

EDITOR'S NOTE

In this issue of Abstract Digest, we have brought together a collection of articles and systematic reviews on multiple aspects of nutrition including stunting, micronutrient supplementation, adolescent nutrition, and policy analysis. Here are some of the highlights:

- [Bhatia and colleagues](#) (2018) examined the trend in inequalities in infant mortality rate (IMR) in Indian states over 1992-2016 timeframe using four rounds of the National Family Health Survey data and found a huge variability in IMR and in relative inequalities among states and how the variability changed over time.
- Three studies highlighted the significance of gender, education and poverty in children's well-being:
 - [Menon and colleagues](#) (2018) emphasized that variability in stunting across India reinforces the multifactorial determinants of stunting and addressing women's well-being and education are critical to any strategy focused on reducing child stunting in India, as nearly three-fourth of the differences in childhood stunting between low and high burden Indian districts can be explained by differences in women's low body mass index and education.
 - Using Demographic and Health Survey (DHS) and Multiple Indicator Cluster Survey (MICS) data from 49 low-and-middle-income countries (LMICs), [Ekbrand and Halleröd](#) (2018) confirmed that gender equity is an important determinant of child deprivation and therefore strengthening of women's position is critical to children's welfare.
 - [Harding and colleagues](#) (2018) found that adult women's education is associated with lower anemia and vitamin A deficiency among children, lower anemia among non-pregnant women, and lower zinc deficiency in the general population.
- Two studies highlighted the importance of the role of micronutrients:
 - [Ramírez-Luzuriaga and colleagues](#) (2018) conducted a systematic review and meta-analysis from randomized and quasi-randomized controlled trials to assess the impact of double-fortified salt (DFS) on biomarkers of iron status, and the risk of anemia and iron-deficiency anemia and found that DFS is efficacious in increasing hemoglobin concentrations and reducing the risk of anemia and iron deficiency anemia in populations of LMICs.
 - [Garrett and Bailey](#) (2018) reviewed the evidence basis for prevention of folic acid-sensitive neural tube defects (NTDs) and concluded that folic acid fortification is an evidence-based intervention that reduces the prevalence of NTDs, and that large-scale food fortification with folic acid is underutilized.
- [van der Haar and colleagues](#) (2018) presented a new statistical approach of apportioning the population urinary iodine concentration (UIC) from spot urine collections, which may be useful for future monitoring of change in iodine nutrition from reduced salt use in processed foods and in households.
- [Chakrabarti and colleagues](#) (2018) examined factors associated with anemia reduction using a synthetic panel data set created from two rounds of the District Level Household and Facility Survey (2002–04 and 2012–13) and Household Consumer Expenditures Survey (2004–05 and 2011–12) and found that non-dietary factors such as age at pregnancy, village-

level open defecation, and urbanization were important for anemia reduction as were the dietary factors including consumption of IFA, highlighting the need for a holistic approach to address anemia.

- [Wendt and colleagues](#) (2018) showed that multiple factors are contributing to insufficient or inconsistent supply of iron and folic acid (IFA) supplements in Bihar, India, including issues with forecasting, inadequate inventory documentation, later supply deliveries, and lack of proper storage facilities.
- [Chaturvedi and colleagues](#) (2018) found that child feeding practices, participation in ICDS activities, and adequate supply were associated with the consumption of micronutrient fortified blended food among 6–35 months old children, which is provided through the Integrated Child Development Services program in Gujarat, India.
- [Graziose and colleagues](#) (2018) conducted a systematic review of the design, implementation and effectiveness of mass media and nutrition education interventions for infant and young child feeding in low- and middle-income countries and found that there are few common elements in the design of interventions and highlighted the need for consistent reporting of details of intervention to ensure replicability.
- Examining the association between growth outcomes and modified versions of WHO's core indicators for infant and young child feeding including minimum dietary diversity and minimum acceptable diet (MAD), [Do and colleagues](#) (2018) found that children of 36 months age who met the modified MAD had better weight-for-height compared to those who did not.
- [Taneja and colleagues](#) (2018) demonstrated that in low-resource settings where height measurement is not feasible, mid-upper arm circumference can be a valid screening tool for identifying severely malnourished children.
- Focusing specifically on adolescent undernutrition:
 - [Christian and Smith](#) (2018) analyzed the global burden of adolescent nutrition, and highlighted the need for research to fill the huge data gaps related to nutrition and growth during adolescence and for testing interventions to enhance growth and development.
 - [Madjdian and colleagues](#) (2018) conducted a systematic narrative review of socio-cultural and economic determinants and consequences associated with adolescent undernutrition in LMICs, which highlighted the importance of the broad range of context-specific factors at several levels that influence adolescent nutritional status.
 - [Radhika and colleagues](#) (2018) examined the dietary and nondietary determinants of nutritional status among adolescent girls and adult women in India and emphasized the need for multipronged strategies along with dietary interventions.
- Examining the agriculture and nutrition linkages:
 - [Thow and colleagues](#) (2018) conducted a qualitative analysis of the policies in India and identified development of Public-Private Partnerships, linking of health and economic/agricultural policy agendas and strengthening surveillance of policy impacts on consumer access to fruit and vegetables, as the key strategies for improving food environment for fruit and vegetables in India.
 - In their systematic review [Sibhatu and Qaim](#) (2018) found little evidence to support the assumption that increasing farm production diversity is effective in improving smallholder farmer household diets.
 - International Food Policy Research Institute's [2018 Global food policy report](#) highlighted the role of global food systems and trade in improving food security, nutrition, and sustainability in developing countries.

