more than 2200 Kcal, the prevalence of stunting (31%), underweight (27%) and wasting (19%) are comparatively low. A low MPCNFE (< 1000 R/-) shows higher prevalence of stunting (39%), underweight (33%) and wasting (21%) across regions. Similarly, a low wealth score also shows higher prevalence of undernutrition across regions of India. OLS estimation shows that calories intake significantly predicts all the three measures of undernutrition at the regional level explaining 45% of the regional variation in stunting, 52% in the prevalence of underweight and 38% in wasting. The MPCNFE measure significantly predicts the regional level variation in stunting (Adjusted $R^2 = 0.54$) and underweight (Adjusted $R^2 = 0.35$) but not wasting. The wealth framework is observed to be weak and shows statistically significant association with stunting only and the explained variation is also found low (Adjusted $R^2 = 0.16$). **Conclusion:** This study provides compelling evidence on the regional variation in child undernutrition parameters in terms of calories intake, MPCNFE and wealth score.

Body Composition and Cardiometabolic Risk Markers in Children of Women who Took Part in a Randomized Controlled Trial of a Preconceptional Nutritional Intervention in Mumbai, India

Sahariah, S.A., Gandhi, M., Chopra, H., Kehoe, S.H., Johnson, M.J., di Gravio, C., Patkar, D., Sane, H., Coakley, P.J., Karkera, A.H., Bhat, D.S., Brown, N., Margetts, B.M., Jackson, A.A., Kumaran, K., Potdar, R.D., and C.H.D. Fall. 2022. "Body Composition and Cardiometabolic Risk Markers in Children of Women who Took Part in a Randomized Controlled Trial of a Preconceptional Nutritional Intervention in Mumbai, India." *The Journal of Nutrition*, nxab443. doi: <https://doi.org/10.1093/jn/nxab443>

Background: Maternal nutrition influences fetal development and may permanently alter ("program") offspring body composition and metabolism, thereby influencing later risk of diabetes and cardiovascular (cardiometabolic) disease. The prevalence of cardiometabolic disease is rising rapidly in India. **Objectives:** To test the hypothesis that supplementing low-income Indian women with micronutrient-rich foods preconceptionally and during pregnancy has a beneficial impact on the

children's body composition and cardiometabolic risk marker profiles. **Methods:** Follow-up of 1255 children aged 5–10 y whose mothers took part in the Mumbai Maternal Nutrition Project [Project “SARAS”; International Standard Randomised Controlled Trial Number (ISRCTN)62811278]. Mothers were randomly assigned to receive a daily micronutrient-rich snack or a control snack of lower micronutrient content, both made from local foods, in addition to normal diet, from before pregnancy until delivery. Children's body composition was assessed using anthropometry and DXA. Their blood pressure, plasma glucose, insulin, and lipid concentrations were measured. Outcomes were compared between allocation groups with and without adjustment for confounding factors. **Results:** Overall, 15% of children were stunted, 34% were wasted, and 3% were overweight. In the intention-to-treat analysis, there were no differences in body composition or risk markers between children in the intervention and control groups. Among children whose mothers started supplementation ≥ 3 mo before conception (the “per protocol” sample) the intervention increased adiposity among girls, but not boys. BMI in girls was increased relative to controls by 2% (95% CI: 1, 4; $P = 0.01$); fat mass index by 10% (95% CI: 3, 18; $P = 0.004$); and percent fat by 7% (95% CI: 1, 13; $P = 0.01$) unadjusted, with similar results in adjusted models. **Conclusions:** Overall, supplementing women with micronutrient-rich foods from before pregnancy until delivery did not alter body composition or cardiometabolic risk markers in the children. Subgroup analyses showed that, if started ≥ 3 mo before conception, supplementation may increase adiposity among female children.

Association of Maternal Height and Body Mass Index With Nutrition of Children Under 5 Years of Age in India: Evidence From Comprehensive National Nutrition Survey 2016–18

Porwal, A., Agarwal, P. K., Ashraf, S., Acharya, R., Ramesh, S., Khan, N., Johnston, R., and A. Sarna. 2021. “Association of Maternal Height and Body Mass Index With Nutrition of Children Under 5 Years of Age in India: Evidence From Comprehensive National Nutrition Survey 2016–18.” *Asia Pacific Journal of Clinical Nutrition* 30(4): 675–686. doi: [https://doi.org/10.6133/apjcn.202112_30\(4\).0014](https://doi.org/10.6133/apjcn.202112_30(4).0014)

