

# Addressing the Dual Burden of Malnutrition: A Review of Double Duty Actions and Multifaceted Approaches

Namrata Tyagi\* and Vijayaraghavan M Chariar

Centre for Rural Development and Technology, Indian Institute of Technology Delhi, India

\*Corresponding author: Namrata Tyagi, Centre for Rural Development and Technology, Indian Institute of Technology (I.I.T) Delhi, Hauz Khas New Delhi - 110 016, India

## ARTICLE INFO

**Received:** 📅 July 05, 2023

**Published:** 📅 July 18, 2023

**Citation:** Namrata Tyagi and Vijayaraghavan M Chariar. Addressing the Dual Burden of Malnutrition: A Review of Double Duty Actions and Multifaceted Approaches. Biomed J Sci & Tech Res 51(4)-2023. BJSTR. MS.ID.008129.

## ABSTRACT

The dual burden of malnutrition (DBM) is a serious public health issue affecting billions all over the globe resulting in disability-adjusted life years (DALYs), productivity losses, and economic burden. The primary fuel to the rising global disease burden is the poor-quality diet and lifestyle responsible for multiple forms of malnutrition. This review paper discusses the present challenges, interventions, and approaches to target the root of DBM problems, as healthcare treatment is unaffordable and inaccessible to all, especially for those at the bottom of the pyramid. Also, this review focuses majorly on the double duty actions targeting both undernutrition and overweight and obesity simultaneously that can help in taking appropriate measures to control the prevalence of the disease burden. The outcome of this study provides an overview of double-duty actions for an integrated DBM management system as a preventive measure that could be helpful in policymaking, strategy development, and program planning to put less burden on the healthcare system.

**Keywords:** Obesity; Undernutrition; Dietary Assessment; Anthropometrics; Dual Burden of Malnutrition; Nutrition Surveillance Framework

**Abbreviations:** DBM: Dual Burden of Malnutrition; DALYs: Disability-Adjusted Life Years; HDDS: Household Dietary Diversity Score; IDDS: Individual Dietary Diversity Score; FCS: Food Consumption Score; CNNS: Comprehensive National Nutrition Survey; NNMB: National Nutrition Monitoring Bureau; NFHS: National Family Health Survey; DLHS: District Level Household Survey; RSoC: Rapid Survey on Children

## Introduction

The current dietary transitions and changing food environments result in the double burden of malnutrition, including undernutrition (stunting, wasting, underweight, and micronutrient deficiencies) and overweight, obesity, and diet-related non-communicable diseases (WHO, 2017). According to the 2017 Global Nutrition Report, progress in addressing global malnutrition challenges and meeting targets set for 2025 is slow. The report states that a significant number of children are affected by malnutrition, with 150.8 million experiencing stunted growth, 50.5 million suffering from wasting, and 38.3 million being overweight. Additionally, the report notes that a large proportion of adults are also overweight or obese, with 2.01 billion affected. There is an urgent need to address malnutrition in all its forms to

achieve SDG 2 and Target 3.4 and the Rome Declaration on Nutrition's Commitments within the U.N. Decade of Action on Nutrition (WHO, 2017). DBM is posing a serious threat and also taking a faster pace as a silent epidemic in the country, and the present healthcare system is not conducive to solving the crisis, especially for the vulnerable population (Plan, et al. [1]). 5.87 million deaths, i.e., nearly 60% of total deaths, are due to NCDs in India, and it accounts for nearly two-thirds of all deaths in SEAR of WHO due to NCDs (Global Status Report on NCDs [2]). It is projected that diet-related health costs could be more than 1.3 trillion U.S. dollars a year, and GHG emissions cost the U.S. \$1.7 trillion a year by 2030. Shifting to healthy diets can reduce health costs by up to 97% and climate costs by 74% (SOFI). Hence, there is an urgent need to transform food systems towards the household lev-

el to overcome malnutrition's double burden. There is a raging nutrition transition in LMICS even amongst the rural population that now have access to processed and high calorie but nutrient deficient and high salt and sugary food that has replaced the traditional Indian diverse diets [The Lancet [3]]. The Disability-adjusted life years (DALY) attributed to malnutrition is of major concern as malnutrition is the leading risk factor in all age groups, indicating 4% of the total DALY of 64% population in 2017 (Swaminathan, et al. [4]). The dual burden of malnutrition (DBM) is a serious public health issue affecting billions all over the globe resulting in disability-adjusted life years (DALYs), productivity losses, and economic burden. Hence this review aims to study integrated and multifaceted approaches to address this issue.

