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NUTRITIONAL INTERVENTIONS AND THEIR EFFECTIVENESS IN REDUCING MALNUTRITION AMONG RURAL CHILDREN: A REVIEW

Deepika Singh,
Research Scholar, Department of Public Health, Faculty of Humanities and Social Sciences, Shri Ramswaroop Memorial University, Lucknow-Deva Road, Uttar Pradesh, India. **E-mail:** deepikasingh2505@gmail.com
Astuti Verma,
Assistant Professor, Department of Home Science, Government Girls PG College, Banda, Uttar Pradesh, **E-mail:** astutiverma9@gmail.com
Anil Kumar,
Assistant Professor (Sociology) & Coordinator, Department of Public Health, Faculty of Humanities and Social Sciences, Shri Ramswaroop Memorial University, Lucknow-Deva Road, Uttar Pradesh, India. **E-mail:** anil.aina@gmail.com

ABSTRACT
Malnutrition remains a pervasive worldwide public fitness assignment with profound effects, especially for rural youngsters in low- and centre-profits nations. This research seriously examines the effectiveness of nutritional interventions in mitigating malnutrition among rural youngsters, which encompasses undernutrition, micronutrient deficiencies, and the burgeoning trouble of overweight and obesity. Malnutrition's multifaceted impact on bodily, mental, and social development underscores the pressing need for proof-based techniques to enhance children's fitness and survival. The study encompasses the superiority, styles, and determinants of malnutrition in numerous rural settings globally, aiming to spotlight gaps within the current literature. We critically verify the effects and challenges of diverse nutritional interventions, starting from meals-based strategies to behaviour exchange interventions. By doing so, this assessment seeks to contribute to a deeper information of effective measures to combat malnutrition in rural contexts. Key findings include an outline of India's Global Hunger Index (GHI) scores, kingdom-level malnutrition data, and government projects. While GHI rankings have visible development in India over time, child stunting, undernourishment, and infant loss persist as concerning issues. These findings underscore the significance of context-specific, proof-based interventions that address the complexities of malnutrition in rural youngsters. This comprehensive overview serves as a treasured aid for researchers, policymakers, and practitioners striving to enhance the nutritional well-being of rural children worldwide.

Keywords: Undernutrition, Micronutrient Deficiencies, Obesity, Evidence-Based Strategies, Global Hunger Index

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I. INTRODUCTION

Malnutrition is an urgent international public health challenge that casts an extended shadow over the lives of thousands and thousands of youngsters internationally, with a specifically severe impact on the ones living in low- and centre-income nations (Murarkar et al. 2020). Its outcomes, both on the current and enduring, ripple through the bodily, mental, and social improvement of children, affecting not only their health but also their probabilities of survival. Malnutrition takes on various guises, encompassing undernutrition, micronutrient deficiencies, and the spectre of overweight or weight problems, a developing challenge in the world.

Undernutrition, a heart-wrenching manifestation of this trouble, is defined with the aid of kids grappling with low weight-for-age (underweight), stunted growth as a result of insufficient hight-for-age (stunting), or the alarming deficit in weight-for-hight/length (wasting). On the turn side, micronutrient deficiencies underscore the absence of important nutrients and minerals, together with iron, iodine, Vitamin A, and zinc, which might be crucial for wholesome development. Amid this tricky panorama of malnutrition, there's also a growing tide of obesity, characterized with the aid of the accumulation of excessive frame fat that threatens to undermine the well-being of the affected youngsters.

Compounding the complexity of this venture is the dual challenge of malnutrition arises as a disconcerting phenomenon, wherein both undernourishment and excessive weight or weight problems coexist within a given community, family, or even an individual. This dual agony is becoming increasingly prevalent, especially in rural regions, where getting admission to healthcare, sources, and schooling can be confined. Rural children, specifically, bear the brunt of these dietary disparities. They confront a constellation of hazard factors that amplify the effect of malnutrition, consisting of poverty, meal insecurity, confined nutritional diversity, inadequate access to healthcare, environmental pollution, and educational deficits. Moreover, the nutritional wishes and demanding situations confronted by rural children range substantially based totally on elements consisting of age, gender, and developmental level.

