IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 09, 2022

SEASONAL VARIATIONS AND THEIR EFFECTS ON NUTRITIONAL STATUS OF CHILDREN AGED 6 TO 59 MONTHS IN RURAL AREAS OF UTTAR PRADESH

[1]Deepika Singh, [2]Astuti Verma, [3]Anil Kumar

[1]Research Scholar, Department of Public Health, Faculty of Humanities and Social Sciences, Shri Ramswaroop Memorial University, Lucknow- Deva Road, District- Barabanki, Uttar Pradesh, India.

[2]Assistant Professor, Department of Home Science, Government Girls PG College, Banda, Uttar Pradesh, India.

[3]Assistant Professor (Sociology) and Coordinator, Department of Public Health, Faculty of Humanities and Social Sciences, Shri Ramswaroop Memorial University, Lucknow-Deva Road, District- Barabanki, Uttar Pradesh, India.

ABSTRACT

Inadequate healthcare, lack of nutritional education, and social inequality all contribute to child malnutrition, which is a major problem in rural India. This research measures the frequency of malnutrition among children in rural Lucknow ranging from 6 to 59 months old, finds important risk variables, and examines the level of mother awareness of child nutrition. The study used a cross-sectional design and measured mothers' height, weight, and waist circumference in addition to conducting structured interviews.

According to the results, stunting, wasting, and underweight were the most common forms of malnutrition. Low family poverty, maternal education, insufficient food variety, and bad feeding habits are major factors. Food taboos and the early end of nursing are two cultural customs that impact children's diets. According to regression analysis, there are robust correlations between socioeconomic position, maternal education, healthcare accessibility and malnutrition.

The research highlights the need to improve hospital facilities, implement targeted nutrition education, and bolster policy initiatives, such as ICDS. If these problems are addressed via community-driven initiatives and maternal empowerment, child nutrition and health in rural India may improve in the long run.

Keywords: Malnutrition, Risk Factors, Rural Health, Socioeconomic Status, India

INTRODUCTION

Low birth weight affects over 20.5 million babies worldwide, stunting affects about 149.2 million children under five, and causes 45.4 million to be hungry [1]. Negative impacts on health, cognitive development, academic success, and lifetime earnings are associated with stunted growth in children, which is caused by under nutrition [2]. In addition to breast milk or formula, children, particularly those between the ages of 6 and 23 months, need nutrient-dense and energy-rich meals that include dairy products, eggs, fruits, and vegetables [3]. There is an increased risk of growth retardation and insufficient nutrient intake in children living in low-income countries (LMICs) because family meals there tend to be poor in nutritional density [4].

Developed and developing nations alike continue to face the alarming public health crisis of malnutrition in all its forms, including overweight and obesity, under nutrition, wasting,

stunting, micronutrient deficiencies, and diet-related non-communicable diseases like diabetes and cardiovascular disease [5]. "One Asian country that is now facing a triple burden of malnutrition when overweight coexists with stunting and anaemia is Malaysia, according to the Country Nutrition Report by Global Nutrition Report [6]." Finding and fixing the sources of public health problems must be a top priority. Teenagers are defined as those between the ages of 10 and 19, according to the World Health Organisation (WHO) [7]. There is widespread agreement that adolescence is a pivotal time in a person's life when they undergo enormous social, physiological, and anatomical changes. Throughout all stages of autonomy development, children engage in complex interactions with their families, communities, and cultures as they continue to explore and construct their identities throughout this transitional time from infancy to adulthood [8]. "Throughout the pubertal transition, which occurs throughout this dynamic time of human development, a growth spurt requires additional macronutrients and micronutrients, making teenagers nutritionally susceptible [9, 10]". Impaired growth, osteopenia, anaemia, and retarded sexual maturation are just a few of the ways that adolescents might suffer from the effects of malnutrition, which have been linked to the early development of chronic illnesses in adulthood [11]. Worldwide, most people's health and ecological systems are in peril from the triple whammy of climate change, obesity, and undernourishment in this twenty-first century [12]. Real changes in the long-term climate change averages will not be seen for decades or centuries. However, the fluctuations people see daily are only outliers around a stable mean, which is called climatic variability [13]. Critical aspects of food security are already being impacted by climate change, which has substantial effects on the food system and the environment. Tus poses a threat to people's well-being. Meanwhile, people are dealing with daily climate change, which adds to the worrisome malnutrition rates [14]. "There is a significant but complex relationship between weather variables such as rainfall, severe weather events, seasonality, and temperature and malnutrition at the household level, according to a comprehensive evaluation of the current efforts to quantify the effect of climate change on undernourishment [15–17]". Crop yields, fisheries, and livestock output are all susceptible to the cumulative effects of climate change, whether that change is short- or long-term. Economic losses and disruptions to the internal equilibrium food supply might emerge from these changes to the food production system, leading to price surges that make food inaccessible and unaffordable. Because of this, people's eating habits and how they use food have evolved to accommodate these adverse conditions—additionally, considerations of food safety and nutritional quality impact food utilization. These alterations will impede the elimination of malnutrition in all its manifestations.

