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Dietary Diversity-A Key to Nutritional Adequacy

Smita Sahu [1]*

[1]* Assistant Professor, Dept. of Food & Nutrition, Budge Budge College,
Email: sahsmita12@gmail.com

Abstract

Malnutrition and non-communicable diseases are two major public health concerns of 21st century India in rural and urban settings. The yield-oriented Green Revolution has a detrimental effect on biodiversity and human health, increasing the availability of energy-dense, non-diversified diet and exposure to toxic chemicals. This analytical study aimed to analyse the role of agricultural procedures in mitigating the impact of seasonality and climate variability to improve food security and nutritional status. The environmental tariff of food production such as the deterioration of inland waterways, nitrogen and phosphorus pollution of coastal aquatic ecosystems, the development of photochemical smog, and surging concentrations of nitrous oxide and methane are devoted to climate change. Environmental degradation can instigate major nutrition-oriented health problems such as malnutrition, infectious disease, and contamination. The prevalence of food insecurity, wasting, and inadequate growth was significantly higher in monsoon seasons than in dry seasons. Elevated atmospheric CO2 can lead to micronutrient and protein deficiency due to the reduced nutritional value of staple food crops. According to NFHS-5, 67.1 per cent of 6-59 months Indian children are anaemic, which could be worse in this changing scenario. The annual gross domestic product (GDP) losses from low weight, poor child growth, and micronutrient deficiencies average 11 per cent in Asia and Africa. Government policies need to emphasise nutrition-sensitive agriculture to achieve nutritional goals and reduce poverty, which contributes to undernutrition. The paper would conclude with the suggestion that social and gender dimensions of seasonal variability and climate change need to be considered for a better realisation of nutritional security through adopting a sustainable and diversified diet.

KEYWORDS: Non-communicable diseases, public health, dietary diversity, climate variability, sustainable diet

INTRODUCTION

India has been discerned as a development paradox as the current economic growth rates are not commensurate with the rates of health and nutritional improvements. Nutrition is one of the best drivers of development. Nutrition outcomes are consequences of the coaction of several aspects- individual diet and health status, household food and nutrition security, caring capacity and practices, access to adequate health services, and a healthy environment. But the crucial part of this conundrum is the role played by the agricultural sector (Gaiha *et al.,* 2012). India's economy depends heavily on agriculture, with more than 57.8 per cent of rural

households using it as their main source of income. But agricultural productivity, as well as family food and nutrition security, are contemplated to be constrained by seasonality (Nithya *et al*., 2018). The relationships between agriculture, health, and nutrition are complex and dynamic. Agriculture has enormous potential because of the numerous ways through which it can affect the fundamental factors that determine nutrition outcomes, such as by enhancing household food security, quality of diet, income, and women's empowerment, as well as by expanding global food availability and access. Agricultural development programmes that support production diversity, micronutrient-dense crops, dairy, or other livestock farming can boost the production and consumption of targeted commodities, and these improvements result in greater dietary diversity within households and sometimes among mothers and children (Ruela *et al.*,2018). Diversification of diet is related to nutrient adequacy and it can act as an intermediary indicator for the quality of diet. A reliable indication of food security is dietary diversification (Stevens *et al.*, 2017). Lack of diversity in diets raises the risk of iron deficiency in children and women of childbearing age, mortality from cancer and cardiovascular diseases, and chronic undernutrition in children. In Asia and Africa, annual gross domestic product (GDP) losses from underweight, stunted child growth, and micronutrient deficiencies average 11 per cent, whereas investing in avoiding malnutrition yields a return on investment of $16 for every dollar spent. Micronutrient deficiency has significant negative effects on society that seriously damage national development efforts. These effects include decreased labour productivity, decreased child educational achievement, decreased school enrolment and attendance, increased mortality and morbidity rates, and increased health care expenses. Only iron deficiency anaemia (IDA) causes physical and cognitive impairments that can cost developing nations up to 4.05 per cent of their annual GDP, slowing social and economic progress. These losses amount to 1.18 per cent of India's GDP. The anthropometric measurements of children and adults exhibit significant intra-annual changes (Hirvonen *et al*., 2016). Intakes were at their lowest during the wet season, while work outputs were at their highest, leading to a severe inequality between intake and needs (Wandel and Holmboe, 1992). During the lean season in Burkina Faso, households eat a diet deficient in micronutrients and energy than they consume in post-harvest season. In rural Gambia, seasonality has a significant role in determining the micronutrient status of pregnant and nursing women (Hirvonen *et al*., 2016). Access to and availability of food reflect dietary diversity and household food security, but seasonality is a crucial component of food availability in several low-income nations (Stevens *et al.*, 2017). This secondary data based paper analyses the role of the agricultural procedures on food security and nutritional status of people to ameliorate the impact of seasonality and climate variability.

