



TECHNICAL BRIEF

Factors associated with intra-household double and triple burden of malnutrition in Kathmandu Valley, Nepal

Helen Keller International | Nepal



Government of Nepal
Ministry of Health and Population
Department of Health Services
Family Welfare Division

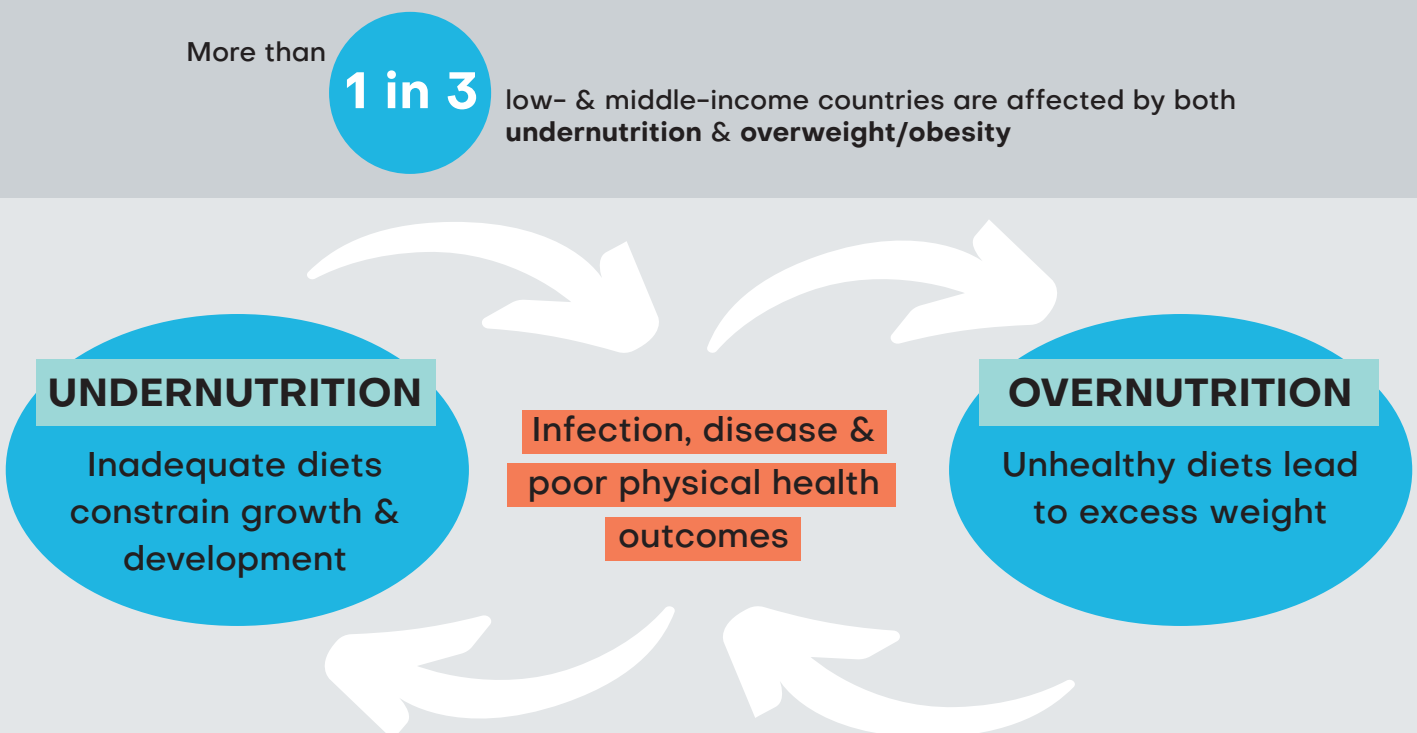
HELEN KELLER INTL | ARCH ASSESSMENT & RESEARCH ON CHILD FEEDING



Background:

The 'double burden of malnutrition' is a phenomenon observed in low- and middle-income countries (LMIC) where high rates of undernutrition, such as stunting or wasting, coexist alongside increasing rates of obesity and overweight. These forms of malnutrition are difficult to address on their own and present an even more complex public health problem when they are present together in societies, households, or even individuals. More than a third of LMIC are impacted to some degree by the double burden of malnutrition.¹ This has lifelong consequences for child and population health. Some experts also acknowledge the 'triple burden of malnutrition', where overweight/obesity, undernutrition and micronutrient deficiencies or 'hidden hunger' coexist.² See Figure 1.