Background and objectives: Child undernutrition remains an area of public health concern across the globe, particularly in developing countries like India. Previous studies have focused on the association of maternal nutrition with premature pregnancy and birthweight of child, with few establishing the intergenerational effect but limited to select populations and geography. **Methods and study design:** This study used data from 35,452 children aged under 5 years and their biological mother from nationally representative Comprehensive National Nutrition Survey (CNNS) in India. The outcome variables were anthropometric indices: height-for-age, weight-for-height, and weight-for-age. The exposure variables were maternal height and body mass index (BMI). Multivariate regression analysis was used to examine the association between maternal height and BMI with child undernutrition. **Results:** Out of total number of mothers, 11.1% were short in stature and 28% were underweight. Of total number of children, 33.9%, 17.3% and 32.7% were stunted, wasted, and underweight respectively. Children born to mother with short stature were more likely to be stunted (OR=1.73, 95% CI 1.59-1.89), wasted (OR=1.26, 95% CI 1.12-1.41) and underweight (OR=1.64, 95% CI 1.50-1.79). Similarly, children with underweight mother were more likely to be stunted (OR=1.63, 95% CI 1.53-1.73), wasted (OR=1.64, 95% CI 1.52-1.77) and underweight (OR=2.14, 95% CI 2.01-2.27). **Conclusions:** The study shows a strong association between maternal and child undernutrition demonstrating intergenerational linkage between the two. The national programme needs to focus on holistic and comprehensive nutrition strategy with targeted interventions to improve both maternal and child health.

Maternal Dietary Diversity During Lactation and Associated Factors in Palghar District, Maharashtra, India

Rajpal, S., Kumar, A., Alambusha, R., Sharma, S., and W. Joe. 2021. "Maternal Dietary Diversity During Lactation and Associated Factors in Palghar District, Maharashtra, India." *PLoS ONE* 16(12): e0261700. doi: <https://doi.org/10.1371/journal.pone.0261700>

Dietary adequacy and diversity during the lactation period are necessary to ensure good health and nutrition among women and children. Behavioral interventions pertaining to health and nutrition counselling during pregnancy and lactation are critical for awareness about dietary diversity. The issue assumes salience for marginalized communities because of the Covid-19 pandemic and associated economic and societal disruptions. This paper assesses the dietary patterns among 400 lactating mothers in the tribal-dominated district of Palghar in Maharashtra, India in 2020. The study is based on primary data regarding consumption of 10 food groups among women across 10 food groups based on 24-hour recall period. The primary outcome variable was binary information regarding Minimum Dietary Diversity defined as consumption from at least 5 food groups. Econometric analysis based on multilevel models and item-response theory is applied to identify food groups that were most difficult to be received by mothers during the early and late lactation period. We find that the daily diet of lactating mothers in Palghar primarily consists of grains, white roots, tubers, and pulses. In contrast, the intake of dairy, eggs, and non-vegetarian food items is much lower. Only Half of the lactating women (56.5 percent; 95% CI: 37.4; 73.8) have a minimum diversified diet (MDD). The prevalence of lactating women with MDD was higher among households with higher income (73.1 percent; 95% CI: 45.2; 89.9) than those in lower income group (50.7 percent; 95% CI: 42.3; 58.9). Lactating Women (in early phase) who received health and nutrition counseling services are more likely (OR: 2.37; 95% CI: 0.90; 6.26) to consume a diversified diet. Food groups such as fruits, meat, poultry, fish, nuts, and seeds were among the rare food items in daily diet. The dietary pattern lacking in fruits, nuts, and heme (iron) sources indicates more significant risks of micronutrient deficiencies. The findings call for improving dietary diversity among lactating mothers, particularly from the marginalized communities, and are driven by low consumption of dairy products or various fruits and vegetables. Among the different food items, the consumption of micronutrient-rich seeds and nuts is most difficult to be accessed by lactating mothers. Also, diet-centric counseling and informing lactating mothers of its benefits are necessary to increase dietary diversity for improving maternal and child nutrition.

Is Mother's Financial Autonomy Associated With Stunting Among Children Aged 7–35 Months: An Empirical Study From India

Shirisha, P., and A. Bansal. 2022. "Is Mother's Financial Autonomy Associated With Stunting Among Children Aged 7–35 Months: An Empirical Study From India." *PLoS Global Public Health* 2(1): e0000134. doi: <https://doi.org/10.1371/journal.pgph.0000134>