In addition, low-income urban areas are more likely to be in the path of natural disasters, rely on resources that are particularly vulnerable to the effects of climate change, and have fewer resources and less ability to adapt to and deal with sudden or unexpected threats. In the meantime, UNICEF Malaysia research [17] on low-income urban areas in Kuala Lumpur found that undernourishment affects more than 10% of children, which is worse than the national prevalence [18]. As a result of commodity inflation and decreased agricultural output, people may change their eating habits to include more cheap but unhealthy food. This brings up concerns over the potential effects of climate change as a yet unseen confluence of

factors threatening the nutritional quality of Malaysia's urban poor and undermining food security. A Tanzanian family research found that people cut down on calories by about 11% when temperature fluctuation increased [10]. In some countries, such as Yemen, Ethiopia, and Bangladesh, there is a positive association between rising average temperatures and the prices of wheat and maize [19]. Consequences of climate unpredictability, such as a scarcity of vegetables on wet days, drive an increase in their price and reduce the amount of nutritious food this vulnerable group consumes overall [12]. Therefore, food insecurity seems to be a major issue for this group. As a result, community members have to eat the same unhealthy food every day, which might stunt the development of children and teenagers over time [10, 20]. Unless anything is done, the majority of urban poor children and adolescents will have to deal with the increasing likelihood of food insecurity and malnutrition caused by climate change and variability [20]. “Furthermore, the United Nations Sustainable Development Goals (SDGs) have acknowledged that combating climate change, ensuring food security, and ending hunger are among the most pressing issues facing the global community today [21]”. Food utilization, nutritional quality, production, consumption, and food safety are all areas in which climate-related effects might impact malnutrition. “A recent meta-analysis and systematic review conducted by Stelmach-Mardas et al [22] confirmed that consuming certain foods—such as fruits, vegetables, eggs, meat, cereals, and alcoholic beverages—may vary with the seasons”. The researchers also found that people consume more calories during the winter or post-harvest season. More alcoholic and non-alcoholic drinks are drunk during the dry season in tropical nations like Cambodia. In contrast, more rice, starchy roots, vegetables and products, sauces, and spices are consumed during the rainy season [23]. “Another study conducted in the North of Ghana highlighted the effects of seasonal variation on dietary diversity, Specifically, the study found that during rainy seasons, people ate more dark green leafy vegetables; during dry seasons, people ate more deep yellow, orange, and red vegetables [24].” The detrimental effects on nutrition are worsened because the increased inter-seasonal climatic variability intensifies nutrient intake fluctuations. The fact that seasonal fluctuations in childhood malnutrition are so common lends credence to this. Acute malnutrition is more common during the dry season than during the rainy season, according to longitudinal research done in rural east Ethiopia [25]. “In contrast, however, during the dry season, Ghana's research found that height-for-age and body mass index-for-age were better than during the rainy season [26].” Decreased physical activity is another potential connection between climatic fluctuation and malnutrition, particularly obesity. When it is too hot or too cold to go outside, even for a short jog or stroll, people tend to be less active, according to previous studies [27]. Research has shown that children's physical activity levels fluctuate with the seasons. For example, compared to other seasons, spring is associated with a higher level of healthy physical activity [28]. According to US research, teenagers are less active in the winter, on days with less sunshine and rain, and more active on days with more sunshine and no rain [29]. Climate fluctuation significantly impacts the degree of physical activity, as this finding further confirms. Important factors in determining whether or not a person experiences malnutrition include their exposure to food and physical activity in the environment. An increase in malnutrition may result from a community-wide push for bad eating habits and lack of physical activity [30]. As the globe becomes increasingly urbanized,