In reaction to the pervasive and multifaceted hassle of child malnutrition, numerous nutritional interventions have been developed and deployed. These interventions are designed to prevent, deal with, or mitigate malnutrition amongst kids, and they can be categorised into two number one procedures: particular vitamins and vitamins-sensitive interventions (Caleyachetty et al 2023). Nutrition-specific interventions consist of strategies inclusive of supplementation, fortification, dietary diversification, and therapeutic feeding, with a right-away focus on enhancing the dietary popularity of youngsters. Nutrition-sensitive interventions, then again, intend to cope with the underlying determinants of malnutrition by enhancing maternal health, promoting breastfeeding, improving sanitation and hygiene, and empowering ladies in these communities. These interventions may be added through a range of structures, such as healthcare centres, colleges, community centres, and families etc.

The rationale of this comprehensive research is twofold: to find out the present body of past studies concerning the prevalence, patterns, and factors affecting malnutrition among rural youngsters in one-of-a-kind areas of the sector, and to significantly look at the effectiveness

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and demanding situations related to numerous dietary interventions concentrated on this susceptible populace. By doing so, we are searching to shed light on the gaps and limitations within the current evidence, offering precious insights for future research and informing nice practices in addressing the continual problem of infant malnutrition in rural settings. As we embark on this journey through the tricky landscape of youth malnutrition in rural areas, we aim to contribute to the ongoing effort to improve the fitness and children's health going through those daunting demanding situations.

II. LITERATURE REVIEW

Nutrition is one of the agendas of development worldwide and especially for developing nations like India. The problem of malnutrition in India has been examined anomaly thrown up by statistical averages. It could be explained through intensive approaches that complement or triangulate survey data on the basis of clinical, statistical and socio-cultural aspects to disclose nuance that statistical patterns and the linear theories cannot initially capture (Sujatha 2017:299).

Malnutrition is a situation as a result of an insufficient or imbalanced consumption of vital vitamins essential for the preservation of overall fitness and physical features. It primarily manifests in principal paperwork: undernutrition and overnutrition (UNICEF 2019). Undernutrition occurs whilst there may be a deficit in energy, protein, or micronutrient consumption, leading to situations like losing, stunting, underweight, or micronutrient deficiencies. In contrast, overnutrition arises from an excess of energy consumption, resulting in issues together with overweight, obesity, or metabolic disorders.

Malnutrition amongst rural kids stands as a giant public health task, profoundly impacting their boom, development, and survival. This quandary arises from a multitude of complex factors, encompassing organic, environmental, social, monetary, and behavioural factors. Contributing elements encompass poverty, confined dietary variety, insufficient maternal and childcare practices, infectious ailments, limited access to healthcare services, and low stages of education. The results of malnutrition in rural children are intense and enduring, affecting their bodily, cognitive, and emotional well-being (Mrimi et al. 2022). It weakens their immune systems, heightens vulnerability to infections, impedes getting to know competencies, reduces productiveness, and increases the risk of continual sicknesses and death rate (Abded Wahid et al. 2017).

Numerous studies have investigated the efficacy of nutritional interventions designed to combat malnutrition in rural regions. These interventions may be extensively labelled into 3 important kinds: food-based, supplementation, and conduct exchange interventions (Singh 2020). Food-based interventions aim to beautify the nice and accessibility of food for rural populations, encompassing strategies like meal fortification, biofortification, home gardening, and college feeding packages. Supplementation interventions recognise handing over unique vitamins or power to inclined businesses through means like micronutrient powders, geared up-to-use therapeutic ingredients or lipid-based totally nutrient dietary supplements. The behaviour change intervention's goal is the promotion of the highest quality feeding and care

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practices through techniques like nutrition schooling, counselling, and social advertising and marketing. Despite the wealth of research on nutritional interventions, there are outstanding gaps within the current literature that warrant further exploration:

Lack of Comprehensive Evaluation: A shortage exists in the availability of thorough and comprehensive assessments related to the impact and cost-effectiveness of various intervention categories across multiple dimensions, including anthropometric, biochemical, functional, and behavioral indicators.