Figure 1: The double burden of malnutrition – Adapted from *The Lancet Double Burden of Malnutrition Series*



In Nepal, undernutrition among children under 5 years of age is prevalent. Over a third of children are stunted, a condition where they do not grow to their full potential due to chronic malnutrition and/or infections in the first years of life.³ A further 10% of children are wasted, or acutely malnourished, while 27% are underweight for their age. Evidence shows that micronutrient deficiencies are also common among children in Nepal. More than half of children under five years old are anemic, indicating that iron deficiency is a concern among this population.³ Only 47% of children 6–23 months of age consume four or more different food groups each day, meaning that their dietary diversity is insufficient to meet vitamin and mineral needs. Limited dietary diversity likely contributes to childhood micronutrient deficiencies in Nepal.

Over one-fifth (22%) of women and 17% of men are overweight or obese in Nepal,³ and this rate has grown steadily over the last decade. Overweight and obesity are more common among women of reproductive age in urban areas, and among those over 30 years old.⁴ Women in households with higher wealth status and higher food security also have a higher prevalence of overweight/obesity.^{3,5}

Rates of non-communicable diseases have been increasing in Nepal and are now the leading cause of death in the country.⁶ The links between overweight/obesity and non-communicable diseases such as diabetes and heart disease are well established, and are becoming a particular focus of health research and interventions in South Asia.⁷ Type 2 diabetes prevalence in particular has increased dramatically since the 1990's;⁸ 4% of Nepali adults now have type 2 diabetes, with a greater prevalence observed among urban residents (8%).⁹

A recent analysis of the 2016 Nepal Demographic and Health Survey (NDHS) assessed the national prevalence of double and triple burdens of malnutrition within mother-child pairs.¹⁰ Overweight or obese mothers who had a child suffering from either stunting, wasting or underweight were classified as experiencing the double burden of malnutrition (DBM), while mother-child pairs with these characteristics along with an anemic child were classified as having the triple burden of malnutrition (TBM). DBM and TBM were found to affect 6.6% and 7%

of households, respectively. DBM and TBM was more likely to be observed in households with mothers over 35 years old, from the richest wealth quintile, and with at least secondary education. While this NDHS analysis provided a national level assessment, the risk of DBM and TBM could be higher in an urban setting such as the Kathmandu Valley where the food system is rapidly evolving, adult overweight/obesity is increasing, and a reliance on unhealthy, processed foods for young child feeding has been found.¹¹ There is a need to explore DBM and TBM in the urban context where the risk may be greater, and the aspects of children's dietary intake potentially contributing to the multiple burdens of nutrition in Nepal.

Data from Helen Keller International's Assessment and Research on Child Feeding (ARCH) project was analyzed in order to fill these gaps in the available literature and provide an estimate of Kathmandu Valley's prevalence of double and triple burden of malnutrition among mothers and young children. Exploration of factors which may be associated with these conditions is also reported here.



The data:

A cross-sectional survey was conducted in Kathmandu Valley, Nepal in 2017 to assess relationships between consumption of ultra-processed foods and child nutritional status and dietary adequacy. Methods and results of this study have been published in detail elsewhere.^{11–14} The study was comprised of a representative sample of children aged 12–23 months (n=745). Their caregivers were interviewed to collect information about sociodemographic characteristics, household factors, and child food consumption patterns. Quantitative 24-hour dietary recalls were conducted to estimate children’s energy and nutrient intakes, and anthropometric measures (height and weight) were collected for mothers (excluding other categories of caregivers) and children. Blood samples were collected from children to assess micronutrient deficiencies, including iron deficiency anemia.

Methods:

From the original study sample, 667 participants with complete maternal and child anthropometric data were included in this analysis assessing DBM. 612 participants with complete anthropometrics and child blood samples were included in this analysis assessing TBM. These outcome measures were constructed as indicated in Table 1.