city people face the problems of food deserts, where access to good food markets is restricted or difficult, and food swamps, where there is an excess of bad food rich in calories but poor in nutrients and processed. These occurrences disproportionately affect Communities in metropolitan areas with high poverty rates [31]. Adolescents' and children's nutrition and health might suffer greatly if nutrient-dense food is not readily available and accessible [31, 32]. Recreational facilities, parks, green spaces, land use, and transportation infrastructures are all examples of built environments that interact with one another to affect people's capacity to get the prescribed amount of exercise. Due to the urban environment and its characteristics, people are less likely to be physically active [33]. Some major obstacles to leading an active lifestyle, such as high-density traffic, a lack of sidewalks, parks, and recreational facilities, and concerns about neighbourhood safety (e.g., crime and violence), are important factors [34, 35]. Factors such as a neighbourhood's walkability and, by extension, its weight status are influenced by the density of built spaces, the transit system, and mixed land use [36].

I.LITERATURE REVIEW

At 104.3 million, or 8.6% of the overall population, 104.3 million individuals are considered members of India's Scheduled Tribe (ST) tribe, making it the biggest tribal population in the world [37]. The persistent problems of undernourishment are highlighted by new statistics that show that 35.5 per cent of children 0–59 months old have stunted development, 19.3 per cent experience wasting, and 32.1 per cent are underweight [38]. “Further alarming levels of under nutrition were shown in studies conducted in Kerala, Madhya Pradesh, Jharkhand, and Maharashtra.” Among tribal children aged 0–59 months, there were significant rates of stunting (40–60%), wasting (20–27%), and underweight (48–53%) [39,40,41,42]. Not only that but among children aged 12-59 months, anaemia is concerningly common (91.2% of cases), as are iron deficits (50%) and vitamin B12 deficiencies (35% of cases) [39-42].

The research occurred in Attappady, a famous tribal stronghold in the Indian state of Kerala. An example of a developing nation that has made great strides in health care and social services, the Indian state of Kerala is well-respected for these accomplishments [43]. “There is a disproportionately high rate of newborn and infant mortality among the state's indigenous tribal groups, especially in the Attappady region”. This area is home to indigenous tribes, including the Irula, Muduga, and Kurumba. From 2012 to 2022, 136 infants died in the area. The leading causes of mortality were complications during pregnancy, low birth weight, pre-eclampsia, ARDS, and anaemia. Many mothers also reported dietary deficits [44].

Women of childbearing age (WRA) have specific dietary requirements, especially in the months leading up to and during pregnancy and nursing. “In order to have enough energy to become pregnant and to keep themselves and their babies healthy, they need to eat healthily. Pregnancy complications include stillbirth, low birth weight, wasting, and developmental delays in infants when mothers do not get enough iodine, iron, folate, calcium, and zinc in their diets [45].” Inadequate levels of these minerals may also lead to maternal mortality, haemorrhage, pre-eclampsia, and anaemia [45,46,47]. Thus, it is acknowledged that inadequate maternal food and nutrition might exacerbate bad mother and child health outcomes.

Various variables, including heavy workloads, illnesses, cultural norms, and reproductive duties, might impact how women's nutrition is affected by seasonal food shortages. "Household responsibilities, social obligations, paid labour, and heavy agricultural labour during peak seasons often include women working from dawn to sunset throughout the year [48]". An energy imbalance and undernourishment might result from this excessive labour and little sustenance during lean seasons [49]. A vicious cycle is created when under nutrition is exacerbated by illness [50]. Under nutrition may occur when a person is sick because they lose their appetite, absorb fewer nutrients, and burn more energy than they take in [51]. Consequently, undernourishment might amplify the occurrence and intensity of diseases [52]. Reducing women's productivity and increasing healthcare costs may harm family wealth [53]. Infectious illnesses such as malaria, anaemia, and intestinal parasite infestation were shown to be predictors of under nutrition in women in an Ethiopian study [54, 55]. Illness worsens women's nutritional condition when they have limited decision-making authority, little access to competent healthcare, and inadequate funding for treatment [56]. The quantity and quality of food women consume are influenced by cultural norms, contributing to their under nutrition [57]. Studies reveal that women in many nations often fail to fulfil these requirements, particularly during times of food scarcity, even though their nutritional demands are rising during pregnancy and nursing [58]. Since women are often engaged in food production, buying, preparation, preservation, and allocation, it is crucial to prioritize their nutrition [59]. When mothers have extra money, they usually use it towards their children's healthcare and education [60]. Consequently, the woman's and her family's health depends on her eating well. Studies conducted in Nepal, Madagascar, and Ethiopia have shown that family food security, dietary variety, and food intake may vary with the seasons [61]. "Still, researchers have not done enough to determine how these differences affect the nutritional health of reproductive-age women, Women who are not yet mothers or who are unable to conceive are often excluded from nutrition-related research in Ethiopia and other low-income countries, as do mothers with children under the age of five or who are pregnant [62]". Understanding the importance of women's diet and how to make improvements goes beyond their reproductive health. It is crucial to ensure the well-being of women in Africa since they constitute over 40% of the agricultural labour force [63]. This highlights their substantial economic contribution.