Enjoy reading!

PEER-REVIEWED

Mind the Gap: Temporal trends in Inequalities in infant and child mortality in India (1992–2016)

Bhatia, M., M. Ranjan, P. Dixit, and L.K. Dwivedi. 2018. *SSM - Population Health*. doi: <https://doi.org/10.1016/j.ssmph.2018.05.001>.

- Temporal trends in inequalities in infant and child mortality over two and half decades in India.
 - Relative change in inequalities in child mortality over survey periods.
 - Scatter plots to identify states with largest inequalities among wealth index groups.
 - Concentration Index by various background characteristics.
 - Decomposition analysis identifying the factors contributing in inequality in infant mortality between richest and poorest groups.
 - Gap between the poorest and richest groups has narrowed in most states in India in recent years.
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Understanding the geographical burden of stunting in India: A regression-decomposition analysis of district-level data from 2015–16

Menon, P., D. Headey, R. Avula, and P.H. Nguyen. 2018. *Maternal & Child Nutrition*. doi: <https://doi.org/10.1111/mcn.12620>.

India accounts for approximately one third of the world's total population of stunted preschoolers. Addressing global undernutrition, therefore, requires an understanding of the determinants of stunting across India's diverse states and districts. We created a district-level aggregate data set from the recently released 2015–2016 National and Family Health Survey, which covered 601,509 households in 640 districts. We used mapping and descriptive analyses to understand spatial differences in distribution of stunting. We then used population-weighted regressions to identify stunting determinants and regression-based decompositions to explain differences between high- and low-stunting districts across India. Stunting prevalence is high (38.4%) and varies considerably across districts (range: 12.4% to 65.1%), with 239 of the 640 districts have stunting levels above 40% and 202 have prevalence of 30–40%. High-stunting districts are heavily clustered in the north and centre of the country. Differences in stunting prevalence between low and high burden districts were explained by differences in women's low body mass index (19% of the difference), education (12%), children's adequate diet (9%), assets (7%), open defecation (7%), age at marriage (7%), antenatal care (6%), and household size (5%). The decomposition models explained 71% of the observed difference in stunting prevalence. Our findings emphasize the variability in stunting across India, reinforce the multifactorial determinants of stunting, and highlight that interdistrict differences in stunting are strongly explained by a multitude of economic, health, hygiene, and demographic factors. A nationwide focus for stunting prevention is required, while addressing critical determinants district-by-district to reduce inequalities and prevalence of childhood stunting.

The more gender equity, the less child poverty? A multilevel analysis of malnutrition and health deprivation in 49 low- and middle-income countries

Ekbrand, H., and B. Halleröd. 2018. *World Development* 108: 221–230. <https://www.sciencedirect.com/science/article/pii/S0305750X1830038X>

Mothers are often perceived as key agents in safeguarding the interests of children. If the assumption that women, given the opportunity, are more likely than men to see to the interests of children is true, children can be expected to be less exposed to severe forms of deprivation in countries where women have a relatively strong position in society. The hypotheses that fewer children are exposed to health deprivation and to severe forms of food deprivation in countries where there is a high degree of gender equity are tested. A combination of country-level data and micro-level survey data, makes it possible to analyze whether and to what degree gender equity in a country only benefits children of mothers who have been able to take advantage of a high degree of gender equity or if it also benefits children of less resourceful mothers. The analysis is based on a combination of macro- and micro-data (N = 391,817) from 49 low- and middle-income countries to analyze the relationship between gender equity and malnutrition, and gender equity and health deprivation among children. The results indicate that gender equity in education and employment decreases child malnutrition, and that women's empowerment decreases health deprivation for children with unschooled mothers. The results support the notion that women are instrumental in children's welfare. Even when we control for a whole range of both country-level and individual-level factors, gender equity at the country-level still comes out as an important determinant of children's nutrition and access to health care. Thus, strengthening women's position is important if we wish to improve children's living conditions.

Education and micronutrient deficiencies: an ecological study exploring interactions between women's schooling and children's micronutrient status

Harding, K.L., V.M. Aguayo, W.A. Masters, and P. Webb. 2018. *BMC Public Health* 18:470.

<https://doi.org/10.1186/s12889-018-5312-1>

Background

Formal education can be a nutrition-sensitive intervention that supports the scale-up and impact of nutrition-specific actions. Maternal education has long been linked to child survival, growth, and development while adult earnings and nutrition are tied to years in school as a child. However, less is known about the relationship between maternal education and the micronutrient status of children, women and the general population.

Methods

Using country-level data and an ecological study design, we explored the global associations between women's educational attainment and: a) anemia and vitamin A deficiency (VAD) in children aged 6–59 months; b) anemia in non-pregnant women; and c) zinc deficiency, urinary iodine excretion (UIE), and the proportion of infants protected against iodine deficiency in the general population. Cross-sectional relationships (2005–2013) were assessed using linear regression models.

Results

Percentage of women without schooling was negatively associated with all outcomes. Number of years of schooling among women was positively associated with all outcomes except for UIE and the proportion of infants protected against iodine deficiency. Income level was a significant effect modifier of the effect of years of women's schooling on child anemia as well as of the proportion of women without formal education on zinc deficiency in the population. The relationship was strongest in low-income countries for child anemia, and was not significant in upper middle-income countries. For zinc deficiency, the relationship was not significant in low or lower middle-income countries, which may suggest that a minimum threshold of resources needs to be reached before education can influence zinc status.