Table 1: Construction of double and triple burden of malnutrition indicators

Double burden of malnutrition (DBM)	
Mother Characteristics	Overweight/obesity • WHO definition: BMI ≥ 25 ¹⁵
Child Characteristics	Stunting (height for age Z-score ≤ 2) ¹⁶ Or Wasting (weight for height Z-score ≤ 2) Or Undernutrition (weight for age Z-score ≤ 2)

Triple burden of malnutrition (TBM)	
Mother Characteristics	Overweight/obesity • WHO definition: BMI ≥ 25 ¹⁵
Child Characteristics	Stunting or Wasting or Undernutrition And Iron deficiency anemia (hemoglobin <11.0 g/dL, transferrin receptor >8.3 mg/L and ferritin <12 μ g/L, adjusted for inflammation) ¹⁰

Factors shown to be associated with child undernutrition outcomes in prior literature^{3,10,17–19} were included in bivariate and multivariate logistic regression models to assess crude and adjusted associations with both DBM and TBM. These hypothesized predictive factors of DBM/TBM fit broadly into three categories: household factors, caregiver factors and child factors (see Table 2). Both DBM and TBM models were adjusted for cluster sampling at the municipality ward level. Hosmer-Lemeshow goodness of fit tests were used to verify model fit for the adjusted model.



Helen Keller International | Nepal

Table 2: Definitions and construction of variables included in analysis of factors related to DBM/TBM

Double burden of malnutrition (DBM)	
Household Factors	<ul style="list-style-type: none"> • Socioeconomic status • Sex of head of household • Household food security categorized as food secure or mild/moderate/severe food insecurity based on household food security index questions
Caregiver Factors	<ul style="list-style-type: none"> • Caregiver age, categorized as younger (<30 years of age) or older (≥30 years of age) • Caregiver educational attainment based on last year of schooling completed, categorized as non/nonformal, primary, secondary or tertiary education • Caregiver's reported caste categorized as advantaged ethnic/caste group (including advantaged janajati and upper caste) and disadvantaged ethnic/caste group (advantaged dalit, disadvantaged janajati and disadvantaged non-dalit terai caste)
Child Factors	<ul style="list-style-type: none"> • Child age • Child sex • Low/moderate/high consumption of unhealthy ultra-processed foods (biscuits, chips, candy or sugar sweetened beverages); split into terciles • Mean probability of dietary adequacy (MPA) for 11 micronutrients based on 24-hour dietary recall; split into terciles

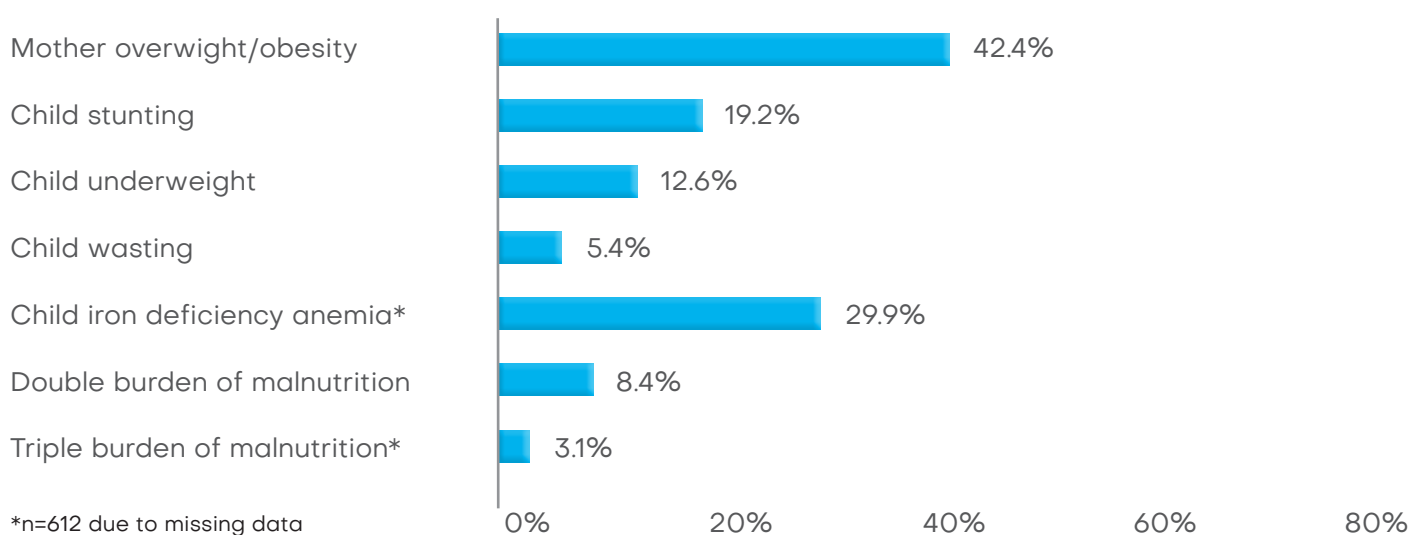
Results:

The mean age of the 667 caregivers included in the DBM analysis was 27.6 years. 98% of these caregivers were the mother of the child, but some fathers, grandparents, or other relatives were interviewed as the child's primary caregiver. Approximately 36% of caregivers had no or non-formal education only, while 45% had secondary or higher education.

The majority of households (86%) were food secure. Mean probability of dietary adequacy for 11 micronutrients among the children was 57%. These descriptive statistics were similar in the subset of 612 participants in the TBM analysis.

Overall, DBM and TBM were rare in this sample of Kathmandu Valley mothers and children. 8.4% of mother-child pairs were impacted by DBM, and 3.1% TBM (Figure 2).

Figure 2: Prevalence of double and triple burden of malnutrition outcomes (n=667)



Caregiver age of 30 years or older was significantly associated with DBM ($p < 0.05$). In both crude and adjusted models, older respondents were nearly twice as likely to experience DBM than respondents under 30 years old. In the crude model, caregivers with primary education only had twice the odds of experiencing DBM as compared to caregivers who had not attended school ($p = 0.06$) but this relationship was no longer significant when adjusting for other household, caregiver and child factors. No other factors were significantly associated with DBM.

In models assessing factors associated with TBM, caregiver and child ethnic/caste group status was significantly associated with TBM ($p < 0.05$). In adjusted models, caregivers and their children from advantaged ethnic/caste groups had 12.5 greater odds of experiencing TBM as compared to those from disadvantaged ethnic/caste groups. The highest dietary adequacy among children (children who were categorized in the highest MPA tercile) was found to be borderline protective against TBM in the adjusted model, reducing the odds by 71% compared to children with the lowest dietary adequacy ($p = 0.07$).

Older caregivers were nearly twice as likely to be a part of households with double burden of malnutrition among mother-child pairs than respondents under 30 years old.

Mothers and children in the advantaged ethnic/caste group had 12.5 higher odds of experiencing triple burden of nutrition compared to the disadvantaged ethnic/caste group.

Discussion:

The low prevalence (8%) of double burden of malnutrition among mother-child pairs in Kathmandu Valley is comparable to recent results from a national sample of mothers and children.¹⁰ Sunuwar and colleagues reported that 6.6% of Nepali households had an overweight/obese mother with an undernourished child. The slightly higher prevalence of double burden in our analysis is likely driven by the high rate of maternal overweight/obesity (42%), which is nearly double the national overweight/obesity rate among adult Nepali women published in NDHS.³ This is consistent with the observation that overweight/obesity is more prevalent among women of reproductive age living in urban compared to rural areas of Nepal.²⁰ The changes in lifestyles and food environments which accompany urbanization, including reduced physical activity and prevalent marketing of unhealthy foods and beverages, have been implicated in the increased obesity rates in Asia and low- and middle-income countries throughout the world.²¹ Kathmandu Valley is the most urbanized area of Nepal, and already has a high burden of non-communicable diseases and adult overweight/obesity.²² Without focused interventions to improve the food environment and social determinants of health, which contribute to overweight/obesity in urban Nepal, the consequences of DBM may become an even bigger problem in the future.

The national-level triple burden of malnutrition analysis by Sunuwar et al. revealed a prevalence of 7%, compared to our estimate of 3%. These researchers assessed child anemia rather than iron deficiency anemia in their calculation of TBM, a measure which could also include anemia caused by infection or disease rather than dietary causes alone. Triple burden of malnutrition in our data would only reach 4% if using this metric, indicating that our sample still has a lower prevalence than the country as a whole. Anemia is a persistent problem throughout South Asia, particularly among children under five years of age.²³ Because of the interrelated nature of poor maternal nutrition, low birthweight, and child anemia, effective interventions will require investment in better nutrition across multiple life stages. Addressing the causes and consequences of micronutrient deficiencies like iron-deficiency anemia becomes even more difficult in a context where overweight/obesity must be simultaneously confronted.