This review discusses in detail about the co-existence of DBM, drivers, determinants and risk factors, current challenges, interventions majorly related to double duty actions and throws light on the major surveillance systems in India for malnutrition monitoring. Also, it provides an overview of the present progress and research gaps in the existing literature are discussed along with future scope. A range of literature was searched from various databases like Web of Science, NCBI, Scopus, Google Scholar, and Science Direct for the related articles. The keywords used were double burden malnutrition, double duty actions, surveillance, monitoring, policy, strategy, or interventions. The search was focused on literature from the last decade (2011-2021). A search using the following keywords search was performed, and the retrieved documents were analysed: ((dual OR double ) burden AND malnutrition ) AND ( surveillance OR monitor\* OR evaluat\* ) AND ( double AND duty OR dual OR action\* OR strateg\* OR polic\* OR intervention\* ))

## Discussion

The global problem of co-existence of DBM is characterized by the prevalence of undernutrition resulting in either stunting, wasting, or micronutrient deficiencies or diet-related non-communicable diseases parallelly with overweight or obesity. As per WHO, this can occur at multiple levels: individually, within a household, at a community level, or across a population. Overweight/obesity and undernutrition can occur in the same being. For example: At the individual level, it is commonly observed that one may experience stunted growth while also being overweight or obese; may have a short stature and carry excess weight around the abdomen; Overweight/obesity with micronutrient deficiencies (e.g., iron deficiency anemia) in children and adults. Prenatal undernutrition that results in less birth weight of the child may result in more adiposity at later stages of life. The co-existence at the household level is more common in middle-income countries.

## Drivers of DBM

The main drivers of the DBM are behavioural factors such as life-style-related, habits, psychological factors; social factors and demographics such as SES, food insecurity in that region, environmental factors such as food systems, food supply, food cost, trade policies,

built environments, cultural and social aspects, and biological factors such as epigenetics, inheritance and early life experience (Wells, et al. [5]). The nutrition transition results in complex intergenerational cycles of undernutrition associated with energy/ micronutrient inadequate diets and overweight associated with an energy-dense diet. The undernutrition cycle leads to the decreased metabolism for homeostasis and hampers the growth of an individual. On the other hand, the overnutrition cycle results in increased adiposity, compromising homeostasis. Hence, nutrition transition helps to link the biological connection with DBM (Dietz [6]). Inadequate and uncertain access to food in terms of quality, quantity, and continuity relates to the multiple forms of malnutrition. Inappropriate intake of calories, vitamins, protein, and minerals results in stunting, wasting, and micronutrient deficiencies taking undernutrition pathway. On the other hand, high calorie, nutrient-poor food, and disordered eating pattern take an obesogenic pathway resulting in overweight and obesity.

## Anthropometrics as an Indicator of Malnutrition

The anthropometric status indicators that are used to measure nutritional imbalances are stunting (low height for age), wasting (low weight for height), underweight (low weight for age) and overweight (high weight for age); MUAC (mid-upper-arm circumference) in children and BMI for adults (Anthropometric Status Indicators) According to WHO, BMI cut-offs for adults above 20 years of age is depicted in the Table 1.

**Table 1:** BMI Cut-offs as an Indicator of Malnutrition for adults.

BMI value	Diagnosis
<16	Underweight (grade 3 thinness)
16-16.99	Underweight (grade 2 thinness)
17-18.49	Underweight (grade 1 thinness)
18.5-24.99	Normal
18.5-24.99	Overweight (Pre-obese)
>30	Obese

Note: For adolescents, as per 2007 WHO growth references the operational definition values (Hadush, et al. [9]) is depicted in the table 2.

## Other Indicators of DBM

Other indicators that are also used to track the progress on malnutrition as per the Global Nutrition Report as nutrition indicators are: minimally acceptable diet, minimal dietary diversity, raised blood pressure, salt intake, minimal meal frequency, low birth weight and breastfeeding (Global Nutrition Report [7]).

## Dietary Diversity as an Indicator of Malnutrition

Dietary diversity plays a very important role in tackling the challenges related to nutritional imbalances and a diverse diet helps in combating multiple forms of malnutrition. It represents the household's availability and accessibility to a range of different type diverse foods and This metric is used as a representation of the nutritional

needs being met for a person and is seen as a measure of their nutritional adequacy. FAO recommends two dietary diversity scores HDDS (Household Dietary Diversity Score) and IDDS (Individual dietary diversity score) based upon twelve and nine food groups respectively. The HDDS system categorizes food items into the following groups: cereals, white tubers and roots, vegetables, fruits, meat, eggs, fish and other seafood, legumes, nuts and seeds, milk and milk products, oils and fats, sweets, spices, condiments and beverages. IDDS categorizes food items into nine groups: staples such as grains and roots, dark green leafy vegetables, fruits and vegetables high in vitamin A, other fruits and vegetables, organ meats, animal-based protein sources such as meat and fish, eggs, legumes, nuts and seeds, and dairy products. The majority of diets consumed are heavily focused on starchy staples and lack variety, with inadequate or less intake of fruits and vegetables and more intake of grains, resulting in deficiencies in essential nutrients. IDDS is used to predict the nutrient adequacy in an individual and is calculated based upon the food consumption score (FCS), frequency of consumption of the nine food groups recommended by an individual in a week (Islam, et al. [8]). If an individual consumes more than 4 or 4 out of the nine food groups then it is considered as adequate else inadequate if lesser than 4 out of the nine food groups recommended by WHO (Hadush, et al. [9]).