Conclusions

While relationships between maternal schooling and micronutrient outcomes vary around the globe, more schooling is generally linked to lower rates of deficiency. These findings draw policy-relevant connections between formal education and anemia and micronutrient status globally. It is necessary to examine the mechanisms through which this relationship may be working at both household and country level.

Impact of Double-Fortified Salt with Iron and Iodine on Hemoglobin, Anemia, and Iron Deficiency Anemia: A Systematic Review and Meta-Analysis

Ramírez-Luzuriaga, M.J., L.M. Larson, V. Mannar, and R. Martorell. 2018. *Advances in Nutrition* 9(3): 207–218.

<https://doi.org/10.1093/advances/nmy008>

Double-fortified salt (DFS) containing iron and iodine has been proposed as a feasible and cost-effective alternative for iron fortification in low- and middle-income countries (LMICs). We conducted a systematic review and meta-analysis from randomized and quasi-randomized controlled trials to 1) assess the effect of DFS on biomarkers of iron status and the risk of anemia and iron deficiency anemia (IDA) and 2) evaluate differential effects of DFS by study type (efficacy or effectiveness), population subgroups, iron formulation (ferrous sulfate, ferrous fumarate, and ferric pyrophosphate), iron concentration, duration of intervention, and study quality. A systematic search with the use of MEDLINE, EMBASE, Cochrane, Web of Science, and other sources identified 221 articles. Twelve efficacy and 2 effectiveness studies met prespecified inclusion criteria. All studies were conducted in LMICs: 10 in India, 2 in Morocco, and 1 each in Côte d'Ivoire and Ghana. In efficacy studies, DFS increased hemoglobin concentrations [standardized mean difference (SMD): 0.28; 95% CI: 0.11, 0.44; $P < 0.001$] and reduced the risk of anemia (RR: 0.59; 95% CI: 0.46, 0.77; $P < 0.001$) and IDA (RR 0.37; 95% CI: 0.25, 0.54; $P < 0.001$). In effectiveness studies, the effect size for hemoglobin was smaller but significant (SMD: 0.03; 95% CI: 0.01, 0.05; $P < 0.01$). Stratified analyses of efficacy studies by population subgroups indicated positive effects of DFS among women and school-age children. For the latter, DFS increased hemoglobin concentrations (SMD: 0.32; 95% CI: 0.03, 0.60; $P < 0.05$) and reduced the risk of anemia (SMD: 0.48; 95% CI: 0.34, 0.67; $P < 0.001$) and IDA (SMD: 0.37; 95% CI: 0.25, 0.54; $P < 0.001$). Hemoglobin concentrations, anemia prevalence and deworming at baseline, sample size, and study duration were not associated with effect sizes. The results indicate that DFS is efficacious in increasing hemoglobin concentrations and reducing the risk of anemia and IDA in LMIC populations. More effectiveness studies are needed.

A public health approach for preventing neural tube defects: folic acid fortification and beyond

Garrett, G.S., and L.B. Bailey. 2018. *Annals of the New York Academy of Sciences* 1414: 47-58. doi: 10.1111/nyas.13579.

<http://onlinelibrary.wiley.com/doi/10.1111/nyas.13579/full>

In this paper we review the evidence basis for prevention of folic acid-sensitive neural tube defects (NTDs) through public health interventions in women of reproductive age (WRA), the proven vehicles for delivery of folic acid, and what is needed to effectively scale these, and provide a snapshot of potential innovations that require future research. Our primary focus is on the global situation affecting large-scale food fortification (LSFF) with folic acid, in particular the fortification of wheat flour and maize meal. Our overarching conclusion is that folic acid fortification is an evidence-

based intervention that reduces the prevalence of NTDs, and that LSFF with folic acid is underutilized. Thus, food fortification with folic acid should be a component of most national public health strategies, in particular where folate status is insufficient and a fortifiable food vehicle, processed by a centralized industry, is consumed regularly by WRA. The evidence shows that there is still much work needed (1) to build the enabling environment and expand programs where there is currently no legislation, (2) to improve the low quality of delivery of existing programs, and (3) to measure and sustain programs by generating new coverage data and demonstrating evidence of impact in low- and middle-income countries.

New Statistical Approach to Apportion Dietary Sources of Iodine Intake: Findings from Kenya, Senegal and India

van der Haar, F., J. Knowles, Z. Bukania, B. Camara, C.S. Pandav, J.M. Mwai, N.K. Toure, and K. Yadav. 2018. *Nutrients* 10(4): 430. doi:10.3390/nu10040430.
<http://www.mdpi.com/2072-6643/10/4/430/htm>