Limited Understanding of Contextual Factors: The contextual elements influencing intervention, implementation and sustainability, such as the availability and acceptability of assets, the capability and motivation of stakeholders, and cultural and social norms, are not properly understood. These elements can appreciably influence the achievement of dietary interventions.

Insufficient Integration and Coordination: The lack of integration and coordination of interventions throughout numerous sectors such as health, ICDS, agriculture, schooling, fitness and social safety, hampers the fulfilment of synergistic and holistic effects. A greater cohesive technique ought to enhance the general effect of interventions.

These studies' gaps underscore the want for context-particular, evidence-primarily based interventions to cope with the difficult and dynamic nature of malnutrition in rural regions. This study's mission goal is to bridge those gaps by undertaking a scientific evaluation of the present literature on dietary interventions in rural areas and through conducting a case take a look at that delves into a selected intervention in a rural setting. Through this multifaceted technique, we propose to make contributions to a higher understanding of how to fight malnutrition and improve the well-being of rural kids (Murarkar et al 2020).

Deaton and Dreze (2009) have developed three hypotheses to understand malnutrition in India on the basis existing knowledge which are:

I. "Social determinants" hypothesis: Stunting among privileged children reflects social factors such as a poor epidemiological environment, inadequate social support, and inappropriate social norms relating (say) to breastfeeding or child feeding.
II. "Genetic potential" hypothesis: Indian children do not have the same genetic potential as children in the international reference population – they are "naturally" shorter, even when they are well-nourished.
III. "Gradual catch-up" hypothesis: Indian children have the same genetic potential as children in the reference population, but it takes time for the heights of privileged children to catch up with the genetic potential, given the history of undernutrition.

National health mission has adopted the suggestion of Abhya Bang and others (1999) to improve health education and home-based neonatal care (HBNC) programmes to reduce by nearly half of the infant mortality rate (IMR), even in populations with poor economic and nutritional status, and low female literacy.

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III. OBJECTIVE OF THE STUDY

This study conducts a comprehensive review of nutritional interventions targeted at reducing malnutrition among rural children. By assessing the effectiveness of these interventions and their impact on the prevalence of malnutrition in diverse rural settings, we aim to contribute to the growing body of knowledge on this critical public health issue and provide insights that can inform evidence-based strategies for improving the nutritional well-being of rural children globally.

IV. METHODOLOGY

This research paper adopts a secondary data analysis method. Secondary data used from existing and publicly available data sets, research reports, and scholarly literature related to malnutrition and nutritional interventions among rural children. The data used in this study have previously been collected by other researchers or organizations.