### Prevalence of DBM and Current Challenges

The pathways from inadequate food access results in DBM taking obesogenic and undernutrition pathway (SOFI - The State of Food Security and Nutrition in the World, n.d. [10]). The primary fuel to the rising global disease burden is the poor-quality diet responsible for multiple forms of malnutrition. The lack of any system to monitor what the population is consuming is a big challenge. Moreover, there is insufficient information on the collection of indicators of diet quality in terms of individual dietary data within a population across countries. One primary concern is related to the calories coming from non-staple food. The calories could be comparable from a population that consumes more fruits and vegetables to consuming more sugar and fats (Global Nutrition Report [11]). Biological pathways show a link with DBM, indicating that a person who suffered from undernutrition in childhood is at a high risk of becoming obese or overweight in adulthood and is more prone to diet related NCDs. There is a raging nutrition transition in LMICS even amongst the rural population that now have access to processed and high calorie but nutrient deficient and high salt and sugary food that has replaced the traditional Indian diverse diets (The Lancet [3]). The Disability-adjusted life years (DALY) attributed to malnutrition is of major concern as malnutrition is the leading risk factor in all age groups, indicating 4% of the total DALY of 64% population in 2017 (Swaminathan, et al. [4]). Childhood malnutrition resulting in overweight in later stages of life could be a result of gut dysbiosis, metabolic imbalances and dysregulation, inflammations, and impaired insulin signaling that results in a high risk for NCD's later with a degraded potential for homeostasis due to increased metabolic loads (Wells, et al. [12]).

### Interventions Targeting DBM

Interventions that aim to improve diet quality and lifestyle change are cost-effective and efficient ways to target the root of malnutrition problems as the healthcare treatment is unaffordable, with increased side effects and antimicrobial resistance related to drugs. Dietary interventions can play an essential role in improving health and reducing healthcare costs by contributing to rural areas' overall development. Due to rapid urbanization and globalization, westernized diets have become the go-to food due to their availability and affordability and have replaced the traditional indigenous nutritional wisdom of ethnic foods and have many health implications. There is a vast wealth of traditional knowledge within rural communities related to traditional food systems and ethno-dietary practices. Many Indian fermented foods prepared by households have many health-promoting roles owing to beneficial microorganisms in them (Tamang, et al. [13]). Food-based intervention focusing on enhanced quality and diversity through household production and consumption or at the community level can help tackle the malnutrition and related nutritional deficiencies in that region. Community-based actions to more decentralized approaches are crucial where each household can ensure their food security and well-being by utilizing existing knowledge and resources and empowering women and marginal groups (Bisht [14]).

### Primary Prevention to Address DBM

The most cost-effective and efficient solution for addressing DBM is primary prevention, including determining the major risk factors. Knowledge related to major risk factors from a population can help in taking preventing measures to control the prevalence of the disease burden. Hence there is a need for an efficient surveillance system for the assessment of significant risk factors of DBM for targeted interventions to address the issue. An integrated DBM surveillance system is crucial to take necessary preventive measures and help in policymaking, strategy development, and program planning to take preventive measures than corrective actions.

### Knowledge of Shared Common Drivers as an Approach to Target DBM

Knowledge related to shared common drivers can help strategize the dual duty actions to target DBM. The DBM challenge calls for dual duty actions to address both the challenges simultaneously. There is little evidence suggesting that the dietary factors that results in undernutrition could also possibly lead to stunting and obesity in the same individual. For example, certain foods that are used as complementary foods containing breastmilk alternatives or snacks or any kind of processed foods might provide calories but not the appropriate nourishment and micronutrients to the body and therefore could result in a higher incidence of both undernutrition and obesity or stunting in the same individual. Thus, understanding the consumption patterns can help understand the linkages between the co-exis-

tence of DBM with the dietary pattern to understand the causal relationship between them and help strategize the double duty actions to target DBM (Dietz [15]). Table 2 highlights the current work done on strategies, interventions, factors and policies to target DBM.