Progress of national Universal Salt Iodization (USI) strategies is typically assessed by household coverage of adequately iodized salt and median urinary iodine concentration (UIC) in spot urine collections. However, household coverage does not inform on the iodized salt used in preparation of processed foods outside homes, nor does the total UIC reflect the portion of population iodine intake attributable to the USI strategy. This study used data from three population-representative surveys of women of reproductive age (WRA) in Kenya, Senegal and India to develop and illustrate a new approach to apportion the population UIC levels by the principal dietary sources of iodine intake, namely native iodine, iodine in processed food salt and iodine in household salt. The technique requires measurement of urinary sodium concentrations (UNaC) in the same spot urine samples collected for iodine status assessment. Taking into account the different complex survey designs of each survey, generalized linear regression (GLR) analyses were performed in which the UIC data of WRA was set as the outcome variable that depends on their UNaC and household salt iodine (SI) data as explanatory variables. Estimates of the UIC portions that correspond to iodine intake sources were calculated with use of the intercept and regression coefficients for the UNaC and SI variables in each country's regression equation. GLR coefficients for UNaC and SI were significant in all country-specific models. Rural location did not show a significant association in any country when controlled for other explanatory variables. The estimated UIC portion from native dietary iodine intake in each country fell below the minimum threshold for iodine sufficiency. The UIC portion arising from processed food salt in Kenya was substantially higher than in Senegal and India, while the UIC portions from household salt use varied in accordance with the mean level of household SI content in the country surveys. The UIC portions and all-salt-derived iodine intakes found in this study were illustrative of existing differences in national USI legislative frameworks and national salt supply situations between countries. The approach of apportioning the population UIC from spot urine collections may be useful for future monitoring of change in iodine nutrition from reduced salt use in processed foods and in households.

Identifying sociodemographic, programmatic and dietary drivers of anaemia reduction in pregnant Indian women over 10 years

Chakrabarti, S., N. George, M. Majumder, N. Raykar, and S. Scott. 2018. *Public Health Nutrition*. doi:10.1017/S1368980018000903.

<https://www.cambridge.org/core/journals/public-health-nutrition/article/identifying-sociodemographic-programmatic-and-dietary-drivers-of-anaemia-reduction-in-pregnant-indian-women-over-10-years/3187C8CC8C833DA5FBD270343A393116>

Objective

Anaemia is a major contributor to the global disease burden and half of pregnant women in India were anaemic in 2016. The aetiology of anaemia is complex, yet anaemia determinants are frequently examined in isolation. We sought to explore how shifts in sociodemographic (wealth, age at pregnancy, education, open defecation, cooking fuel type, household size), programmatic (iron-folic acid tablet consumption, antenatal care visits) and dietary factors (intake of Fe, folic acid, vitamin B12, phytate) predicted changes in anaemia prevalence.

Design

Nutrient levels for eighty-eight food items were multiplied by household consumption of these foods to estimate household-level nutrient supply. A synthetic panel data set was created from two rounds of the District Level Household and Facility Survey (2002–04 and 2012–13) and Household Consumer Expenditures Survey (2004–05 and 2011–12). Ordinary least-squares multivariate regression models were used.

Setting

Districts (n 446) spanning north, north-east, central and south India.

Subjects

Pregnant women aged 15–49 years (n 17 138).

Results

In the model accounting for both non-dietary and dietary factors, increased age at pregnancy ($P<0.001$), reduced village-level open defecation ($P=0.001$), consuming more Fe ($P<0.001$) and folic acid ($P=0.018$) and less phytate ($P=0.002$), and urbanization ($P=0.015$) were associated with anaemia reductions. A 10 mg increase in daily household Fe supply from 2012 levels was associated with a 10 % reduction in anaemia.

Conclusions

Public health interventions to combat anaemia in pregnant women should use a holistic approach, including promotion of delayed marriage, construction and use of toilets, and measures that facilitate adoption of nutrient-rich diets.

Identifying bottlenecks in the iron and folic acid supply chain in Bihar, India: a mixed-methods study

Wendt, A. S., R. Stephenson, M. F. Young, P. Verma, S. Srikantiah, A. Webb-Girard, C. J. Hogue, U. Ramakrishnan, and R. Martorell. 2018. *BMC Health Services Research* 18:281.

<https://doi.org/10.1186/s12913-018-3017-x>

Background

Maternal anaemia prevalence in Bihar, India remains high despite government mandated iron supplementation targeting pregnant women. Inadequate supply has been identified as a potential barrier to iron and folic acid (IFA) receipt. Our study objective was to examine the government health system's IFA supply and distribution system and identify bottlenecks contributing to insufficient IFA supply.

Methods

Primary data collection was conducted in November 2011 and July 2012 across 8 districts in Bihar, India. A cross-sectional, observational, mixed methods approach was utilized. Auxiliary Nurse

Midwives were surveyed on current IFA supply and practices. In-depth interviews (n = 59) were conducted with health workers at state, district, block, health sub-centre, and village levels.

Results

Overall, 44% of Auxiliary Nurse Midwives were out of IFA stock. Stock levels and supply chain practices varied greatly across districts. Qualitative data revealed specific bottlenecks impacting IFA forecasting, procurement, storage, disposal, lack of personnel, and few training opportunities for key players in the supply chain.

Conclusions

Inadequate IFA supply is a major constraint to the IFA supplementation program, the extent of which varies widely across districts. Improvements at all levels of infrastructure, practices, and effective monitoring will be critical to strengthen the IFA supply chain in Bihar.

Determinants of micronutrient fortified blended food (balbhog) consumption among children 6–35 months of age provided through the integrated child development services program in Gujarat, India

Chaturvedi, A., N. Nakkeeran, M. Doshi, R. Patel, and S. Bhagwat. 2018. *Indian Journal of Community Medicine* 43(2): 97-101.