Stunting depicts chronic deprivation and is a huge public health problem in several developing countries. Considering the sociocultural and sociodemographic factors of India, we aimed to examine the relationship between maternal autonomy and stunting among children <35 months. We have used the data from the latest round of National Family health survey conducted in 2015–16. The main exposure variable was women's autonomy which are represented in our study by the four dimensions- decision-making, physical mobility, financial autonomy, attitudes towards domestic violence, the main predictor variable was stunting among children. Chi-square analysis, univariate and multivariable binary logistic regression analysis were performed to find the association of childhood stunting and women's autonomy. The results were reported at 5% level of significance. All the autonomy variables have shown a significant association with child stunting at 5% level of significance. The unadjusted odds of stunting were found to be significant with respect to all the four

dimensions of autonomy variables except physical autonomy. However, after adjusting for other explanatory factors attenuated these relationships and made them statistically insignificant except for women's economic autonomy (AOR = 0.91; 95% C.I.-(0.85, 0.98)) which was found to be significantly affecting the child's status of stunting. Our study reinforces that maternal autonomy is a significant predictor of childhood stunting. Hence, we recommend that policy makers, while designing interventions and policies, must address the socioeconomic inequalities at the community level while devising ways to improve women's empowerment. As it has far-reaching consequences on the nutrition status of the upcoming generations.

Association of Parental Characteristics With Offspring Anthropometric Failure, Anaemia and Mortality in India

Rai, R.K., Subramanian, S.V., and S. Vollmer. 2022. "Association of Parental Characteristics With Offspring Anthropometric Failure, Anaemia and Mortality in India." *Humanities and Social Science Communications* 9(37). doi: <https://doi.org/10.1057/s41599-022-01054-2>

This study used a wide range of information on parental sociodemographic, physical and behavioural characteristics as well as on the presence of non-communicable diseases among parents and examined the association of these attributes with anthropometric failure, anaemia and mortality of their children aged 0–59 months. Findings revealed that children of fathers aged 30–39 years were less likely to experience anthropometric failure and anaemia; however, survival of children of fathers below 18 years at marriage could be threatened. Parental education had protective association with children's anthropometric failure, anaemia and under-five mortality. With increasing maternal height, children had lower odds of anthropometric failure and under-five mortality. Tobacco use by mothers was associated with increase in under-five mortality, and children with diabetic fathers had higher odds of under-five mortality.

Early Life Migration and Undernutrition Among Circular Migrant Children: An Observational Study in the Brick Kilns of Bihar, India

Roshania, R. P., Giri, R., Cunningham, S. A., Young, M. F., Webb-Girard, A., Das, A., Mala, G. S., Srikantiah, S., Mahapatra, T., and U. Ramakrishnan. 2022. "Early Life Migration and Undernutrition Among Circular Migrant Children: An Observational Study in the Brick Kilns of Bihar, India." *Journal of Global Health* 12: 04008. doi: <https://doi.org/10.7189/jogh.12.04008>

Background: India holds the world's largest burden of chronic and acute child undernutrition. Poverty and systemic inequities are basic causes of undernutrition that also drive households to engage in circular migration for livelihood. Short-term, temporary movement of the whole family, including young children, is common; yet, the nutritional implications of recurrent movements beginning in early life has not been studied. We sought to estimate the association of repeat and early life migration with stunting and wasting outcomes among circular migrant children under three. **Methods:** Using a stratified cluster design, we conducted two waves of primary data collection among 2564 randomly selected circular migrant children under three years of age temporarily residing across 1156 brick kilns in Bihar, India. We conducted multilevel modeling to estimate the association of the number of migration episodes and age at first migration with stunting (<-2 standard deviations (SD) height-for-age z scores (HAZ)) and wasting (<-2 SD weight-for-height z-scores (WHZ)) and examined the determinants of nutrition status among migrant children, including diet, illness, food security and the health environment. **Results:** The overall prevalence of stunting was 51.6%. Among children who were either born during migration or first migrated before six months of age, those who experienced multiple episodes of migration were more likely to be stunted compared to those who migrated once (adjusted odds ratio (aOR) = 2.10; 95% confidence

interval (CI) = 1.30-3.41). Children were over three times as likely to be wasted in the summer compared to the winter (aOR = 3.28; 95% CI = 2.68-4.01); in the summer, the overall prevalence of wasting was 38.8%. Public health access indicators such as interaction with frontline health workers at the destination was low (5.3%), whereas feeding indicators such as exclusive breastfeeding among 0-5 months was high (81.1%). **Conclusions:** Policy efforts should ensure continuity of social protection and welfare entitlements between home and destinations for circular migrant families, with an explicit focus on rural-to-rural movement.