**Table 2:** Landscape exploration of the dynamics of DBM, highlights and research contribution.

S.No	Authors	Title	Year	Source Title	Highlights
1	Garbero A, Jäckering L (Garbero & Jäckering, 2021) [25]	The potential of agricultural programs for improving food security: A multi-country perspective	2021	Global Food Security	Examining and exploring the potential and effectiveness of agricultural programs enhancing accessibility to food, reducing food insecurity and enhancing the overall scenario.
2	[No author name available] ("Who Global Meeting to Accelerate Progress on Sdg Target 3.4 on Noncommunicable Diseases and Mental Health1," 2021) [52]	WHO global meeting to accelerate progress on sdg target 3.4 on noncommunicable diseases and mental health1	2021	Eastern Mediterranean Health Journal	Strategies, policies and action plans bringing different stakeholders together to address challenges associated with NCDs, mental health and malnutrition.
3	Torto NM, Brownell KD (Torto & Brownell, 2020) [51]	Role of food aid and assistance in addressing the double burden of malnutrition in Ghana: A qualitative policy analysis	2020	BMJ Nutrition, Prevention and Health	Policy, programs and interventions and different approaches related to food aid and assistance and the impact on addressing the DBM along with how these can be leveraged to tackle the issue.
4	Miller V, Webb P, Micha R, Mozaffarian D, Global Dietary Database(Miller et al., 2020) [36]	Defining diet quality: a synthesis of dietary quality metrics and their validity for the double burden of malnutrition	2020	The Lancet Planetary Health	Assessment of dietary metrics, defining a metrics and assessing its validity to monitor the DBM. Association between metrics and DBM is studied for better understanding the dietary intake measurement using the metrics and tackling DBM.
5	Casu L, Gillespie S, Nisbett N(Casu et al. 2020) [20]	Integrating nutrition and physical activity promotion: A scoping review	2020	PLoS ONE	A comprehensive scopus review providing information on the successful strategies, interventions and efforts for integrating physical activity and nutrition along with exploring synergies and challenges for overall health improvement.
6	Berhane HY, Jirström M, Abdelmenan S, Berhane Y, Alsanus B, Trenholm J, Ekström E.-C.(Berhane et al., 2020) [19]	Social stratification, diet diversity and malnutrition among preschoolers: A survey of Addis Ababa, Ethiopia	2020	Nutrients	The assessment of the relationship between social stratification and socio-economic factors, dietary diversity and its linkages with malnutrition is examined to plan for interventions to tackle the issue.
7	Onu JU, Osuji PN(Onu, Osuji, 2020) [40]	Double burden of malnutrition amongst patients with first-episode schizophrenia in a psychiatric hospital: A 1-year follow-up study	2020	South African Journal of Psychiatry	Investigating the DBM and unique challenges faced by people with schizophrenia and study of the factors majorly responsible.
8	Mooi NM, Ncama BP(Mooi & Ncama, 2019) [37]	Evidence on nutritional therapy practice guidelines and implementation in adult critically ill patients: A systematic scoping review	2019	Curatoris	Establishing the guidelines the implementation along with evidence on the importance of Nutritional therapy for patients in health-care settings.
9	De Silva A, Untoro J, Blankenship J, Udomkesmalee E(de Silva et al, 2019) [21]	Regional Overview on Maternal Nutrition and Examples of Health System Programme and Policy Responses: Asia and the Pacific	2019	Annals of Nutrition and Metabolism	Initiatives and policies review for understating the state of maternal nutrition to contribute and improve the status in Asia Pacific region.
10	Owino VO, Mouratidou T(Owino, Mouratidou, 2019) [41]	Strengthened Data Systems to Mitigate the Double Burden of Malnutrition: The Role of Stable Isotope Technique-Derived Nutrition Indicators	2019	Annals of Nutrition and Metabolism	Importance and reliable and accurate data and the role of stable isotope technique to tackle DBM by strengthening data systems.

11	Martin W (Martin, 2019) [33]	Economic growth, convergence, and agricultural economics	2019	Agricultural Economics (United Kingdom)	Exploration of the impact of economic growth on agricultural development, and dynamics of convergence patterns for overall development.
12	Heidari-Beni M, Kelishadi R.(Heidari-Beni, 2019) [26]	Prevalence of Weight Disorders in Iranian Children and Adolescents	2019	Archives of Iranian medicine	Assessment of overweight, obesity and underweight and insights into the nutritional status and weight related problems and disorders and causes for the issue.
13	Nyati LH, Pettifor JM, Norris SA (Nyati, et al. 2019) [39]	The prevalence of malnutrition and growth percentiles for urban South African children	2019	BMC Public Health	Examining the status and growth patterns to assess the prevalence and impact of malnutrition in Children.
14	Kshatriya GK, Acharya SK(Kshatriya, Acharya, 2019) [30]	Prevalence and risks of hypertension among Indian tribes and its status among the lean and underweight individuals	2019	Diabetes and Metabolic Syndrome: Clinical Research and Reviews	Investigating the unique characteristics and factors associated with the hypertension in the tribal population along with finding an association between hypertension and DBM.
15	Ishikawa M, Yokoyama T, Sagehashi M, Kunugita N, Miura H(Ishikawa, et al. 2018) [27]	Diagnosing the double burden of malnutrition using estimated deviation values in low- and lower-middle-income countries	2018	PLoS ONE	Assessment of nutritional status using estimated deviation values for individuals suffering from both undernutrition and overweight and obesity to present a new approach to evaluate DBM.
16	Swain S, Chowdhury S (Swain, Chowdhury, 2018) [48]	Trends of nutritional status among rural adults in six states of India: findings from national survey data	2018	Clinical Epidemiology and Global Health	Examining the nutritional status trends and analysis of the prevalence of the DBM and patterns of nutritional transition over time in rural areas and insights into nutritional challenges.
17	Djordjic V, Jorga J, Radisavljevic S, Milanovic I, Bozic P, Ostojic SM(Djordjic, et al. 2018) [23]	Thinness in young schoolchildren in Serbia: Another case of the double burden of malnutrition?	2018	Public Health Nutrition	Exploration on the prevalence of the thinness and its association with DBM and nutritional status highlighting the dynamics and complexity of the issue.
18	Enache G, Rusu E, Ilinca A, Rusu F, Costache A, Jinga M, Pănu C, Radulian G(Enache et al. 2018) [24]	Prevalence of overweight and obesity in a Roma population from southern Romania - Calarasi county	2018	Acta Endocrinologica	Examining the nutritional status and weight related issues and prevalence of overweight and obesity along with disparities faced.
19	Mersini E, Hyska J, Burazeri G(Mersini, et al. 2017) [35]	Evaluation of national food and nutrition policy in Albania	2017	Zdravstveno Varstvo	Assessing the effectiveness and impact of policy related to food and nutrition, coherence with the guidelines and strategies for implementation to address nutritional challenges.
20	Barquera S, Pedroza-Tobias A, Medina C(Barquera et al. 2016) [18]	Cardiovascular diseases in mega-countries: The challenges of the nutrition, physical activity and epidemiologic transitions, and the double burden of disease	2016	Current Opinion in Lipidology	Assessment of sociodemographic status and the association between the present epidemiologic transitions with DBM along with nutritional challenges and physical activity-related factors.
21	Pei L, Ren L, Wang D, Yan H.(Pei, et al. 2014) [43]	The evaluation of maternal health in rural western China	2014	Ethnicity and Health	Examining the specific challenges faced by mothers and their needs assessment including healthcare accessibility, antenatal care for improved maternal health.