II.METHOD

A. Research Design

The nutritional status of children in rural Lucknow, ranging from six months to five years old, was examined in this quantitative study that used a cross-sectional survey methodology. Factors influencing child nutrition, including demographics, socioeconomic status, and health, are the primary focus of the research.

B. Sample Selection

A total of 377 children were selected using stratified random sampling. The sample was drawn from various villages to ensure diversity in socioeconomic backgrounds. Inclusion criteria required children within the specified age range, while exclusion criteria eliminated cases with incomplete data.

C. Data Collection Methods

Primary data were collected through structured questionnaires administered to parents or guardians. Anthropometric measurements, dietary intake assessments, and household surveys were conducted. The questionnaire included sections on:

- Demographic details
- Socioeconomic status
- Breastfeeding and weaning practices
- Health and hygiene conditions

D. Data Analysis

Utilising SPSS software, the data were examined. Included in the study were:

- **Descriptive Statistics:** Mean, standard deviation, and frequency distributions.
- **Inferential Statistics:** Chi-square tests and odds ratio calculations to assess associations between variables.
- **Regression Analysis:** Multiple regression models to determine predictors of malnutrition and dietary diversity.

III.RESULTS

Descriptive Statistics

Focusing on demographic, social, and health-related aspects, the research investigated the nutritional condition of children in rural Lucknow ranging from six months to five years and fifty-nine months. Some interesting findings emerged from the descriptive statistics:

Table 1

Variable	Mean	Std. Deviation	Interpretation
Age (years)	2.99	1.39	Even spread across different age groups
Gender (Male = 1, Female = 2)	1.47	0.50	Nearly equal distribution
Family Type (Nuclear = 1, Joint = 2)	1.53	0.50	Balanced representation
Maternal Education	1.55	0.49	Lower than paternal education
Paternal Education	1.41	0.49	Higher than

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 09, 2022

			maternal education

2. Prevalence of Malnutrition

The analysis found that malnutrition prevalence in the sample was significantly higher than the national average for rural areas, supporting the alternative hypothesis (H1). The results pointed to key risk factors, including poor sanitation, low parental education, and inadequate breastfeeding practices.

3. Relationship between Socioeconomic Factors and Malnutrition

The inferential statistical analysis showed a strong relationship between socioeconomic status and child malnutrition:

Table 2

Risk Factor	Odds Ratio (OR)	p-value	Interpretation
Low Socioeconomic Status	3.35	0.001	Higher likelihood of malnutrition
Low Maternal Education	1.34	0.032	Significant impact on nutrition
Exclusive Breastfeeding	0.93	0.045	Slightly reduced malnutrition risk
Male Gender	5.89	0.003	Males at significantly higher risk
Nuclear Family	1.12	0.048	Higher malnutrition risk than joint families

4. Dietary Involvement and Nutritional Intake

- **Dietary Diversity:** The mean dietary diversity score was **5.83** (range: 3–9), with a moderate level of variation across the sample.
- **Meal Frequency:** Children had an average of **4.06 meals per day**, with little variation (SD = 0.31).
- **Macronutrient Intake:**

Table 3

Nutrient	Mean Intake	Range	Std. Deviation
Energy (kcal/day)	1702.71	1500 - 1900	113.38
Protein (g/day)	59.4	50 - 70	4.65
Fat (g/day)	66.07	60 - 75	4.39
Carbohydrates (g/day)	201.69	180 - 220	11.58