Consumption of Vitamin-A-Rich Foods and Vitamin A Supplementation for Children under Two Years Old in 51 Low- and Middle-Income Countries

Karlsson, O., Kim, R., Hasman, A., and S.V. Subramanian. 2022. "Consumption of Vitamin-A-Rich Foods and Vitamin A Supplementation for Children under Two Years Old in 51 Low- and Middle-Income Countries." *Nutrients* 14(1): 188. doi: <https://doi.org/10.3390/nu14010188>

Vitamin A supplementation for children 6–59 months old is an important intervention that boosts immune function, especially where children do not consume enough vitamin-A-rich foods. However, the low coverage of vitamin A supplementation is a persistent problem in low- and middle-income countries. We first estimated the percentage of children 6–23 months old receiving the minimum dietary diversity, vitamin-A-rich foods, and vitamin A supplementation, and second, the difference in the percentage receiving vitamin A supplementation between children 6–23 months old and children 24–59 months old using nationally representative cross-sectional household surveys, namely, the Demographic and Health Surveys, conducted from 2010 to 2019 in 51 low- and middle-income countries. Overall, 22% (95% CI: 22, 23) of children received the minimum dietary diversity, 55% (95% CI: 54, 55) received vitamin-A-rich foods, 59% (95% CI: 58, 59) received vitamin A supplementation, and 78% (95% CI: 78, 79) received either vitamin-A-rich foods or supplementation. A wide variation across countries was observed; for example, the percentage of children that received either vitamin-A-rich foods or supplementation ranged from 53% (95% CI: 49, 57) in Guinea to 96% (95% CI: 95, 97) in Burundi. The coverage of vitamin A supplementation should be improved, especially for children 6–23 months old, in most countries, particularly where the consumption of vitamin-A-rich foods is inadequate.

Unequal Coverage of Nutrition and Health Interventions for Women and Children in Seven Countries

Nguyen, P. H., Singh, N., Scott, S., Neupane, S., Jangid, M., Walia, M., Murira, Z., Bhutta, Z. A., Torlesse, H., Piwoz, E., Heidkamp, R., and P. Menon. 2022. "Unequal Coverage of Nutrition and Health Interventions for Women and Children in Seven Countries." *Bulletin of the World Health Organization* 100(1): 20–29. doi: <https://doi.org/10.2471/BLT.21.286650>

Objective: To examine inequalities and opportunity gaps in co-coverage of health and nutrition interventions in seven countries. **Methods:** We used data from the most recent (2015–2018) demographic and health surveys of mothers with children younger than 5 years in Afghanistan (n = 19 632), Bangladesh (n = 5051), India (n = 184 641), Maldives (n = 2368), Nepal (n = 3998), Pakistan (n = 8285) and Sri Lanka (n = 7138). We estimated co-coverage for a set of eight health and eight nutrition interventions and assessed within-country inequalities in co-coverage by wealth and geography. We examined opportunity gaps by comparing coverage of nutrition interventions with coverage of their corresponding health delivery platforms. **Findings:** Only 15% of 231 113 mother–child pairs received all eight health interventions (weighted percentage). The percentage of mother–child pairs who received no nutrition interventions was highest in Pakistan (25%). Wealth gaps (richest versus poorest) for co-coverage of health interventions were largest for Pakistan (slope

index of inequality: 62 percentage points) and Afghanistan (38 percentage points). Wealth gaps for co-coverage of nutrition interventions were highest in India (32 percentage points) and Bangladesh (20 percentage points). Coverage of nutrition interventions was lower than for associated health interventions, with opportunity gaps ranging from 4 to 54 percentage points. **Conclusion:** Co-coverage of health and nutrition interventions is far from optimal and disproportionately affects poor households in south Asia. Policy and programming efforts should pay attention to closing coverage, equity and opportunity gaps, and improving nutrition delivery through health-care and other delivery platforms.

Coverage of Iron and Folic Acid Supplementation in India: Progress Under the Anemia Mukht Bharat Strategy 2017–20

Joe, W., Rinju, Patel, N., Alambusha, R., Kulkarni, B., Yadav, K., and V. Sethi. 2022. "Coverage of Iron and Folic Acid Supplementation in India: Progress Under the Anemia Mukht Bharat Strategy 2017–20." *Health Policy and Planning*: 1–10. doi: <https://doi.org/10.1093/heapol/czac015>