<http://www.ijcm.org.in/article.asp?issn=0970-0218;year=2018;volume=43;issue=2;spage=97;epage=101;aulast=Chaturvedi>

The state of Gujarat had introduced Extruded Fortified Blended Food, Balbhog, as take-home ration for children 6–35 months of age. The study aimed to understand awareness, availability, and consumption pattern of Balbhog and gain insights on factors influencing its regular use. Aims: This study aims to understand coverage and feeding practices of micronutrient fortified blended food (Balbhog) and determine factors for its regular use. Subjects and Methods: A cross-sectional survey of 1623 households with children of 6–35 months of age registered in Anganwadi centers was conducted in the four districts of Gujarat. Household and dietary survey were conducted to understand child care and feeding practices at household level. Results: The results showed high awareness about Balbhog (88.6%) among caregivers, with majority reporting using it (81.7%) before. Regular Balbhog consumption (42.2%), however, declined considerably across all population characteristics. Monthly distribution of adequate Balbhog packets, taste of Balbhog preparations, meal frequency of children, and caregivers' participation in the monthly Integrated Child Development Services (ICDS) event emerged as strong predictors of regular Balbhog consumption. No disparity in consumption was observed across socioeconomic characteristics of the population. Conclusion: Household feeding practices and ICDS program factors mediated regular use of Balbhog among children. Improving availability of entitled Balbhog packets, raising awareness about Balbhog preparations, and improving child feeding practices could help in increasing Balbhog consumption in the community.

Systematic review of the design, implementation and effectiveness of mass media and nutrition education interventions for infant and young child feeding

Graziose, M. M., S. M. Downs, Q. O'Brien, and J. Fanzo. 2018. *Public Health Nutrition* 21(2): 273-287. <https://www.cambridge.org/core/journals/public-health-nutrition/article/systematic-review-of-the-design-implementation-and-effectiveness-of-mass-media-and-nutrition-education-interventions-for-infant-and-young-child-feeding/8F35F151D28593B2950A7632B11A67BA>

Objective

To systematically review the design, implementation and effectiveness of mass media and nutrition education interventions for improving infant and young child feeding (IYCF) practices and related psychosocial factors.

Design

A search of PubMed, Embase and PsycINFO databases, a Google search, and a consultation with experts in the field of IYCF performed in July 2016.

Setting

Low- and middle-income countries, as defined by the World Bank Group.

Subjects

Eligible studies: included a mass media component (with or without nutrition education); conducted a pre–post evaluation (with or without a control group); assessed IYCF knowledge, attitudes, beliefs and/or practices; and were published in English between 2000 and present.

Results

Eighteen unique studies were identified that examined the effect of mass media (types included: television; print; voice and/or SMS (text) messages; radio; megaphones/loudspeakers; videos; social media; songs/dramas) and nutrition education interventions on IYCF practices within thirteen countries. Of these, fifteen studies reported improvements in breast- and/or complementary feeding practices, using indicators recommended by the WHO, and six studies reported improvements in related psychosocial factors. However, little detail was provided on the use of formative research, a formal behaviour change theory and behaviour change techniques. Few studies reported both dose delivered and participants' exposure to the intervention.

Conclusions

Despite evidence of effectiveness, few common elements in the design of interventions were identified. Future research should consistently report these details to open the 'black box' of IYCF interventions, identify effective design components and ensure replicability.

Associations between feeding practices and growth and neurodevelopmental outcomes at 36 months among children living in low- and low-middle income countries who participated in the BRAIN-HIT trial

Do, B.T., N.I. Hansen, C. Bann, R.L. Lander, S.S. Goudar, O. Pasha, E. Chomba, S.M. Dhaded, V.R. Thorsten, J.L. Wallander, F.J. Biasini, R. Derman, R.L. Goldenberg, and W.A. Carlo. 2018. *BMC Nutrition* 4:19.

<https://doi.org/10.1186/s40795-018-0228-9>

Background

Feeding practices over the first several years of a child's life can critically influence development. The purpose of this study was to examine associations between feeding practices and growth and neurodevelopmental outcomes at 36 months of age among children from low- and low-middle-income countries (LMIC).

Methods

We conducted a secondary analysis using data collected from children in India, Pakistan, and Zambia who were enrolled in a randomized controlled trial of a home-based early development intervention program called Brain Research to Ameliorate Impaired Neurodevelopment Home-based Intervention Trial. Qualitative dietary data collected at 36 months was used to assess the modified Minimum Acceptable Diet (mMAD), a measure based on a core indicator developed by the World Health Organization to measure whether young children receive the minimum number of meals recommended and adequate diversity of major food groups in their diet. Regression models were

used to assess cross-sectional associations between diet and growth indices, including Z-scores for height-for-age (HAZ), weight-for-age (WAZ), weight-for-height (WHZ), head circumference (HCZ), and Bayley Scales of Infant Development II mental and psychomotor developmental measures at 36 months of age.

Results

Of 371 children, 174 (47%) consumed the mMAD, with significantly higher mean adjusted WHZ than those who did not meet mMAD (0.20 vs -0.08, $p = 0.05$). Egg consumption was found to be significantly associated with a decreased risk of wasting [adjusted RR (95% CI): 0.37 (0.15, 0.89), $p = 0.03$]. HCZ at 36 months did not differ significantly for children who did and did not receive the mMAD.

Conclusion

Meeting the mMAD was associated with better weight-for-height outcomes at 36 months in children in these three LMIC, highlighting the importance of adequate food quantity and quality.