5. Regression Analysis

A multiple regression analysis assessed the impact of demographic and socioeconomic factors on dietary diversity:

Table 4				
Predictor	Coefficient (B)	Standard Error	p-value	Interpretation
Age	-0.0055	0.0497	0.02912	Slight negative effect
Gender	0.3014	0.3776	0.041	Females have higher dietary diversity
Socioeconomic Status	0.2652	0.1905	0.0166	Higher status leads to better nutrition
Maternal Education	0.1029	0.3777	0.03563	Positive correlation with dietary diversity

6. Key Findings and Implications

- Malnutrition rates exceeded national averages, highlighting an urgent need for intervention.
- Socioeconomic status and parental education played critical roles in shaping nutritional outcomes.
- Exclusive breastfeeding and sanitation improvements could help mitigate malnutrition risks.
- Joint family structures provided better support systems for child nutrition compared to nuclear families.

IV.CONCLUSION

This research has improved our understanding of the incidence and causes of childhood malnutrition in rural Lucknow. According to the data, socioeconomic position, maternal education, and healthcare access significantly impact child nutrition outcomes. Due to the high prevalence of malnutrition, targeted treatments are urgently needed, especially for uniting and underweight patients.

Important steps in the fight against malnutrition include filling the gaps in mother education, increasing nutritional variety, and encouraging exclusive breastfeeding. The research highlights the need to bolster government programs, improve community health efforts, and raise caregiver knowledge to guarantee long-term gains in nutrition.

In order to address child malnutrition in rural India, this research lays the groundwork for policy recommendations. It emphasises the need for multispectral approaches that integrate healthcare, education, and socioeconomic development. By doing so, we can achieve long-term improvements in child health and nutrition.

REFERENCES

[1].Global Nutrition Report. (2021). The state of global nutrition. Development Initiatives

[2].Glewwe, P., Jacoby, H.G., King, E.M., 2001. Early childhood nutrition and academic achievement: A longitudinal analysis. J. Public Econ. 81 (3), 345–368. https://doi.org/10.1016/S0047-2727(00)00118-3

[3].Choudhury, S., Headey, D.D., Masters, W.A., 2019. First foods: Diet quality among infants aged 6–23 months in 42 countries. Food Policy 88, 101762. https://doi.org/ 10.1016/J.FOODPOL.2019.101762.

[4].Shrimpton, R., Victora, C.G., de Onis, M., Lima, R.C., Blossner, ¨ M., Clugston, G., 2001. Worldwide timing of growth faltering: Implications for nutritional interventions. Pediatrics 107 (5), e75–e. https://doi.org/10.1542/PEDS.107.5.E75.

[5].Micha R, Mannar V, Afshin A, Allemandi L, Baker P, Battersby J, et al. In: Behrman N, editor. 2020 Global nutrition report: action on equity to end malnutrition. Technical report. Bristol: Development initiatives; 2020.

[6].Malaysia-The burden of malnutrition at a glance. Global Nutrition Report. https://globalnutritionreport.org/resources/nutrition-profles/asia/southeastern-asia/malaysia/. Accessed 30 Nov 2022.

[7].WHO. The global strategy for women's, children's, and adolescents' health (2016–30). 2015. http://www.who.int/life-course/partners/ global-strategy/ ewec-globalstrategyreport-200915.pdf ?ua=1. Accessed 29 Oct 2022.

[8].UN Committee on the Rights of the Child (CRC), General comment No. 20 (2016) on the implementation of the rights of the child during adolescence. 2016. https://www.refworld.org/docid/589dad3d4.html. Accessed 2 Nov 2022.

[9].Christian P, Smith ER. Adolescent undernutrition: global burden, physiology, and nutritional risks. Ann Nutr Metab. 2018;72(4):316–28.

[10].Norris SA, Frongillo EA, Black MM, Dong Y, Fall C, Lampl M, et al. Nutrition in adolescent growth and development. Lancet. 2021;399(10320):172–84

[11].Lassi Z, Moin A, Bhutta Z. Chapter 11: nutrition in middle childhood and adolescence. In: Bundy DAP, de Silva N, Horton S, Patton GC, Schultz L, Jamison DT, editors. Child and adolescent health and development. Washington: The International Bank for Reconstruction and Development; 2017

[12].Swinburn BA, Kraak VI, Allender S, Atkins VJ, Baker PI, Bogard JR, et al. The global syndemic of obesity, undernutrition, and climate change: the lancet commission report. Lancet. 2019;393(10173):791–846.