22	Laurentin A (Laurentin, 2014) [32]	Venezuelan experience in the study of the nutrition transition: The TAN group [Experiencia venezolana para el estudio de la transición nutricional: El grupo TAN]	2014	Anales Venezolanos de Nutricion	Examining the shifts in the current dietary patterns and nutritional transitions over time and throwing light on the major factors influencing the shifts.
23	Masquelier B, Waltisperger D, Ralijaona O, Pison G, Ravélo A (Masquelier et al. 2014) [34]	The epidemiological transition in Antananarivo, Madagascar: An assessment based on death registers (1900-2012)	2014	Global Health Action	Assessing the changing patterns of mortality and the death causes over time as a result of epidemiological transitions.
24	Najeh H, Rguibi M, Kandil M, Belahsen R (Najeh, et al. 2012) [38]	Nutritional status of adolescent berber children from Anti Atlas Mountains in Morocco [Estado nutricional de adolescentes y niños bereberes de las Montañas del Anti Atlas en Marruecos]	2012	Nutricion Clinica y Dietetica Hospitalaria	Assessing the prevalence of malnutrition and examining factors related to nutritional challenges in the given population.
25	Sarmiento OL, Ramirez A, Kutschbach BS, Pinzón PL, García S, Olarte AC, Mosquera T, Atalah E, Ojeda G, Forero Y (Sarmiento et al. 2012) [46]	Nutrition in Colombian pregnant women	2012	Public Health Nutrition	Examining the nutritional status and dietary patterns of expecting mothers, highlighting the importance of adequate nutrition during pregnancy and impact on maternal and fetal health.
26	Kraak VI, Harrigan PB, Lawrence M, Harrison PJ, Jackson MA, Swinburn B (Kraak et al., 2012) [29]	Balancing the benefits and risks of public-private partnerships to address the global double burden of malnutrition	2012	Public Health Nutrition	Examining the potential of collaboration and convergence between public private partnerships to devise effective strategies and solutions to tackle DBM worldwide.
27	Hills AP, Davidsson L (P. Hills, Davidsson, 2010) [42]	Stable isotope techniques to develop and monitor nutrition interventions	2010	Current Nutrition and Food Science	Exploration of the stable isotope technique in studying nutrient absorption, metabolism and body composition highlighting the effectiveness of the monitoring tool for nutritional interventions.
28	Shetty P (Shetty, 2009) [47]	Community-based approaches to address childhood undernutrition and obesity in developing countries	2009	Nestle Nutrition Workshop Series: Paediatric Program	Examining community level interventions and strategies in improving the nutritional status and tackling DBM.
29	Khan NC, Hoan PV (Khan, 2008) [28]	Vietnam recommended dietary allowances 2007	2008	Asia Pacific Journal of Clinical Nutrition	Establishing comprehensive dietary guidelines taking into account nutritional requirements and socio-cultural aspects.

### Major Surveillance Systems to Address DBM

A surveillance system that can monitor these risk factors about what population consumes and information on the lifestyle can help in the primary prevention to address DBM. An integrated surveillance system to monitor these risk factors would help policy planning and is an essential part of any prevention program. It is evident that a more robust surveillance system adds more success to any program. Primary prevention of DBM includes monitoring the risk factors related to it that can be used as a tool to understand the current and future

prevalence of the disease in the region, and this knowledge can then be applied to target possible interventions and programs beforehand rather than taking corrective measures. Current surveillance systems focus on collecting information on individual risk factors. For NCD, risk factors focus on tobacco consumption, alcohol intake, and diet, or significantly less emphasis is given to the information related to quality and quantity, and dietary diversity of food intake. A comprehensive view of the collection of dietary risk factors information plays an essential role in advocacy. Some of the major surveys and programs that are used to collect data on malnutrition in India are discussed (Table 3).