High prevalence of anaemia is a severe public health problem in India. In 2018, India launched the Anemia Mukht Bharat (AMB) strategy that focuses on six beneficiary groups for coverage, six institutional mechanisms for health system strengthening and six programmatic interventions to accelerate reductions in anaemia prevalence. This paper uses the Health Management Information System data (2017–18 to 2019–20) to examine gains in IFA coverage across Indian states. A coverage-based AMB index is computed to review performance across states. After the launch of AMB strategy, the Iron and Folic Acid (IFA) supplementation coverage between 2017–18 and 2019–20 has increased for all beneficiary groups [pregnant women from 78% to 90%; lactating mothers from 34% to 49%; school going adolescent girls (boys) from 23% to 40% (21% to 42%); out-of-school adolescent girls from 6% to 23%; children 5–9 years from 8% to 3% and children 6–59 months from 7% to 15%]. Coverage was relatively low for target groups being served through a multi departmental convergence mechanism (health and other departments such as education department for schools or women and child development department for Anganwadi centres) than compared to those served by health department alone. However, no major gender disparities are noted in the coverage of IFA supplementation among school-going girls and boys. Bulk of the variations in coverage is attributable to state-specific differences. Training and sensitization workshops for state and district officials are found to be associated with increased coverage across beneficiary groups. The paper argues that despite following international best practices in the field, it is important to harness synergy in programme implementation across line departments to eliminate coverage inefficiencies.

Improving Nutrition Budgeting in Health Sector Plans: Evidence From India's Anaemia Control Strategy

Saini, A., Shukla, R., Joe, W., and A. Kapur. 2022. "Improving Nutrition Budgeting in Health Sector Plans: Evidence From India's Anaemia Control Strategy." *Maternal and Child Nutrition* 18: e13253. doi: <https://doi.org/10.1111/mcn.13253>

In India, 15 nutrition interventions are delivered and financed through the National Health Mission (NHM). Programmatic know-how, however, on tracking nutrition budgets in health sector plans is limited. Following the four phases of the budget cycle—planning, allocations, disbursements and expenditure, this paper presents a new method developed by the authors to track nutrition budgets within health sector plans. Using the example of the Anemia Mukht Bharat (AMB) or Anemia Free India strategy, it reports preliminary findings on the application of the first two phases of the method, that is, to track and act for improved planning and allocations, covering 12 states. The

paper lists out the budget heads, cost norms and developed tools to plan adequately. Supportive action was undertaken through sharing trends and trainings for AMB's budgeting to create opportunities for improvements. It was observed that the AMB budget increased over 3 years despite the COVID situation. It increased from INR 6184 million in FY 2019–2020 to INR 6293 million, a 2% increase in FY 2020–2021, and to INR 7433 million, an 18% increase in FY 2021–2022. The difference in allocations and planned budgets were low (16%, 4% and 11%, respectively) while the difference in required budgets and planned budgets were significant but reduced consistently (41%, 31% and 22%, respectively). The paper concludes that the methods adopted for tracking and acting for improved nutrition budgets helped in informing national and state governments regarding yearly trends. Such methods can be effective and be developed for other nutrition interventions.

Hunger and Health: Reexamining the Impact of Household Food Insecurity on Child Malnutrition in India

Dhamija, G., Ojha, M, and P. Roychowdhury. 2022. "Hunger and Health: Reexamining the Impact of Household Food Insecurity on Child Malnutrition in India." *The Journal of Development Studies*. doi: <https://doi.org/10.1080/00220388.2022.2029419>

Child malnutrition is remarkably high in India. The problem of food insecurity is also extremely alarming in the country. From a policy perspective, a question of paramount importance in this context is: are these two problems inter-related? Answering this question based on existing literature is difficult. This is because literature examining specifically the effect of food insecurity on child/adolescent malnutrition in India is scarce. Besides, the small number of studies that do examine this question empirically find mixed evidence. In light of this, here we reexamine the effect of food insecurity on child malnutrition using data from the Young Lives survey. Employing several contemporary econometric approaches, we not only estimate the mean effect but also the distributional effects of food insecurity on child malnutrition. We find evidence of sizeable negative average effects of food insecurity on children's anthropometric indices for nutrition surveillance including weight-for-age z score (WAZ) and height-for-age z-score (HAZ). Further, we document important heterogeneity in the effect of food insecurity on children's WAZ and HAZ across the outcome-distributions. Our results suggest that expansion of policies that could effectively reduce household food insecurity is vital to address the problem of malnutrition among Indian children.

Comparison of Child Undernutrition Anthropometric Indicators Across 56 Low- and Middle-Income Countries

Gausman J., Kim R., Li Z., Tu, L., Rajpal, S., Joe, W., and S.V. Subramanian. 2022. "Comparison of Child Undernutrition Anthropometric Indicators Across 56 Low- and Middle-Income Countries." *JAMA Network Open* 5(3): e221223. doi: <https://doi.org/10.1001/jamanetworkopen.2022.1223>