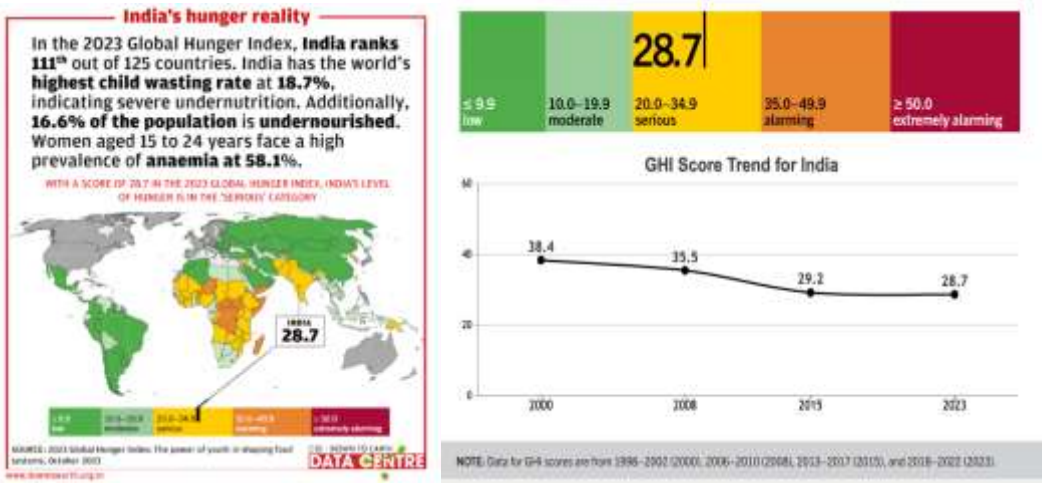
Data Selection Criteria: The data selection process is guided by relevance to the research objectives. Only data sources that directly address malnutrition among rural children and nutritional interventions will be included. Data quality, representativeness, and coverage of the study period are key considerations.

V. DATA ANALYSIS & DISCUSSIONS

Table 1: Global Hunger Index- India Score

Sl. No.	Year	GHI Score	GHI Severity
1	2010	19.8	Moderate
2	2015	21.5	Serious
3	2018	20.9	Serious
4	2020	18.2	Moderate
5	2021	18.7	Moderate
6	**2023**	**28.7**	**Serious**

Source: GHI



In 2023, the GHI score of India is at 28.7, placing it in the "serious" category on the Severity of "GHI Hunger Scale". This reflects a slight improvement from India's score of 29.2 in

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2015, which was also categorized as "serious". Significant progress has been made analysing the distressing GHI values of 38.4 and 35.5 in 2000 and 2008 respectively showcasing the efforts taken by India to combat hunger and malnutrition. Child stunting remains a concern with a prevalence of 35.5%, as reported by "India's National Family Health Survey (NFHS)" for the years 2019-2021. The "State of Food Security and Nutrition" in the World Report for 2023 indicates that 16.6% of the population in India experiences undernourishment. Notably, the child-wasting rate of India is 18.7%, making it the country with the highest child-wasting rate in the report, according to India's NFHS data from 2019-21. The "United Nations Inter-Agency Group for Child Mortality" estimated in January 2023 that the under-five mortality rate in India stands at 3.1. On a global scale, the report published by GHI 2023 highlights countries like "Belarus, Bosnia & Herzegovina, Chile, and China" as top-rated nations with minimal hunger. Conversely, "Yemen, Madagascar, and the Central African Republic" are ranked below in levels. 18.3 is the world's GHI score in 2023, indicating a "moderate" level of hunger, with only marginal improvements since 2015. Since 2017, there has been a concerning increase in the existence of undernourishment, rising from 572 million to about 735 million people as reported by the GHI. The GHI attributes this stillness to a combination of shortfalls, including climatic transition, conflicts, economic turn sides, the COVID-19 pandemic, and currently the Russia-Ukraine war. These problems have created social and economic inequalities and have impeded development in the global effort to reduce hunger and malnutrition.

Table 2: "Malnutrition Rates in India- State-wise Details 2015-2021"