**Table 3:** Indicators of malnutrition for adolescents.

Indicator	Value
Stunting	Height for age Z score < -2 SD
Severe Stunting	Height for age Z score < -3 SD
Thinness	BMI for age Z score < -2 SD
Severe Thinness	BMI for age Z score < -3 SD
Body mass index (BMI)	Normal Weight: BMI > 18.5 kg/m <sup>2</sup> - 25 kg/m <sup>2</sup>
	Underweight: BMI < 18.5 kg/m <sup>2</sup>
	Overweight: BMI > 25 kg/m <sup>2</sup>
MUAC	Severe acute malnutrition: MUAC < 18 cm
	Moderate acute malnutrition: MUAC 18-21 cm
	Normal: > 21 cm

**Comprehensive National Nutrition Survey:** The CNNS of India (2016-2018) conducted by MoHFW and UNICEF is the largest micronutrient survey that was used to measure malnutrition by collecting data on the nutritional status of school-age children of age group 5-9 years along with pre-schoolers of below five years of age and adolescents of age group 10-19 years. The survey monitored the nutritional status using interviews (food intake), anthropometric measurements (height/ length, MUAC, triceps, and subscapular skinfold thickness; waist circumference), and biochemical tastings (biological samples: blood, urine, and stools) for biochemical, nutritional indicators like anaemia, proteins, micronutrients, inflammatory markers, and NCDs. The survey also measured NCD risk factors such as cholesterol, diabetes, hypertension measuring blood pressure, blood glucose levels, lipid profile, renal function, along with the details on micronutrient deficiency in children and adolescents. CNNS proved to help predict the micronutrient deficiencies, risk factors of NCDs, and co-existence of DBM (Comprehensive National Nutrition Survey [16]).

**National Nutrition Monitoring Bureau (NNMB):** ICMR set up NNMB to assess the dietary intake at the individual and household level along with assessing the ongoing national nutrition programs for assessing the nutritional situation in rural and urban areas along with tribal areas. NNMB's main objectives are to access various nutritional and dietary problems that are there in the community and to monitor the nutritional situation of the country.

**National Family Health Survey (NFHS):** NFHS is a large-scale country wide survey set up by MoHFW to collect information on nutrition, anemia, reproductive health, maternal and child health, fertility, family planning, infant and child mortality. NFHS - 5 (2019-2020) collected data on child nutrition indicators: stunting, wasting, overweight along with other parameters and the data indicated that malnutrition in the country has worsened (NFHS 5).

**District Level Household Survey (DLHS):** DLHS set up by MoHFW is the first district level survey in India to access the data related to maternal and child health (MCH), hemoglobin levels, reproductive health, further to access information on the utilisation of

healthcare services (District Level Household & Facility Survey). Under DLHS 4, the data related to health of individuals and households was accessed on collecting information related to their anthropometrics (weight, height) and biochemical parameters (BP, blood glucose and hemoglobin and relevant data related to lifestyle related diseases (Ladusingh, n.d.)

**Rapid Survey on Children (RSOC):** RSOC (2013-2014) conducted by Ministry of Women and Child Development with UNICEF was used to access the status of malnutrition over NFHS-3. Under RSOC, the nutritional status was accessed by recording data on height and weight of children (0-4 years) and adolescent females (10-18 years). The survey helped in the assessment of prevalence of child stunting (low, medium and high) and wasting (low, medium and high) across the country (Rapid Survey of Wasting and Stunting in Children) [17-52].

### Research Gaps in The Existing Literature

There is a lack of an integrated surveillance system that can target the co-existence of both undernutrition and overnutrition within a population. Current surveillance systems focus upon behavioral, physical, and biochemical measurements that are exhaustive and expensive. Biochemical measurements are not always culturally accepted by some individuals, and these use invasive methods, for example, drawing out blood samples. Carrying out biochemical measurements also requires technical expertise and proper storage and handling of the samples, which increases the process's overall cost. Current nutrition surveys focus on calories, total fat, saturated fat without considering food type, quality, and processing. Energy adequacy is calculated in calories only without considering if calories are obtained from a healthy or unhealthy source. Current studies don't touch upon the importance of desired quality and quantity of food, its nature, ingredients in it, proper food, appropriate consumption manner, appropriate utensils and cooking methods and techniques as a whole. Current actions to target the dual burden of malnutrition focus on reductionistic approaches of considering single nutrient or micronutrient deficiencies linked to a specific disorder rather than working upon holistic approaches. There is a lack of a multidisciplinary framework that can address DBM by exploring the synergistic potential of integrated approaches.

### Conclusion

The co-existence of the dual burden of malnutrition is a major public health problem. The current interventions to target DBM focus either on reducing the prevalence of stunting, wasting, and micronutrient deficiencies or on overweight, obesity, or non-communicable diseases. There needs to be an integrated system that can address DBM in a single approach. The double-duty actions targeting multiple forms of malnutrition can help take appropriate measures to control the prevalence of the disease burden. An integrated DBM system is crucial to assist in policy making, strategy development, and program

planning. Holistic Nutritional Interventions might help decision-makers strengthen Healthcare Environment to address the double burden of malnutrition and primarily target those at the bottom of the pyramid.