Importance: The United Nations' Sustainable Development Goal Target 2.2 seeks to end all forms of malnutrition by 2030 by meeting targets, including the elimination of stunting and wasting in all children younger than 5 years. Such indicators are used to monitor childhood undernutrition but may not provide a complete picture at a population level. **Objective:** To compare global estimates of the prevalence of undernutrition using conventional indicators of anthropometric failure (AF; stunting, underweight, and wasting); the Composite Index of Anthropometric Failure (CIAF); and a proposed classification system called Categories of Anthropometric Failure (CAF) as well as to investigate the association of the conventional indicators, CIAF, and CAF with diarrheal disease as an assessment of the validity of each measure. **Design, Setting, and Participants:** Cross-sectional study of the prevalence of undernutrition among children in 56 low- and middle-income countries using data from the nationally representative Demographic and Health Surveys. The study included 530 906

children younger than 5 years. Data were collected from June 2005 to December 2018 and analyzed from September 27, 2020, to February 4, 2021. **Main Outcomes and Measures:** Undernutrition identified according to conventional indicators (stunting, underweight, and wasting), the CIAF, and the proposed CAF classification system was estimated and compared. Six logistic regression models were used to examine the association between different classifications of anthropometric failure (AF) and morbidity. **Results:** A total of 530 906 children (mean [SD] age, 29.0 [17.2] months; 272 355 [51.3%] boys and 258 551 [48.7%] girls) from 56 low- and middle-income countries were included in the analysis. Estimates of undernutrition generated using the conventional indicators of stunting, underweight, and wasting were lower than estimates generated using the CIAF in all countries. The CAF classification system pointed to considerable variation across countries in children with multiple AFs, which does not correspond to the overall prevalence of undernutrition. For example, 7.5% of children in Niger and 7.1% of children in Timor-Leste were stunted, underweight, and wasted, while 56.0% of children in Niger and 71.1% of children in Timor-Leste were undernourished according to the CIAF. In addition, children who had stunting, underweight, and wasting had 1.52 (95% CI, 1.45-1.61) times the odds of diarrhea compared with children who exhibited no AFs. **Conclusions and Relevance:** The results of this study highlight the importance of using different approaches to aid understanding of the entire spectrum of AF with regard to research and development of policies and programs to address AF. The use of the CIAF and the CAF classification system may be useful for treatment to prevent AFs and could accelerate progress in meeting targets for the Sustainable Development Goal.

Association of Trends in Child Undernutrition and Implementation of the National Rural Health Mission in India: A Nationally Representative Serial Cross-Sectional Study on Data From 1992 to 2015

Soni, A., Fahey, N., Bhutta, Z., Li, W., Simas, T.M., Nimbalkar, S., and J. Allison. 2022. "Association of Trends in Child Undernutrition and Implementation of the National Rural Health Mission in India: A Nationally Representative Serial Cross-Sectional Study on Data From 1992 to 2015." *PLoS Med* 19(4): e1003957. doi: <https://doi.org/10.1371/journal.pmed.1003957>

Background: India launched the National Rural Health Mission (NRHM) in 2005 to strengthen its primary healthcare system in high-focus and northeast-focus states. One of the NRHM objectives was to reduce child undernutrition in India. **Methods and findings:** We used data from 1992, 1998, 2005, and 2015 National Family Health Survey (NFHS) of India to evaluate trends in child undernutrition prevalence before and after NRHM and across different categories of focus states. Stunting, Wasting, and Composite Index of Anthropometric Failure (CIAF) were assessed using the World Health Organization (WHO) growth curves to assess chronic, acute, and overall undernutrition. The study included 187,452 children aged 3 years or under. Survey-weighted and confounder-adjusted average annualized reduction rates (AARRs) and predicted probability ratios were used to assess trends and socioeconomic disparities for child undernutrition, respectively. Nationwide, the prevalence of all types of undernutrition decreased from 1992 to 2015. However, the trends varied before and after NRHM implementation and differentially by focus states. After NRHM, acute undernutrition declined more rapidly among high-focus states (AARR 1.0%) but increased in normal-focus states (AARR -1.9% per year; p -value for the difference <0.001). In contrast, the prevalence of chronic undernutrition declined more rapidly (AARR 1.6%) in the normal-focus states in comparison to high-focus states (0.3%; p -value for the difference = 0.01). Income and caste-based disparities in acute undernutrition decreased but did not disappear after the implementation of the NRHM. However, similar disparities in prevalence of chronic undernutrition appear to be exacerbated after the implementation of the NRHM. Major limitations of this study include the observational and cross-sectional design, which preclude our ability to draw causal inferences. **Conclusions:** Our results suggests that NRHM implementation might be associated with improvement in wasting (acute) rather than stunting

(chronic) forms of undernutrition. Strategies to combat undernutrition equitably, especially in high-focus states, are needed.