S. No.	India/State/UT	Stunting (%)		Wasting (%)		Underweight (%)		Women whose Body Mass Index (BMI) is below normal (BMI <18.5 kg/m2) (%)	
		NHFS 4 (2015-16)	NHFS 5 (2019-21)	NHFS 4 (2015-16)	NHFS 5 (2019-21)	NHFS 4 (2015-16)	NHFS 5 (2019-21)	NHFS 4 (2015-16)	NHFS 5 (2019-21)
	India (Average)	**38.4**	**35.5**	**21.0**	**19.5**	**35.8**	**32.1**	**22.9**	**18.7**
	States								
1.	Andhra Pradesh	31.4	31.2	17.2	16.1	31.9	29.6	17.6	14.8
2.	Arunachal Pradesh	29.4	28	17.3	13.1	19.4	15.4	8.5	5.7
3.	Assam	36.4	35.3	17	21.7	29.8	32.8	25.7	17.6
4.	Bihar	48.3	42.9	20.8	22.9	43.9	41	30.4	25.6
5.	Chhattisgarh	37.6	34.6	23.1	18.9	37.7	31.3	26.7	23.1
6.	Goa	20.1	25.8	21.9	19.1	23.8	24	14.7	13.8
7.	Gujarat	38.5	39	26.4	25.1	39.3	39.7	27.2	25.2
8.	Haryana	34	27.5	21.2	11.5	29.4	21.5	15.8	15.1
9.	Himachal Pradesh	26.3	30.8	13.7	17.4	21.2	25.5	16.2	13.9
10.	Jharkhand	45.3	39.6	29	22.4	47.8	39.4	31.5	26.2
11.	Karnataka	36.2	35.4	26.1	19.5	35.2	32.9	20.7	17.2
12.	Kerala	19.7	23.4	15.7	15.8	16.1	19.7	9.7	10.1

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13.	Madhya Pradesh	42	35.7	25.8	19	42.8	33	28.4	23
14.	Maharashtra	34.4	35.2	25.6	25.6	36	36.1	23.5	20.8
15.	Manipur	28.9	23.4	6.8	9.9	13.8	13.3	8.8	7.2
16.	Meghalaya	43.8	46.5	15.3	12.1	28.9	26.6	12.1	10.8
17.	Mizoram	28.1	28.9	6.1	9.8	12	12.7	8.4	5.3
18.	Nagaland	28.6	32.7	11.3	19.1	16.7	26.9	12.3	11.1
19.	Orissa	34.1	31	20.4	18.1	34.4	29.7	26.5	20.8
20.	Punjab	25.7	24.5	15.6	10.6	21.6	16.9	11.7	12.7
21.	Rajasthan	39.1	31.8	23	16.8	36.7	27.6	27	19.6
22.	Sikkim	29.6	22.3	14.2	13.7	14.2	13.1	6.4	5.8
23.	Tamil Nadu	27.1	25	19.7	14.6	23.8	22	14.6	12.6
24.	Telangana	28	33.1	18.1	21.7	28.4	31.8	22.9	18.8
25.	Tripura	24.3	32.3	16.8	18.2	24.1	25.6	18.9	16.2
26.	Uttar Pradesh	46.3	39.7	17.9	17.3	39.5	32.1	25.3	19
27.	Uttarakhand	33.5	27	19.5	13.2	26.6	21	18.4	13.9
28.	West Bengal	32.5	33.8	20.3	20.3	31.6	32.2	21.3	14.8
	Union Territories								
1.	Andaman & Nicobar Islands	23.3	22.5	18.9	16	21.6	23.7	13.1	9.4
2.	Chandigarh	28.7	25.3	10.9	8.4	24.5	20.6	13.3	13
3.	Dadra & Nagar Haveli, Daman & Diu	37.2	39.4	26.7	21.6	35.8	38.7	23.4	25.1
4.	NCT Delhi	31.9	30.9	15.9	11.2	27	21.8	14.9	10
5.	Jammu & Kashmir	27.4	26.9	12.1	19	16.6	21	12.2	5.2
6.	Ladakh	30.9	30.5	9.3	17.5	18.7	20.4	10.5	4.4
7.	Lakshadweep	26.8	32	13.7	17.4	23.6	25.8	13.5	8
8.	Puducherry	23.7	20	23.6	12.4	22	15.3	11.3	9

Source: PIB, NFHS-5.