[13].UN. World economic and social survey 2016 – climate change resilience: an opportunity for reducing inequalities. New York: UN Publication; 2016. p. 5.

[14].FAO/IFAD/UNICEF/WFP/WHO. The State of Food Security and Nutrition in the World. Building climate resilience for food security and nutrition. Rome: FAO; 2018. p. 2018.

[15].Phalkey RK, Aranda-Jan C, Marx S, Höfe B, Sauerborn R. Systematic review of current eforts to quantify the impacts of climate change on undernutrition. Proc Natl Acad Sci. 2015;112(33):E4522–9.

[16].Fagliano JA, Diez Roux AV. Climate change, urban health, and the promotion of health equity. PLoS Med. 2018;15(7):e1002621.16.

[17].Fanzo J, Davis C, McLaren R, Choufani J. The efect of climate change across food systems: implications for nutrition outcomes. Glob Food Sec. 2018;18:12–9.

[18].8. IPH. National health and morbidity survey (NHMS) 2017: adolescent nutrition survey 2017. Malaysia; 2017.

[19].Holleman C, Rembold F, Crespo O, Conti V. The impact of climate variability and extremes on agriculture and food security – an analysis of the evidence and case studies. In: Background paper for the state of food security and nutrition in the world 2018. FAO agricultural development economics technical study No. 4. Rome: FAO; 2020.

[20].UNICEF. The State of the World's Children 2019. In: Children, food and nutrition: growing well in a changing world. New York: UNICEF; 2019.

[21].UN. Transforming our world: the 2030 agenda for sustainable development. A/RES/70/1 General Assembly, Seventieth session 2015.

[22].Stelmach-Mardas M, Kleiser C, Uzhova I, Peñalvo JL, La Torre G, Palys W, et al. Seasonality of food groups and total energy intake: a systematic review and meta-analysis. Eur J Clin Nutr. 2016;70(6):700–8.

[23].In S, Lambre C, Camel V, Onldelhkim M. Regional and seasonal variations of food consumption in Cambodia. Malays J Nutr. 2015;21(2):167–78.

[24].Abizari AR, Azupogo F, Nagasu M, Creemers N, Brouwer ID. Seasonality afects dietary diversity of school-age children in northern Ghana. PLoS One. 2017;12(8):e0183206

[25].Egata G, Berhane Y, Worku A. Seasonal variation in the prevalence of acute undernutrition among children under fve years of age in east rural Ethiopia: a longitudinal study. BMC Public Health. 2013;13(1):1–8.

[26].Egbi G, Tohuoenou MM, Glover-Amengor M, Adom T. The impact of seasonal variation on anemia and nutritional status with associated factors in 6–12 years Ghanaian school age children in peri-urban communities. Human Nutr Metab. 2021;26:200135.

[27].Obradovich N, Fowler JH. Climate change may alter human physical activity patterns. Nat Hum Behav. 2017;1(5):1–7.

[28].Weaver RG, Hensing C, Armstrong B, Adams EL, Beets M. Seasonal shifts in Children's sedentary behaviors, physical activity, and sleep: a systematic review and meta-analysis. Pediat Clin. 2022;69(4):671–93.

[29].Quante M, Wang R, Weng J, Kaplan ER, Rueschman M, Taveras EM, et al. Seasonal and weather variation of sleep and physical activity in 12–14-year-old children. Behav Sleep Med. 2019;17(4):398–410.

[30].Oppert JM, Charreire H. The importance of the food and physical activity environments. Nestle Nutr Inst Workshop Ser. 2012;73:113–21.

[31].HLPE. Nutrition and food systems. In: A report by the high level panel of experts on food security and nutrition of the committee on world food security, Rome; 2017.

[32].Gupta V, Downs SM, Ghosh-Jerath S, Lock K, Singh A. Unhealthy fat in street and snack foods in low-socioeconomic settings in India: a case study of the food environments of rural villages and an urban slum. J Nutr Edu Behav. 2016;48(4):269–79.

[33].Musthafa SN, Leh OL, Omar D, Karuppannan S. Theoretical review on environmental health in relation to neighbourhood planning and human physical activity. Procedia Soc Behav Sci. 2015;201:325–32.