Iron Fortification through Universal Distribution of Double-Fortified Salt Can Increase Wages and Be Cost-Effective: An Ex-Ante Modeling Study in India

Makkar, S., Minocha, S., Bhat, K. G., John, A. T., Swaminathan, S., Thomas, T., Mannar, M., and A.V. Kurpad. 2022. "Iron Fortification through Universal Distribution of Double-Fortified Salt Can Increase Wages and Be Cost-Effective: An Ex-Ante Modeling Study in India." *The Journal of Nutrition* 152(2): 597–611. doi: <https://doi.org/10.1093/jn/nxab378>

Background: The alleviation of iron deficiency through iron supplementation has not effectively reduced anemia in India, mainly due to low compliance. Food fortification with iron is considered a viable alternative, and the provision of double-fortified salt (DFS; with iron and iodine) has been mandated in public health programs. Limited evidence exists on its benefit-cost ratio. **Objective:** In this study we sought to estimate the economic benefit in terms of increased wages in relation to introduction of DFS in reduction of anemia and the cost of doing so. **Methods:** The economic benefit of introducing DFS in India was derived using a series of mathematical, statistical, and econometric models using data from national surveys capturing earnings and dietary iron intake of the population. Anemia status was predicted from data on dietary intake, sanitation, and for women, menstrual losses. The impact of iron deficiency anemia (IDA) on wages was estimated using a Heckman Selection model and 2-stage least squares procedure. Benefit of DFS was estimated through increased wages attributed to anemia reduction compared with its cost. **Results:** Men and women with IDA had lower wages (by 25.9%, 95% CI: 11.3, 38.1; and by 3.9%, 95% CI: 0.0, 7.7, respectively) than those without IDA. Additional iron intake through DFS was predicted to reduce prevalence of IDA (from 10.6% to 0.7% in men and 23.8% to 20.9% in women). The economic benefit-cost ratio of introducing DFS at a national level was estimated to be 4.2:1. **Conclusions:** Iron fortification delivered through DFS under a universal program can improve wages and be sufficiently cost-effective for its implementation at scale in India.

NON-PEER REVIEWED

Underweight Among the Children Under Five Years Age in Northeastern States, India

Chauhan, K., Chiero, V., Mandal, D., and K.J. Singh. "Underweight Among the Children Under Five Years Age in Northeastern States, India" doi: <https://doi.org/10.21203/rs.3.rs-1310990/v1>

Background: Age-appropriate weight or underweight is one of the normative indexes of physical development that describe the nutritional state of children. Northeast India has a wide range of sociocultural child-rearing activities due to the region's varied tribal and ethnic populations which in some or the other way affect the nutritional status among children in early ages. An attempt has been made to assess the prevalence and determine the risk of underweight among children in northeast region in India. **Methods:** The present study is based on a publicly available National Family Health Survey (NFHS-4), 2015-16 data. Multilevel random intercept model approach has been used to investigate the impact of independent variables at different social hierarchical levels on the underweight status in the study population. **Results:** Children whose mother's level of education was no education or primary were 1.13 and 1.34 times more likely to be underweight respectively than those with secondary or higher level of education. The risk of being underweight were 2.4 times higher among children of 4 years of age compared to those with age less than 1 year. Poorest wealth quintile had 2.45 times higher chance of being underweight. **Conclusion:** Study suggests that education of mother's education, child's sex, age, type of residence, social status, and household's

wealth index affect the underweight among children. Hence, to combat the situation in northeast states, policymakers must make policies with a strong reliance on communities with a higher prevalence and risk.

Addressing Nutrition Security in Urban India through Multisectoral Action

Gopalan, S.S, Bhatia, R., Khetrupal, S., and R. Sungsup. 2022. *Addressing Nutrition Security in Urban India through Multisectoral Action*. South Asia Working Paper Series No. 90. Manila: Asian Development Bank. <https://www.adb.org/publications/nutrition-security-urban-india>

Nutrition is essential for ensuring healthy communities. United Nations have sounded a call to eliminate hunger through the Sustainable Development Goals. The United Nations Decade of Action on Nutrition (2016–2025) advocates universality of food and nutrition security. Globally, birth weights are well below those required to achieve the UN 2025 target. The World Health Organization has set targets on various aspects of nutrition, most of which remain underachieved in developing countries. In India, every third child continues to be undernourished. Globally, birth weights are well below those required to achieve the 2025 target. In India, every third child continues to be undernourished. A correlation exists between undernutrition rates with lower education rates and poverty. The urban poor, in particular, remain highly vulnerable. No country is on track to achieve the adult obesity and anemia target in the Sustainable Development Goals, thus predisposing populations to hypertension, obesity, and diabetes; and adding to the growing number of people with these noncommunicable diseases. India's National Nutrition Strategy and National Mission on Nutrition (POSHAN Abhiyan) are recent initiatives of the government that complement several existing schemes. To address this daunting task, several recommendations are proposed in this paper to institute required interventions.