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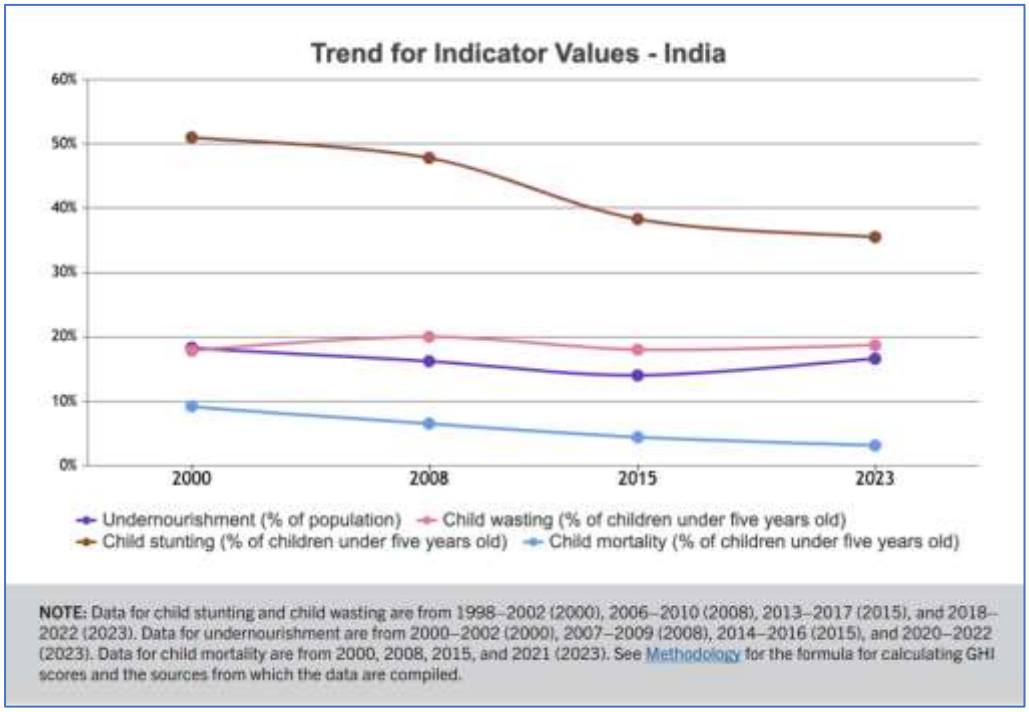

Table 2 provides a comprehensive overview of the nutritional status in various Indian states and Union Territories, comparing data from the "National Family Health Survey" (NHFS) 4 (2015-16) to NHFS 5 (2019-21). It focuses on critical indicators, including stunting, wasting, underweight, and the proportion of female's ratio with a "Body Mass Index" (BMI) below the actual range. Across the surveyed regions, it is evident that there have been mixed changes in these nutritional indicators over the years. Stunting, which reflects chronic undernutrition, has witnessed both improvements and setbacks. While some states, such as Andaman & Nicobar Islands, Andhra Pradesh, and Kerala, have shown reductions in stunting, others like Jharkhand and Meghalaya still grapple with high stunting rates. Significantly, stunting is an intricate issue determined by multiple parameters, including sanitation, genetics, and food utilization. The wasting indicator, which signifies acute malnutrition, has displayed versions as nicely. States like Chandigarh and Sikkim have seen vast enhancements, while others, which include Assam and Uttar Pradesh, hold to stand demanding situations in addressing wasting amongst youngsters.

Underweight incidence has also fluctuated. Bihar and Jharkhand, for example, have suggested discounts for underweight youngsters, reflecting upgrades in nutritional consequences. However, states like Meghalaya and Telangana have confronted hurdles in this regard. Furthermore, the statistics show the proportion of women with a BMI beneath the normal variety. This indicator is vital for assessing the nutritional well-being of ladies, in particular for the duration of pregnancy and lactation. While a few states, inclusive of Delhi and Goa, have made progress in enhancing women's nutritional popularity, others like Bihar and Madhya Pradesh still have work to do.