Mid upper arm circumference as a predictor of risk of mortality in children in a low resource setting in India

Taneja, S., T. Rongsen-Chandola, S.B. Mohan, S. Mazumder, N. Bhandari, J. Kaur, N. Arya, R. Chowdhury, J.C. Martines, R. Bahl, and M.K. Bhan. 2018. *PLoS ONE* 13(6):e0197832. doi: <https://doi.org/10.1371/journal.pone.0197832>

Objective

In this secondary analysis of data from an intervention trial, we assessed the performance of Mid Upper Arm Circumference (MUAC) as a predictor of mortality in children aged 6±59 months from Delhi, India, one year after their initial MUAC measurements were taken. Additionally, we assessed MUAC as an absolute value and MUAC z-scores as predictors of risk of mortality.

Methods

In the trial, children were screened using MUAC prior to referral to the study clinic. These children were revisited a year later to ascertain their vital status. Baseline MUAC and MUAC z-scores were used to categorize children as severely (MUAC <115 mm, MUAC z-score <-3SD) or moderately (MUAC 115 to <125 mm, MUAC z-score <-2SD) malnourished. The proportion of malnutrition, risk of mortality, relative risk estimates, positive predictive value and area under the curve (AUC) by MUAC and MUAC z-scores were calculated.

Results

In the resurvey, the first 36159 children of the 48635 in the initial survey were contacted. Of these, vital status of 34060 (94.2%) was available. The proportion of severe malnutrition by MUAC (<115 mm) was 0.5% with an associated mortality of 4.7% over a one-year period and an attributable mortality of 13% while the proportion of the severe malnutrition by MUAC z-score (<-3SD) was 0.9% with an associated mortality of 2.2%.

Conclusions

MUAC is a significant predictor of subsequent mortality in under-five children. In settings where height measurement is not feasible, MUAC can be used as a screening tool for identifying severely malnourished children for management.

Adolescent Undernutrition: Global Burden, Physiology, and Nutritional Risks

Christian, P., and E.R. Smith. 2018. *Annals of Nutrition & Metabolism* 72:316–328. <https://doi.org/10.1159/000488865>

Background: Adolescents, comprised of 10–19 year olds, form the largest generation of young people in our history. There are an estimated 1.8 billion adolescents in the world, with 90% residing in low- and middle-income countries. The burden of disease among adolescents has its origins in infectious and injury-related causes, but nutritional deficiencies, suboptimal linear growth, and undernutrition are major public health problems, even as overweight may be on the rise in many contexts.

Summary and Key Messages: Girls are most vulnerable to the influences of cultural and gender norms, which often discriminate against them. Dietary patterns and physical activity, in addition to schooling and countervailing social norms for early marriage, influence health and nutritional well-being of adolescents. Nutrient requirements – including those for energy, protein, iron, calcium, and -others – increase in adolescence to support adequate growth and development. In settings where dietary intakes are suboptimal, anemia and micronutrient deficiencies are high. Endocrine factors are essential for promoting normal adolescent growth and are sensitive to undernutrition. Growth velocity increases during puberty when peak height velocity occurs and catch-up is possible; in girls, about 15–25% of adult height is attained. A premature pregnancy can halt linear growth and increase the risk of adverse birth outcomes. Research is needed to fill the huge data gaps related to nutrition and growth during adolescence, in addition to testing interventions during this second window of opportunity to enhance growth and development, improve human capital, and to end the intergenerational cycle of growth failure.

Socio-cultural and economic determinants and consequences of adolescent undernutrition and micronutrient deficiencies in LLMICs: a systematic narrative review

Madjdian, D.S., F. Azupogo, S.J.M. Osendarp, H. Bras, and I.D. Brouwer. 2018. *Annals of the New York Academy of Sciences* 1416: 117–139.

<https://doi.org/10.1111/nyas.13670>

Adolescent undernutrition is a persisting public health problem in low and lower middle-income countries (LLMICs). Nutritional trajectories are complexly interrelated with socio-cultural and economic (SCE) trajectories. However, a synthesis of the SCE determinants or consequences of undernutrition in adolescents is lacking. We undertook a narrative review of published literature to provide a narrative overview of the SCE determinants and consequences associated with undernutrition among adolescents in LLMICs. We identified 98 articles from PubMed, SCOPUS, and CAB-Abstracts on determinants and consequences of undernutrition as defined by stunting, underweight, thinness, and micronutrient deficiencies. At the individual level, significant determinants included age, sex, birth order, religion, ethnicity, educational and literacy level, working status, and marital status. At the household level, parental education and occupation, household size and composition, income, socioeconomic status, and resources were associated with undernutrition. Only a few determinants at the community/environmental level, including residence, sanitation, school type, and seasonality, were identified. The consequences of adolescent undernutrition were mostly related to education and cognition. This review underscores the importance of the broad range of context-specific SCE factors at several levels that influence adolescent nutritional status and shows that further research on SCE consequences of undernutrition is needed.

Dietary and nondietary determinants of nutritional status among adolescent girls and adult women in India

Radhika, M.S., B. Swetha, B.N. Kumar, N.B. Krishna, and A. Laxmaiah. 2018. *Annals of the New York Academy of Sciences* 1416: 5–17.