METHODOLOGY

Fig. 1. Schematic representation of the search strategy used in the study

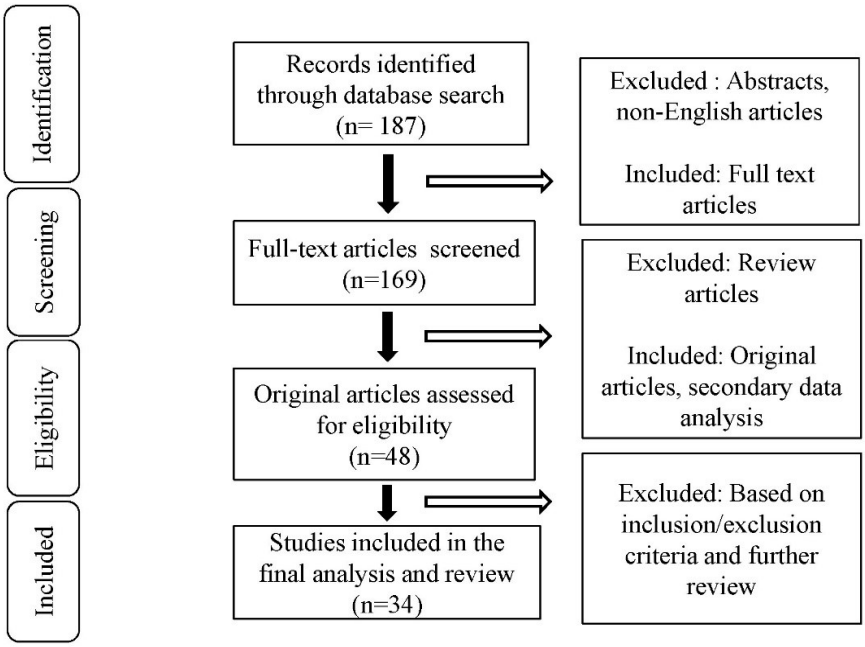

Table 1: Search topics and terms used in the study

Topic	Search terms
Nutrition	"nutrition outcome", "nutritional status", "dietary diversity", "dietary diversification", "micronutrient deficiency", "chronic hunger"
Nutrition-sensitive agriculture	("nutrition-sensitive" OR "nutrition sensitive"") AND agriculture
Seasonality	("seasonality" OR "seasonal variation") AND ("nutritional status" OR "nutrition outcome")
Climate variability	("climate variability" or "climate change"), agriculture AND ("nutritional status" OR "nutrition outcome")

The present paper is a secondary data based analytical paper. At first titles and abstracts of English articles published since 2000 in Google Scholar, PubMed, and Cochrane Library were scrutinised and one hundred eighty seven studies were considered relevant for this analytical study. During screening one hundred sixty nine full-text articles were obtained. From which, forty eight original research works, secondary data analyses were found ideal for the further analysis and the review articles were excluded, since any hypothetical associations considered not an ideal for the secondary data analysis. Finally, thirty four studies were included in this paper, based on their research questions, inclusion criteria and its study design, population, intervention and outcome were considered.

Table 2: Inclusion and exclusion criteria used in the study

Criterion	Include	Exclude
Publication type	Peer reviewed articles, published working papers and abstracts, and online reports	Unpublished abstracts, reports, and briefs
Publication years	2000 –	
Language	English	
Study type	Any quantitative, qualitative, or mixed methods design	Literature reviews
Agriculture	• Biofortification • Homestead production / home gardening • Production diversity	
Nutrition	• Anthropometry (WHZ, HAZ, WAZ, stunting, wasting, underweight, MUAC, weight, height, birth weight) • Infant and young child feeding knowledge and practices (breastfeeding, complementary feeding, including minimum meal frequency, minimum dietary diversity, and minimum adequate diet) • Anaemia/haemoglobin • Diet / dietary diversity • Food security • Macronutrient intake (protein, fats, carbohydrates) • Micronutrient intake (vitamin A, iodine, iron, zinc, folic acid) • Micronutrient status (vitamin A, iron, zinc, folic acid) • Nutrition security	• Health outcomes not directly related to nutrition (such as delivery complications) • Nutrition information/ awareness
Location	Low- and middle-income countries	High-income countries

RESULTS AND DISCUSSION

Agricultural interventions can have an impact on nutrition through six different channels: (1) food access from self-production; (2) income from the sale of produced goods; (3) changes in food prices due to supply and demand; (4) social status and empowerment of women through improved access to and authority over resources; (5) women's time spent working in agriculture, which could be beneficial or unfavourable for the nutritional status of them and their children; (6) women's health and nutrition through involvement in agriculture can also have either favourable or detrimental effects on their own and their children's nutrition, depending on exposure to harmful chemicals and the parity between energy intake and expenditure (Ruela *et al.*, 2018).