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VI. FUTURISTIC APPROACH

The Government of India has prioritized numerous key sports below Mission Saksham Anganwadi and Poshan 2.0 to combat malnutrition efficaciously. The 'Poshan Tracker' ICT Application, advanced via way of the Ministry of Women and Child Development, performs a pivotal role in this attempt. Over 1.396 million Anganwadi Centres are registered on this platform, reaping benefits greater than 103 million beneficiaries, along with pregnant girls, lactating mothers, kids under 6 years in rural regions, and adolescent women. The Poshan Tracker carries WHO's advanced tables for nutritional assessment.

Leading international organizations, consisting of UNICEF, WHO, and the World Bank, have stated the significance of the Poshan Tracker within the vitamins region. This recognition has paved the way for collaborative help from those companies. Moreover, the Government's willpower for meal protection is exemplified through the Pradhan Mantri Garib Kalyan Anna Yojana (PMGKAY), which was modified into launched to mitigate the financially worrying conditions attributable to the COVID-19 pandemic. This initiative allocated about 111. Eight million metric tonnes of meal grains over 28 months, with a deliberate monetary outlay of about Rs. 3.91 lakh crore, reaping benefits to almost 800 million individuals. An extension of PMGKAY for another 12 months guarantees the provision of loose meal grains to AAY and PHH beneficiaries under NFSA, 2013, with an anticipated expenditure of almost Rs. 2 lakh crore. These whole efforts show India's commitment to addressing malnutrition and meal safety, making a terrific-sized impact on the well-being of its residents whilst emphasizing the significance of correct measurement gear in know-how and addressing those worrying conditions.

From April 2023 to September 2023, there was a continuous boom in the records uploaded at the Poshan Tracker, especially concerning children under the age category of five years and below. From April 2023 to September 2023, the numbers increased from 63.4 million to 72.4 million. Notably, the Poshan Tracker always reviews a child-wasting rate ranging under 7.2% each month. This is in stark contrast to the 18.7% baby-wasting rate indicated with the aid of the Global Hunger Index for 2023. These figures underscore the massive divergence between the Poshan Tracker's greater optimistic tests and the GHI's less favourable estimations of toddler vitamins.

VII. CONCLUSION

In keeping with guidance from the “World Health Organization” (WHO), adopting a healthful weight-reduction plan is important in preventing various kinds of malnutrition and lowering the risk of noncommunicable illnesses like diabetes, coronary heart ailment, stroke, and cancer. A wholesome weight-reduction plan includes the inclusion of fruits, greens, vegetables, nuts, and wholesome grains while limiting the intake of processed sugars, saturated fat, trans fat, and salt. The “WHO” recommends that adults must intend to consume not less than 400 grams of fruits and veggies each day, restrict processed sugars to less than 10% of general consumption, limit saturated fats below 10% of regular energy intake, limit trans fats to much below 1% of total intake, and take less than 5 grams of salt day by day.

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For comprehensive and up-to-date statistics on diverse nutrient-associated subjects, inclusive of wholesome eating, low cholesterol, excessive blood pressure, obesity, alcohol use, breastfeeding, little one and infant vitamins, and meal safety, the "Centres for Disease Control and Prevention" (CDC) serve as a dependable source. They provide public fitness records and resources to help people make knowledgeable picks approximately their nutrition and average well-being. Additionally, the "Food and Drug Administration" (FDA) performs a pivotal function in assessing the accuracy and transparency of food and nutritional supplement labelling. They mandate that specific records be displayed on product labels, inclusive of the vitamins statistics panel, component listing, serving length, in line with cent everyday values, and health claims. This regulatory oversight with the aid of the FDA aids purchasers in making informed selections concerning the nutritional content material of the products they consume. Alongside efforts need to be made to combat food wastage through enhancements in warehousing or cold storage centres. The "International Institute of Refrigeration" reveals that by providing developing countries with refrigeration infrastructure equivalent to that of developed nations, approximately foods constituting 200 million tonnes, equivalent to 14% food supply, could be saved. This significant reduction in food wastage holds the potential to contribute to the fight against hunger and malnutrition.

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