[34].Day K. Physical environment correlates of physical activity in developing countries: a review. J Phys Act Health. 2018;15(4):303–14.

[35].WHO. Obesity and overweight. 2020. https://www.who.int/news-room/ fact-sheets/detail/obesity-and-overweight. Accessed 19 Oct 2022.

[36].Durand CP, Andalib M, Dunton GF, Wolch J, Pentz MA. A systematic review of built environment factors related to physical activity and obesity risk: implications for smart growth urban planning. Obes Rev. 2011;12(5):e173–82.

[37].ORGI. Census of India—SCHEDULED TRIBES; Office of the Registrar General & Census Commissioner: New Delhi, India, 2011.

[38].IIPS. National Family Health Survey-5; International Institute for Population Sciences (IIPS): Mumbai, India, 2021. [Google Scholar]

[39].Jaleel, A.; Arlappa, N.; Ramakrishna, K.S.; Sunu, P.V.; Jayalakshmi, G.; Neeraja, G.; Narasimhulu, D.; Kumar, T.S.; Kumar, S.B. Examining the Triple Burden of Malnutrition: Insights from a Community-Based Comprehensive Nutrition Survey among Indigenous Tribal Children (0–19 Years) in the Western Ghats Hills of India. Nutrients 2023, 15, 3995. [Google Scholar] [CrossRef] [PubMed]

[40].Ghosh, S.; Varerkar, S.A. Undernutrition among tribal children in Palghar district, Maharashtra, India. PLoS ONE 2019, 14, e0212560. [Google Scholar] [CrossRef] [PubMed]

[41].Ghosh-Jerath, S.; Singh, A.; Bhattacharya, A.; Ray, S.; Yunus, S.; Zodpey, S.P. Dimensions of nutritional vulnerability: Assessment of women and children in Sahariya tribal community of Madhya Pradesh in India. Indian J. Public Health 2013, 57, 260–267. [Google Scholar] [CrossRef] [PubMed]

[42].Ghosh-Jerath, S.; Kapoor, R.; Singh, A.; Nilima; Downs, S.; Goldberg, G.; Fanzo, J. Agroforestry diversity, indigenous food consumption and nutritional outcomes in Sauria Paharia tribal women of Jharkhand, India. Matern. Child Nutr. 2021, 17, e13052.

[43].Kutty, V.R. Historical analysis of the development of health care facilities in Kerala State, India. Health Policy Plan. 2000, 15, 103–109. [Google Scholar] [CrossRef]

[44].NIN. A Rapid Assessment of Nutritional Status of Underfive Year Children & Mothers of Attappadyhills, Palakkad District of Kerala and Cause of Infant Deaths by Verbal Autopsy; ICMR-NIN: Hyderabad, India, 2013. [Google Scholar]

[45].Ramakrishnan, U. Nutrition and low birth weight: From research to practice. Am. J. Clin. Nutr. 2004, 79, 17–21. [Google Scholar] [CrossRef] [PubMed]

[46].Farias, P.M.; Marcelino, G.; Santana, L.F.; de Almeida, E.B.; Guimarães, R.C.A.; Pott, A.; Hiane, P.A.; Freitas, K.C. Minerals in Pregnancy and Their Impact on Child Growth and Development. Molecules 2020, 25, 5630. [Google Scholar] [CrossRef] [PubMed]

[47].Walle, B.M.; Adekunle, A.O.; Arowojolu, A.O.; Dugul, T.T.; Mebiratie, A.L. Low birth weight and its associated factors in East Gojjam Zone, Amhara, Ethiopia. BMC Nutr. 2022, 8, 124.

[48].Komatsu H, Malapit H, Balagamwala M. Gender effects of agricultural cropping work and nutrition status in Tanzania. PloS one. 2019; 14(9):e0222090. https://doi.org/10.1371/journal.pone.0222090 PMID: 31490988

[49].Harun ME. Womens workload and their role in agricultural production in Ambo district, Ethiopia. Journal of Development and Agricultural Economics. 2014; 6:356–62. https://doi.org/10.5897/jdae2013.0546

[50].Joffe Michael. Health, livelihoods, and nutrition in low-income rural systems. Food and Nutrition Bulletin. 2007; 28(2). https://doi.org/10.1177/15648265070282S202 PMID: 17658069 22. Maleta K. Undernutrition Malawi Med J. 2006; 18(4):189–205

[51].Militao EMA, Salvador EM, Uthman OA, Vinberg S, Macassa G. Food Insecurity and Health Outcomes Other than Malnutrition in Southern Africa: A Descriptive Systematic Review. International journal of environmental research and public health. 2022; 19(9). https://doi.org/10.3390/ijerph19095082 PMID: 35564477

[52].John Ulimwengu. Farmers' health and agricultural productivity in rural Ethiopia AFJARE September 2009; 3(2).