Caregiver age was an important predictor of double burden of malnutrition. Mother-child pairs in which the child's primary caregiver was 30 years of age or older were about twice as likely to be classified as DBM compared to their younger counterparts. A similar relationship was also observed in the recent national-level analysis, with mothers aged 35 years or older having a higher likelihood of being classified as DBM and TBM compared to younger age groups.¹⁰ This increased likelihood of DBM may be due to the correlation between increasing age and overweight/obesity among women of reproductive age; multiple studies in Nepal have observed that older women have higher body mass index than younger women.^{24,25}

Respondents who reported their caste as advantaged janajati or upper caste were significantly more likely to be categorized as TBM. This effect was large, with mother-child pairs in this advantaged ethnic/caste group having over ten times higher odds of TBM. Caste has been found to be a significant predictor of child nutrition outcomes in Nepal in other studies.²⁶⁻²⁸ This relationship may be influenced by differences in maternal and child dietary diversity as a result of culturally prescribed eating habits in these groups.

Limitations of this analysis include the low prevalence of DBM and TBM outcomes, which may have impacted our ability to find consistent statistical associations between factors. The cross-sectional design of this study also limits the ability to make conclusions about causal relationships among these factors.

Double and triple burden of malnutrition are not prevalent in Kathmandu Valley, but global trends suggest attention is needed to ensure health for mothers and children in the future. Policy makers in Nepal have the opportunity to focus on prevention of these conditions and associated health risks. Promoting and ensuring access to nutritious diets for mothers and children while regulating unhealthy packaged foods can help mitigate the effects of the rapid nutrition transition taking place among urban populations. This brief provides cross-sectional estimates of the prevalence of these conditions which can serve as baseline data for this highly urban area which will increasingly see a shift in food systems, diets, lifestyles, and ultimately types of malnutrition present within households. More research needs to be done to identify factors predictive of double and triple burden of malnutrition in Kathmandu Valley families and among those in other urban and peri-urban areas so that clinical and public health programs can be targeted to meet their needs.

Helen Keller International | Nepal



References:

1. Branca, F. et al. A new nutrition manifesto for a new nutrition reality. *Lancet* **395**, 8–10 (2020).
2. Mwangome, M. & Prentice, A. M. Tackling the triple threats of childhood malnutrition. *BMC Medicine* **17**, 210 (2019).
3. Ministry of Health Nepal, New ERA & ICF International. Nepal Demographic and Health Survey 2016. (2017).
4. Kinnunen, T. I. & Neupane, S. Prevalence of overweight among women of childbearing age in Nepal: Trends from 2001 to 2011 and associations with socio-demographic factors. *Matern. Child Health J.* **18**, 1846–1853 (2014).
5. Al Kibria, G. M. Prevalence and factors affecting underweight, overweight and obesity using Asian and World Health Organization cutoffs among adults in Nepal: Analysis of the Demographic and Health Survey 2016. *Obes. Res. Clin. Pract.* **13**, 129–136 (2019).
6. Nepal Health Research Council (NHRC), Ministry of Health and Population (MoHP) & Monitoring Evaluation and Operational Research (MEOR). Nepal Burden of Disease 2017: A Country Report based on the Global Burden of Disease 2017 Study. (2019).
7. Misra, A., Jayawardena, R. & Anoop, S. Obesity in South Asia: Phenotype, Morbidities, and Mitigation. *Curr. Obes. Rep.* **8**, 43–52 (2019).
8. Jayawardena, R. et al. Prevalence and trends of the diabetes epidemic in South Asia: A systematic review and meta-analysis. *BMC Public Health* **12**, 380 (2012).
9. Gyawali, B. et al. Prevalence of type 2 diabetes in Nepal: a systematic review and meta-analysis from 2000 to 2014. *Glob. Health Action* **8**, 29088 (2015).
10. Sunuwar, D. R., Singh, D. R. & Pradhan, P. M. S. Prevalence and factors associated with double and triple burden of malnutrition among mothers and children in Nepal: Evidence from 2016 Nepal demographic and health survey. *BMC Public Health* **20**, 405 (2020).
11. Pries, A. M. et al. Unhealthy Snack Food and Beverage Consumption Is Associated with Lower Dietary Adequacy and Length-for-Age z-Scores among 12–23-Month-Olds in Kathmandu Valley, Nepal. *J. Nutr.* **149**, 1843–1851 (2019).
12. Sharma, N. et al. Perceptions of commercial snack food and beverages for infant and young child feeding: A mixed-methods study among caregivers in Kathmandu Valley, Nepal. *Matern. Child Nutr.* **15**, (2019).
13. Pries, A. M., Ferguson, E. L., Sharma, N., Upadhyay, A. & Filteau, S. Exploratory Analysis of Nutritional Quality and Metrics of Snack Consumption among Nepali Children during the Complementary Feeding Period. *Nutrients* **11**, 2962 (2019).
14. Pries, A. M. et al. Energy intake from unhealthy snack food/beverage among 12–23-month-old children in urban Nepal. *Matern. Child Nutr.* **15**, (2019).
15. WHO. Physical status: the use and interpretation of anthropometry. WHO (World Health Organization). (1995).
16. WHO, UNICEF, USAID, AED, UCDAVIS, & IFPRI. Indicators for Assessing Infant and Young Child Feeding Practices. **2007**, 1–19 (2007).
17. Choy, C. C. et al. Child, maternal and household-level correlates of nutritional status: a cross-sectional study among young Samoan children. *Public Health Nutr.* **20**, 1235–1247 (2017).
18. Morseth, M. S. et al. Severely inadequate micronutrient intake among children 9–24 months in Nepal-The MAL-ED birth cohort study. *Matern. Child Nutr.* **14**, e12552 (2018).
19. Pries, A. M. et al. Consumption of commercially produced snack foods and sugar-sweetened beverages during the complementary feeding period in four African and Asian urban contexts. *Matern. Child Nutr.* **13**, e12412 (2017).
20. Gao, L. et al. Double Burden of Malnutrition and Nutrition Transition in Asia: A Case Study of 4 Selected Countries with Different Socioeconomic Development. doi:10.1093/advances/nmaa064
21. Popkin, B. M., Adair, L. S. & Ng, S. W. Global nutrition transition and the pandemic of obesity in developing countries. *Nutr. Rev.* **70**, 3–21 (2012).
22. Mishra, S. R., Kallestrup, P. & Neupane, D. Country in Focus: confronting the challenge of NCDs in Nepal. *The Lancet Diabetes and Endocrinology* **4**, 979–980 (2016).
23. Harding, K. L., Aguayo, V. M., Namirembe, G. & Webb, P. Determinants of anemia among women and children in Nepal and Pakistan: An analysis of recent national survey data. *Matern. Child Nutr.* **14**, (2018).
24. Rai, A., Gurung, S., Thapa, S. & Saville, N. M. Correlates and inequality of underweight and overweight among women of reproductive age: Evidence from the 2016 Nepal Demographic Health Survey. (2019). doi:10.1371/journal.pone.0216644
25. Rawal, L. B. et al. Prevalence of underweight, overweight and obesity and their associated risk factors in Nepalese adults: Data from a Nationwide Survey, 2016. *PLoS One* **13**, e0205912 (2018).
26. Baek, Y. & Chitekwe, S. Sociodemographic factors associated with inadequate food group consumption and dietary diversity among infants and young children in Nepal. *PLoS One* **14**, (2019).
27. Broaddus-Shea, E. T. et al. Small-Scale Livestock Production in Nepal Is Directly Associated with Children's Increased Intakes of Eggs and Dairy, But Not Meat. *Nutrients* **12**, 252 (2020).
28. Bhandari, S. et al. Dietary intake patterns and nutritional status of women of reproductive age in Nepal: Findings from a health survey. *Arch. Public Heal.* **74**, 2 (2016).

This report was prepared by Mary Champeny (HKI), with technical guidance from Alissa Pries (HKI) and Nisha Sharma (HKI), with support from the Government of Nepal, Ministry of Health and Population Services.

Suggested citation: Helen Keller International & Government of Nepal. Technical Brief: Factors associated with intra-household double and triple burden of malnutrition in Kathmandu Valley, Nepal. Helen Keller International (2020).



Government of Nepal
Ministry of Health and Population
Department of Health Services
Family Welfare Division