<https://nyaspubs.onlinelibrary.wiley.com/doi/pdf/10.1111/nyas.13599>

Adolescence appears to be the next available critical period to improve inadequacies in nutrition, growth, and development from childhood. In this analysis, we describe the dietary and nondietary determinants of nutritional status among adolescent girls and adult women residing in rural areas of India. We used data pertaining to 3930 adolescents (10–19 years) and 11,058 adult women (20–49 years) from the National Nutrition Monitoring Bureau Survey, 2011–2012 database. Logistic regression analysis was conducted to understand the effects of various individual- and household-level determinants of thinness and underweight among adolescents and adult women, respectively. Almost one-third of the adolescents and adult women were undernourished. Factors other than dietary adequacy and diversity had a greater impact on undernutrition in both the adolescents and adult women. The nondietary determinants (e.g., higher age group, higher household wealth status, access to improved water, better maternal work status, and living in better type of houses) predicted good nutritional status in the adolescent girls. In addition, the women's own higher education and household occupation status and better sanitation facilities improved undernutrition in adult women. Therefore, India needs multipronged strategies along with dietary interventions and effective implementation programs to achieve good health and well-being of adolescents and adult women.

How can health, agriculture and economic policy actors work together to enhance the external food environment for fruit and vegetables? A qualitative policy analysis in India

Thow, A.M., G. Verma, D. Soni, D.K. Beri, P. Kumar, K. R. Siegel, N. Shaikh, and S. Khandelwal. 2018. *Food Policy* 77: 143-151.

<https://doi.org/10.1016/j.foodpol.2018.04.012>

The benefits of fruit and vegetables are well established, particularly their role in preventing general micronutrient-deficiencies and chronic diseases. However, global food systems are not delivering diverse and high-quality diets: healthy food is unavailable and too expensive for many. Creating food environments that foster consumer access to fruit and vegetables will require coordinated policy action across sectors, mostly outside of the health sector. The aim of this paper is to identify opportunities to strengthen food system policy for nutrition, through an analysis of the policies relevant to the external food environment for fruit and vegetables in India. We conducted interviews based on policy theory with 55 stakeholders from national and state level, from within government, research, private sector and non-government agencies, and from health, agriculture and economic sectors. Specific strategies identified in this study to improve consumers' external food environment for fruit and vegetables in India were: development of strategic Public-Private Partnerships to increase access to diverse expertise across the supply chain; linking health and economic/agricultural policy agendas; and strengthening surveillance of policy impacts on consumer access to fruit and vegetables. We also found that public health actors can play an important role in advocating for 'consumer oriented' fruit and vegetable supply policy. This study demonstrates the usefulness of 'policy learning'-oriented qualitative policy analysis in identifying 'points of entry' for food policy change, and extends understanding of political dynamics in engendering agricultural policy change for nutrition. Improving access to affordable fruit and vegetables is a global priority,

and given common global food supply challenges, the findings from this study are also likely to be relevant for other low and middle-income countries.

Review: Meta-analysis of the association between production diversity, diets, and nutrition in smallholder farm households

Sibhatu, K.T., and M. Qaim. 2018. *Food Policy* 77: 1-18.

<https://doi.org/10.1016/j.foodpol.2018.04.013>

Undernutrition and low dietary diversity remain big problems in many developing countries. A large proportion of the people affected are smallholder farmers. Hence, it is often assumed that further diversifying small-farm production would be a good strategy to improve nutrition, but the evidence is mixed. We systematically review studies that have analyzed associations between production diversity, dietary diversity, and nutrition in smallholder households and provide a meta-analysis of estimated effects. We identified 45 original studies reporting results from 26 countries and using various indicators of diets and nutrition. While in the majority of these studies positive results are highlighted, less than 20% of the studies report consistently positive and significant associations between production diversity and dietary diversity and/or nutrition. Around 60% report positive associations only for certain subsamples or indicators, the rest found no significant associations at all. The average marginal effect of production diversity on dietary diversity is positive but small. The mean effect of 0.062 implies that farms would have to produce 16 additional crop or livestock species to increase dietary diversity by one food group. The mean effect is somewhat larger in Sub-Saharan Africa than in other regions, but even in Africa farms would have to produce around 9 additional species to increase dietary diversity by one food group. While results may look differently under very specific conditions, there is little evidence to support the assumption that increasing farm production diversity is a highly effective strategy to improve smallholder diets and nutrition in most or all situations.

2018 Global food policy report

International Food Policy Research Institute. 2018. *2018 Global food policy report*. Washington, DC: International Food Policy Research Institute.

<https://www.ifpri.org/publication/2018-global-food-policy-report>

IFPRI's flagship report reviews the major food policy issues, developments, and decisions of 2017, and highlights challenges and opportunities for 2018 at the global and regional levels. This year's report looks at the impacts of greater global integration—including the movement of goods, investment, people, and knowledge—and the threat of current antiglobalization pressures. Drawing on recent research, IFPRI researchers and other distinguished food policy experts consider a range of timely topics:

- How can the global food system deliver food security for all in the face of the radical changes taking place today?
- What is the role of trade in improving food security, nutrition, and sustainability?
- How can international investment best contribute to local food security and better food systems in developing countries?
- Do voluntary and involuntary migration increase or decrease food security in source countries and host countries?

- What opportunities does greater data availability open up for improving agriculture and food security?
- How does reform of developed-country farm support policies affect global food security?
- How can global governance structures better address problems of food security and nutrition?
- What major trends and events affected food security and nutrition across the globe in 2017?

The 2018 Global Food Policy Report also presents data tables and visualizations for several key food policy indicators, including country-level data on hunger, agricultural spending and research investment, and projections for future agricultural production and consumption. In addition to illustrative figures, tables, and a timeline of food policy events in 2017, the report includes the results of a global opinion poll on globalization and the current state of food policy.