## Acknowledgement

The author sincerely thanks IIT Delhi for supporting throughout.

## Conflict of Interest

The authors declare that they have no financial or personal relationships or affiliations that may influence the author's work or interpretation of the research findings.

## References

- Plan SA, Region SA (2016) Strategic Action Plan to reduce the double burden of.
- Burden of NCDs and their risk factors in India (Excerpted from Global Status Report on NCDs-2014). (n.d.).
- (2020) The Lancet. A future direction for tackling malnutrition. The Lancet 395(10217): 2.
- Swaminathan S, Hemalatha R, Pandey A, Kassebaum NJ, Laxmaiah A, et al. (2019). The burden of child and maternal malnutrition and trends in its indicators in the states of India: the Global Burden of Disease Study 1990–2017. The Lancet Child & Adolescent Health 3(12): 855-870.
- Wells JC, Sawaya AL, Wibaek R, Mwangome M, Poullas MS, et al. (2020a) The double burden of malnutrition: aetiological pathways and consequences for health. The Lancet 395(10217): 75-88.
- Dietz WH (2017a) Double-duty solutions for the double burden of malnutrition. The Lancet 390(10113): 2607-2608.
- (2020) Global Nutrition Report: Nutrition indicators - Global Nutrition Report. (n.d.). Retrieved September 5, 2021.
- Islam N, Akther F, Nahar Q (2015) Assessment of Micro Nutritional Malnutrition in an Urban Area of Bangladesh among the Adult Population on the Basis of Individual Dietary Diversity Score (IDDS). J Nutr Food Sci 5(3): 362.
- Hadush G, Seid O, Wuneh AG (2021) Assessment of nutritional status and associated factors among adolescent girls in Afar, Northeastern Ethiopia: a cross-sectional study. Journal of Health Population and Nutrition 40(1).
- SOFI (2018) - The State of Food Security and Nutrition in the World. (n.d.).
- (2017) Global Nutrition Report - Global Nutrition Report. (n.d.).
- Wells JC, Sawaya AL, Wibaek R, Mwangome M, Poullas MS, et al. (2020b) The double burden of malnutrition: aetiological pathways and consequences for health. The Lancet 395(10217), 75–88.
- Tamang JP, Shin DH, Jung SJ, Chae SW (2016) Functional Properties of Microorganisms in Fermented Foods. Frontiers in Microbiology 0 (APR): 578.
- Bisht I (2018) Food-based Approaches towards Community Nutrition and Health: A case of Uttarakhand Hills in North-Western India. In Journal of Food Science and Toxicology 2(1): iMedPub.
- Dietz WH (2017b) Double-duty solutions for the double burden of malnutrition. The Lancet 390(10113): 2607-2608.
- (2016) Comprehensive National Nutrition Survey.
- Anthropometric status indicators. (n.d.).
- Barquera S, Pedroza-Tobias A, Medina C (2016) Cardiovascular diseases in mega-countries: The challenges of the nutrition, physical activity and epidemiologic transitions, and the double burden of disease. Current Opinion in Lipidology 27(4): 329-344.
- Berhane HY, Jirstrom M, Abdelmenan S, Berhane Y, Alsanian B, et al. (2020) Social stratification, diet diversity and malnutrition among preschoolers: A survey of Addis Ababa, Ethiopia. Nutrients 12(3): 712.
- Casu L, Gillespie S, Nisbett N (2020) Integrating nutrition and physical activity promotion: A scoping review. PLOS ONE 15(6): e0233908.
- de Silva A, Untoro J, Blankenship J, Udomkesmalee E (2019) Regional Overview on Maternal Nutrition and Examples of Health System Programme and Policy Responses: Asia and the Pacific. Annals of Nutrition and Metabolism 75(2): 131-134.
- District Level Household & Facility Survey .... (n.d.).
- Djordjic V, Jorga J, Radisavljevic S, Milanovic I, Bozic P, et al. (2018) Thinness in young schoolchildren in Serbia: Another case of the double burden of malnutrition? Public Health Nutrition 21(5): 877-881.
- Enache G, Rusu E, Ilinca A, Rusu F, Costache A, et al. (2018) Prevalence of overweight and obesity in a Roma population from southern Romania - Calarasi county. In Acta Endocrinologica 14(1): 122-130.
- Garbero A, Jäckering L (2021) The potential of agricultural programs for improving food security: A multi-country perspective. Global Food Security 29: 100529.
- Heidari-Beni MK (2019) Prevalence of Weight Disorders in Iranian Children and Adolescents. Archives of Iranian Medicine 22(9): 511-515.
- Ishikawa M, Yokoyama T, Sagehashi M, Kunugita N, Miura H (2018) Diagnosing the double burden of malnutrition using estimated deviation values in low- and lower-middle-income countries. PLOS ONE 13(12): e0208525.
- Khan NCH (2008) Vietnam Recommended Dietary Allowances 2007. Asia Pacific Journal of Clinical Nutrition 17(S2): 409-415.
- Kraak VI, Harrigan PB, Lawrence M, Harrison PJ, Jackson MA, et al. (2012) Balancing the benefits and risks of public-private partnerships to address the global double burden of malnutrition. Public Health Nutrition 15(3): 503-517.
- Kshatriya GK, Acharya SK (2019) Prevalence and risks of hypertension among Indian tribes and its status among the lean and underweight individuals. Diabetes & Metabolic Syndrome: Clinical Research & Reviews 13(2): 1105-1115.
- Ladusingh L (n.d.). NAMS-NFI SYMPOSIUM Nutrition & Health Transition in India: Evidence from National Surveys Nutrition and Health Status: Evidence from DLHS-4 Background of DLHS.
- Laurentin A (2014) Venezuelan experience in the study of the nutrition transition: The TAN group. Anales Venezolanos de Nutrición 27(1): 185-188.
- Martin W (2019) Economic growth, convergence, and agricultural economics. Agricultural Economics (United Kingdom) 50(S1): 7-27.
- Masquelier B, Waltisperger D, Ralijaona O, Pison G, Ravélo A (2014) The epidemiological transition in Antananarivo, Madagascar: an assessment based on death registers (1900–2012).
- Mersini E, Hyska J, Burazeri G (2017) Evaluation of national food and nutrition policy in Albania. Zdravstveno Varstvo 56(2): 115-123.
- Miller V, Webb P, Micha R, Mozaffarian D (2020) Defining diet quality: a