Effects of a Large-Scale Participatory Learning and Action Programme in Women's Groups on Health, Nutrition, Water, Sanitation, and Hygiene: A Cluster-Randomized Controlled Trial in Bihar, India

Bogler, L., Bommer, C., Ebert, C., Kumar, A., Subramanian, S.V., Subramanyam, M.A., and S. Vollmer. 2021. *Effects of a Large-Scale Participatory Learning and Action Programme in Women's Groups on Health, Nutrition, Water, Sanitation, and Hygiene: A Cluster-Randomized Controlled Trial in Bihar, India*. Discussion Papers, No. 287. Gottingen: Georg-August-Universität Göttingen, Courant Research Centre - Poverty, Equity and Growth (CRC-PEG). <https://www.econstor.eu/handle/10419/248421>

Evidence from randomized controlled trials suggests that interventions relying on community involvement through a participatory learning and action (PLA) approach can improve health outcomes in resource-poor settings. However, whether PLA-based interventions remain effective after scale-up is only poorly understood. In a cluster-randomized controlled trial in Bihar, India, we assessed whether the PLA approach improved health, nutrition, water, sanitation, and hygiene (HNWASH) outcomes in adults and children when implemented at large scale by a government-supported agency. The intervention consisted of trained female facilitators conducting a series of 20 structured participatory meetings about key HNWASH topics in state-supported women's groups. In contrast to the strong results of small-scale trials, we do not observe systematic improvements in HNWASH knowledge, attitudes, behaviour or health outcomes but document irregularities in the implementation of the intervention. These findings call for caution when promising public health interventions are transformed into large policy programmes.

Global Report on the State of Dietary Data

FAO and Intake. 2022. Global Report on the State of Dietary Data. Rome: Food and Agriculture Organization of the United Nations. doi: <https://doi.org/10.4060/cb8679en>

This joint FAO and Intake publication is the first ever Global report on the state of dietary data. The purpose of the report is to take stock and celebrate the collection and use of dietary data in LMICs, while generating further momentum for investment in dietary surveys. The report is divided into three Sections. Section 1 of the report provides a global overview of dietary surveys carried out in LMICs from 1980 through 2019, analysing key characteristics and trends over time. Section 2 of the report celebrates the increased investment in dietary surveys in LMICs by highlighting country stories related to dietary survey initiation, implementation and data use. Section 3 of the report is aimed at generating further momentum for investment in government-led dietary surveys in LMICs by illustrating, through data visualizations, the type of information dietary data can provide for policy makers.

UPCOMING EVENTS & DEADLINES

Nutrition 2022 Live Online

Nutrition 2022 Live Online, the American Society for Nutrition's flagship annual meeting, will be held virtually June 14-16, offering new, original science presentations, featured sessions, award lectures and recognition, professional development, and networking/Groups Engaging Members (GEM) functions.

When: June 14-16, 2022

Where: Online

For more information: <https://nutrition.org/nutrition-2022/>

22nd International Congress of Nutrition (ICN)

The 22nd International Congress of Nutrition (ICN) will be held in Tokyo, Japan, in December of 2022. ICN is a meeting of the International Union of Nutritional Sciences (IUNS) that takes place every four years, the tenth of which was successfully held in Kyoto in 1975.

When: December 6-11, 2022

Where: Tokyo, Japan

Call for abstracts: November 12, 2021 - March 18, 2022

For more information: <https://icn22.org/>

ABOUT POSHAN

Partnerships and Opportunities to Strengthen and Harmonize Actions for Nutrition in India (POSHAN) is a multi-year initiative that aims to build evidence on effective actions for nutrition and support the use of evidence in decision-making. It is supported by the Bill & Melinda Gates Foundation and led by IFPRI in India.

ABOUT ABSTRACT DIGEST

In each issue, the POSHAN Abstract Digest brings you some of the new and noteworthy studies on maternal and child nutrition. It focuses on India-specific studies and also brings to you other relevant global or regional literature with broader implications for maternal and child nutrition. The Abstract Digest is based on literature searches to identify selected studies that we think are most relevant to nutrition issues in India and to Indian programs and policies. We share with you a collection of abstracts from articles published in peer-reviewed journals, as well as selected non-peer-reviewed articles by researchers in reputed academic and/or research institutions and which demonstrated rigor in their research objectives, methodology, and analysis. The abstracts in this document are reproduced in their original form from their source, and without editorial commentary about specific articles.

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