NON-PEER REVIEWED

Budget Brief 2018-19: Integrated Child Development Services (ICDS)

Kapur, A., and P. Baisnab. 2018. *Budget Brief 10(7)*. New Delhi: Accountability Initiative.

<http://www.cprindia.org/research/reports/budget-brief-2018-19-integrated-child-development-services-icds>

The Integrated Child Development Services (ICDS) is Government of India's (GoI) flagship programme aimed at providing basic education, health and nutrition services for early childhood development. This brief uses government reported data to analyse ICDS performance along the following parameters:

- Overall trends in allocations and expenditures
- Expenditure of Supplementary Nutrition Programme (SNP)
- Vacancies amongst human resources
- Coverage of beneficiaries and malnutrition rates

Hidden Hunger: Strategies to Improve Nutrition Quality

Biesalski, H.K., and R. Birner (eds). 2018. *Hidden Hunger: Strategies to Improve Nutrition Quality*. World Review of Nutrition and Dietetics, edited by B. Koletzko, 118. Basel: Karger.

<https://www.karger.com/Book/Home/276874>

Hidden hunger has long been an overlooked problem. Vitamin and mineral deficiencies have to be remedied and the availability of calories needs to be increased. As a matter of fact, the number of people who do not have access to a balanced diet has multiplied in rich and poor countries, with lasting consequences for health and well-being. Hidden hunger not only affects childhood growth and cognitive development, but also reduces productivity and well-being later in life, thus keeping the affected population trapped in a circle of poverty and malnutrition. This book illustrates the global fight against hunger by national governments and international organizations. Presented at the Third Hidden Hunger Conference held at the University of Hohenheim in Stuttgart, Germany, it presents a range of strategies being implemented in various regions of the world to improve nutrition quality and combat this international crisis.

Protecting, promoting, and supporting breastfeeding in facilities providing maternity and newborn services: the revised Baby-friendly Hospital Initiative 2018

World Health Organization. 2018. *Implementation guidance: protecting, promoting and supporting breastfeeding in facilities providing maternity and newborn services – the revised Baby-friendly Hospital Initiative*. Geneva: World Health Organization.

<http://www.who.int/nutrition/publications/infantfeeding/bfhi-implementation/en/>

This updated implementation guidance is intended for all those who set policy for, or offer care to, pregnant women, families and infants: governments; national managers of maternal and child health programmes in general, and of breastfeeding- and Baby-friendly Hospital Initiative (BFHI)-related programmes in particular; and health-facility managers at different levels (facility directors, medical directors, chiefs of maternity and neonatal wards). The document presents the first revision of the Ten Steps since 1989. The topic of each step is unchanged, but the wording of each one has been updated in line with the evidence-based guidelines and global public health policy.

The steps are subdivided into (i) the institutional procedures necessary to ensure that care is delivered consistently and ethically (critical management procedures); and (ii) standards for individual care of mothers and infants (key clinical practices). Full application of the International Code of Marketing of Breast-milk Substitutes and relevant World Health Assembly Resolutions (the Code), as well as ongoing internal monitoring of adherence to the clinical practices, have been incorporated into step 1 on infant feeding policies.

Marketing of Breast-milk Substitutes: National implementation of the international code Status Report 2018

Marketing of breast-milk substitutes: National implementation of the international code, status report 2018. Geneva: World Health Organization.

http://www.who.int/nutrition/publications/infantfeeding/code_report2018/en

This report provides updated information on the status of implementing the International Code of Marketing of Breastmilk Substitutes and subsequent relevant World Health Assembly resolutions (“the Code”) in and by countries. The report documents the adoption of new legislation implementing the Code in a few countries since 2016, and formulation of additional measures to strengthen existing legislation in others. It also provides a regional perspective on the legal status of the Code, and in countries where such information is available, the extent to which Code provisions have been incorporated in national legal measures.

UPCOMING EVENTS

21st World Congress on Nutrition & Food Sciences

Theme: Exploring New Dimensions in Food Science for Better Public Health

Nutrition Summit 2018 is intended to give professionals an investigation of the key part of Food Science, and Public Health in health care management.

When: July 09-10, 2018

Where: Sydney, Australia

For more information: <https://nutritioncongress.nutritionalconference.com/>

Annual Conference on Women and Maternal Nutrition and Care

Theme: Nutritional aspects towards managing Women's Health
Women and Maternal Nutrition and Care 2018 is an unprecedented event planned for specialists to empower the spread and use of research revelations on women's nutrition and diet related risk factors for women. The conference is intended to energize the trading of thoughts over a wide scope of disciplines from the scientific areas of nutrition and food science.

When: Aug 31-Sept 01, 2018

Where: Toronto, Ontario, Canada

For more information: <https://womensnutrition.conferenceseries.com/>

International Symposium on Understanding the Double Burden of Malnutrition for Effective Interventions

A tri-agency initiative of the IAEA, World Health Organization (WHO) and UNICEF, this symposium will contribute to strengthen country level implementation of the work programme of the UN Decade of Action on Nutrition.

When: December 10–13, 2018

Where: Vienna, Austria

For more information: <https://www.iaea.org/events/understanding-the-double-burden-of-malnutrition-symposium-2018>

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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This publication has been prepared by POSHAN with research assistance from Pratima Mathews, IFPRI, and has not been peer reviewed. Any opinions stated herein are those of the author(s) and do not necessarily reflect the policies of the International Food Policy Research Institute. Please contact Dr. Rasmi Avula at IFPRI with any questions: r.avula@cgiar.org.