- synthesis of dietary quality metrics and their validity for the double burden of malnutrition. *The Lancet Planetary Health* 4(8): e352-e370.
37. Mooi NM, Ncama BP (2019) Evidence on nutritional therapy practice guidelines and implementation in adult critically ill patients: A systematic scoping review. *Curationis* 42(1): e1-e13.
  38. Najeh H, Kandi M, Rguibi M, Belahsen R (2012) Estado nutricional de adolescentes y niños bereberes de las Montañas del Anti Atlas en Marruecos. *Nutr Clín Diet Hosp* 32(2): 43-47.
  39. Nyati LH, Pettifor JM, Norris SA (2019) The prevalence of malnutrition and growth percentiles for urban South African children. *BMC Public Health* 19(1): 1-13.
  40. Onu JU, Osuji PN (2020) Double burden of malnutrition amongst patients with first-episode schizophrenia in a psychiatric hospital: A 1-year follow-up study. *South African Journal of Psychiatry* 26(1): 1-6.
  41. Owino VO, Mouratidou T (2019) Strengthened Data Systems to Mitigate the Double Burden of Malnutrition: The Role of Stable Isotope Technique-Derived Nutrition Indicators. *Annals of Nutrition and Metabolism* 75(2): 119-122.
  42. P Hills A, Davidsson L (2010) Stable Isotope Techniques to Develop and Monitor Nutrition Interventions. *Current Nutrition & Food Science* 6(2): 100-104.
  43. Pei L, Ren L, Wang D, Yan H (2014) The evaluation of maternal health in rural western China. *Ethnicity and Health* 19(3): 297-310.
  44. Rajib Dasgupta, Dipa Sinha, Veda Yumnam (2016) Rapid Survey of Wasting and Stunting in Children: What's New, What's Old and What's the Buzz? (n.d.). 53: 47-49.
  45. Release of Fact sheets for National Family Health Survey-5 (2019-20) for 22 Phase-I States/ UTs. Ministry of Health and Family Welfare. GOI. (n.d.). Main.Mohfw.Gov.In.
  46. Sarmiento OL, Ramirez A, Kutschbach BS, Pinzón PL, García S, et al. (2012) Nutrition in Colombian pregnant women. *Public Health Nutrition*, 15(6): 955-963.
  47. Shetty P (2009) Community-based approaches to address childhood undernutrition and obesity in developing countries. *Nestle Nutrition Workshop Series. Paediatric Programme* 63: 227-257.
  48. Swain S, Chowdhury S (2018) Trends of nutritional status among rural adults in six states of India: findings from national survey data. *Clinical Epidemiology and Global Health* 6(4): 181-187.
  49. The double burden of malnutrition: policy brief. (n.d.).
  50. The State of Food Security and Nutrition in the World 2020 | FAO | Food and Agriculture Organization of the United Nations. (n.d.).
  51. Torto NM, Brownell KD (2020) Role of food aid and assistance in addressing the double burden of malnutrition in Ghana: a qualitative policy analysis. *BMJ Nutrition, Prevention & Health* 3(2): e000136.
  52. (2021) Who global meeting to accelerate progress on sdg target 3.4 on noncommunicable diseases and mental health<sup>1</sup>. In *Eastern Mediterranean Health Journal* 27(5): 524-525.

ISSN: 2574-1241

DOI: 10.26717/BJSTR.2023.51.008129

Namrata Tyagi. Biomed J Sci &amp; Tech Res



This work is licensed under Creative Commons Attribution 4.0 License

Submission Link: <https://biomedres.us/submit-manuscript.php>



#### Assets of Publishing with us

- Global archiving of articles
- Immediate, unrestricted online access
- Rigorous Peer Review Process
- Authors Retain Copyrights
- Unique DOI for all articles

<https://biomedres.us/>