Seasonal changes affect variety of food, dietary diversity, and overall consumption of food and nutrient which might exacerbate due to the delayed start to the growing season or variation in the seasonal rainfall's distribution. In comparison to the post-harvest season, there are significant reductions in per capita dietary energy consumption and other nutrient intake during the lean season, which is the time between planting and harvesting. Seasonal hunger typically manifests itself during the

wet season between the planting and harvesting of main crops, when a number of unfavourable conditions, such as food scarcity, rising food prices, depleted food stores and reduced work availability are present. Weight-for-age, weight-for-height, growth rate, clinical diagnoses of undernutrition, and anaemia show considerable seasonal changes. Height variations have been seen less frequently, as this height-for-age is less susceptible to acute, cyclical variations in nutritional status. Children's nutritional status is usually lowest during the rainy season or before harvest and best during the months after harvest, as evaluated by weight-for-height or weight-for-age (Stevens *et al*., 2017). In rural Bangladesh, depending on the season, the proportion of wasted and stunted children changed by about 30 per cent points and 40 per cent points, respectively. In Nepal, the difference in weight for height z-scores between the dry and monsoon seasons was 0.47 units. In areas with bimodal rainy seasons and agricultural systems that involve multiple harvests throughout the year, the magnitude of seasonal volatility is less. Seasonal variation affects more children of low-income family (Hillbruner and Egan, 2008).

The months immediately before harvest frequently fall during the rainy season, a time of food scarcities, a lack of variety in diets, and an increased risk of infection. Women, children, and marginalised populations are among those who are poorest and most at danger of suffering from the effect of seasonal variation and climate change (Mohsena *et al.*, 2018). Traditionally, agricultural programmes have been primarily focused on boosting yields, productivity, and overall food availability rather than on promoting human health. For a long time, policies and governmental institutions were developed without considering the linkages between the agriculture, nutrition, and health sectors. So, the traditional food systems are unable to provide sufficient amounts of nutritious food, particularly to the world's marginalised people. The prime focus on agricultural yield is endangering the base of land, soil, air, and water resources through erosion, acidification, salinisation, and desertification, leading to the loss of soil fertility. Micronutrient deficiencies is considered as the primary reasons for global burden of disease. In the low-income countries, staple foods like cereal grains and tuber crops account for a sizable share of the daily dietary intake which have low mineral density. Hunger is substantially worse when people depend on traditional agricultural systems, which are highly sensitive to variations in temperature, rainfall, and severe drought, for their living. Agricultural productivity, food production, and cropping patterns are being negatively impacted by climate unpredictability and extremes, which is contributing to a shortage of food. International Food Policy Research Institute (IFPRI) indicates climate change would cause a 32–37 per cent increase in rice prices by the year 2050. Additionally, they demonstrate that rice yield losses may range between 10 and 15 per cent. According to data from the

International Rice Research Institute (IRRI), a 1°C increase in night time temperatures may result in a 10 per cent reduction in rice output (Tirado *et al.*, 2013).

Reducing meal frequency per day and less at each one, skipping meals, eating less nutrient-dense foods, and/or eating more energy-dense foods rich in fat, sugar, and salt are coping mechanisms that decrease diversity and quality of diet. Seasonal hunger strikes disproportionately women and there is a greater gender disparity in the intake of protein than in the intake of calories (Mohsena *et al.*, 2018). In Bangladesh, increased market price of rice due to lower rice production affected by climate shocks is closely related to higher rates of childhood underweight and less diversified diets. A research done at the household level for Indonesia revealed similar results. There are three major mechanisms by which seasons influence nutritional status- an increased morbidity in the rainy season, a reduced food availability before harvest season, and varying demands for female labour and its effects on care habits. Rural regions experience greater seasonal variation in weight-for-height and weight-for-age than urban locations. Rural food security could be significantly predicted by household location, number of family members, current or previous financial condition, farm size, land quality, access to markets, use of improved agricultural inputs, mother's education, and access to sanitation facilities and safe water (Patterson *et al.,* 2017).