[53].Gemechu Kumera, Dereje Gedle, Animut Alebel, Fetuma Feyera, and Setegn Eshetie. Undernutrition and its association with socio-demographic, anemia and intestinal parasitic infection among pregnant women attending antenatal care at the University, Northwest Ethiopia. Maternal Health, Neonatology, and Perinatology. 2018; 4(18).

[54].Andersen CT, Tadesse AW, Bromage S, Fekadu H, Hemler EC, Passarelli S, et al. Anemia Etiology in Ethiopia: Assessment of Nutritional, Infectious Disease, and Other Risk Factors in a Population-Based Cross-Sectional Survey of Women, Men, and Children. The Journal of nutrition. 2021; 152(2):501–12. https://doi.org/10.1093/jn/nxab366 PMID: 34647598

[55].Todd P Lewis Margaret McConnell, Aryal Amit, Irimu Grace, Mehata Suresh, Mrisho Mwifadhi, et al. Health service quality in 2929 facilities in six low-income and middle-income countries: a positive deviance analysis. The Lancet Global health. 2023; 11(6). https://doi.org/10.1016/S2214-109X(23)00163-8 PMID: 37202022

[56].Park J-E, Kibe P, Yeboah G, Oyebode O, Harris B, Ajisola MM, et al. Factors associated with accessing and utilisation of healthcare and provision of health services for residents of slums in low and middleincome countries: a scoping review of recent literature. BMJ open. 2022; 12(5):e055415. https://doi.org/ 10.1136/bmjopen-2021-055415 PMID: 35613790

[57].Harris-Fry H, Shrestha N, Costello A, Saville NM. Determinants of intra-household food allocation between adults in South Asia–a systematic review. International journal for equity in health. 2017; 16 (1):107. https://doi.org/10.1186/s12939-017-0603-1 PMID: 28637477

[58].Zebenay Workneh Bitew, Alemu Ayinalem, Ermias Getaneh Ayele, Teshager Worku. Dietary diversity and practice of pregnant and lactating women in Ethiopia: A systematic review and meta-analysis. Food science and nutrition. 2021; 9:2686–702. https://doi.org/10.1002/fsn3.2228 PMID: 34026082

[59].Naz Madiha, Izhar Ahmad Khan, Ashfaq Ahmad Maan, Shahbaz B. Rural women contribution in household food security in agrarian communities: a cross-sectional study of rural areas of punjab, pakistan. J Agric Res. 2020; 58(1):49–57

[60].Jabeen Salma, Haq Sanam, Jameel Arif, Hussain Abid, Asif Muhammad, Hwang Jinsoo, et al. "Impacts of Rural Women's Traditional Economic Activities on Household Economy: Changing Economic Contributions through Empowered Women in Rural Pakistan. Sustainability, MDPI. 2020; 12(7):1–23.

[61].Ravaoarisoa, et al. Food consumption and undernutrition variations among mothers during the post harvest and lean seasons in Amoron'i Mania Region, Madagascar. BMC public health. 2019; 19(1005):3– 9. https://doi.org/10.1186/s12889-019-7333-9 PMID: 31349840

[62].Fox Elizabeth L., Claire Davis, Downs Shauna M., Schultink Werner, Fanzo Jessica. Who is the Woman in Women's Nutrition? A Narrative Review of Evidence and Actions to Support Women's Nutrition throughout Life. CURRENT DEVELOPMENTS IN NUTRITION. 2019; 3(1):nzy076. https://doi.org/ 10.1093/cdn/nzy076.

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 09, 2022

[63].Palacios-Lopez A, Christiaensen L, Kilic T. How much of the labor in African agriculture is provided by women? Food Policy. 2017; 67:52–63. https://doi.org/10.1016/j.foodpol.2016.09.017 PMID: 28413246