When compared to the rainy season, household daily calorie availability was much lower throughout the early rains and harvest periods. According to research from Bangladesh, during the monsoon season (August), there was an approximately 6.5 per cent point increase in the percentage of households classified as food insecure (<2,100 kcal/ Adult Equivalent Unit-AEU/day), an 8.1 per cent point increase in the percentage of wasted children, and a 20.8 per cent point increase in the percentage of children who had not grown as expected over the previous six months. The seasonal range of available calorie fluctuation was 37 to 124 kcal, while the seasonal change of WHZ was 0.15 to 0.26 units. Season has a substantial impact on households' financial well-being and the rates of food insecurity and undernutrition in Bangladesh, which are significantly greater in the monsoon season (Hillbruner and Egan, 2008). Decreased energy expenditure, weight loss, inadequate weight gain, and consequent low birth weight are results of seasonal variation in food supply on the nutritional health of women in developing countries. In Northern Bangladesh, pregnant women's dietary diversity and food security status were strongly influenced by the seasonality (Stevens *et al*., 2017). Children may become undernourished as a result of reduced caregiving time spent by mothers during and after harvest. After controlling for the age of the children and the household's income, the findings in India showed a relative risk of stunting and being underweight for a child of a working mother was higher than

that of a non-working mother supporting the role of childcare in children's nutritional health (Chikhungu and Madise, 2014).

By supporting agricultural and farming extension services that promote better crop and food production diversity and biodiversity; resilient, nutrition-sensitive, and health-promoting agriculture contributes to improving dietary diversification and nutrition. Reduced deforestation and sustainable use of nutrient-rich non-wood forest products are two benefits of integrated agroforestry systems, particularly in regions with traditional agroforestry knowledge. Utilising the synergies between horticulture, aquaculture, and small livestock rearing, integrated farming systems increase the diversity of food production, decrease waste and costs associated with agricultural inputs, and improve the efficiency of early warning and surveillance systems for food and nutrition insecurity as well as their connections to early response mechanisms. Research and development programmes for the breeding of chosen crops and livestock with enhanced nutritional quality, improved post-harvest management such as food storage, transformation, handling, and processing to reduce losses in quantity and nutrient content, and social marketing strategies that strengthen local food systems and encourage the cultivation and consumption of local micronutrient-rich foods are all associated with nutrition security (Tirado *et al*., 2013).

Albeit, the study findings contribute to the growing literature that attempts to understand the role of agriculture in improving food and nutrition security in low-income countries in the face of seasonality and climate variability, the evidence of the effectiveness of agricultural interventions on nutrition outcomes still remains sparse. Further research is needed to obtain more concrete evidences from different contexts.

PROGRAMME AND POLICY RECOMMENDATIONS

A wide variety of affordable, nutrient-dense foods such as vegetables, fruits, legumes, animal and dairy products, small fish, underutilised nutrient-rich indigenous foods, etc. must be made more readily available and accessible through agricultural policy, which must go beyond basic staples. Pro-poor agricultural policies are needed to improve and sustain ability of people to obtain and consume diversified, nutritious foods in adequate amount. Policies must consider gender equality and curtailment of women's workload, as 75 per cent of the full-time workers on Indian farms are women who juggle caring for their children and farming every day, affecting the care and nutrition of their children.

Financial and nutritional support such as behavioural change strategies, diversification of household food production and food bank during seasonal fluctuations in income and employment may lessen the shocks of these fluctuations on household food security and dietary diversity. To maintain food and nutrition security around the year

agricultural investments must go beyond targeting the harvest season only as seasonal hunger, especially in the lean season, contributes significantly to malnutrition in low-income countries. Coherent agriculture, health, and nutrition-related science are crucial in achieving a sustainable food system. Despite only the yield, agricultural programs should consider consumption issues, household food security and diversity, and the nutritional needs of the community.

CONCLUSIONS

Health, nutrition, and food security are inevitably interdependent and should be considered crucial objectives of development policies, especially agricultural development policies. To address the effects of seasonal variation and climate change on food and nutrition security, nutrition-sensitive agricultural procedures, institutional and cross-sectoral collaboration, social protection, upgraded maternity and child care, nutrition-sensitive risk mitigation and management, community development initiatives, nutrition-smart investments, and increased policy coherence are recommended.

REFERENCES:

i. Chikhungu C. L., Madise J. N. (2014): Seasonal variation of child under nutrition in Malawi: is seasonal food availability an important factor? Findings from a national level cross-sectional study. BMC Public Health, 14:1146.

ii. Gaiha R., Kaicker N., Imai S. K., Thapa G. (2012): Agriculture-Nutrition Pathway in India. The School of Economics Discussion Paper, Series 1213, Economics, The University of Manchester.

iii. Hillbruner C., Egan R. (2008): Seasonality, household food security, and nutritional status in Dinajpur, Bangladesh. Food Nutr Bull. Sept. 1; 29(3):221-31.

iv. Hirvonen K., S. A., W. I. (2016): Seasonality and household diets in Ethiopia. Public Health Nutr. Jul; 19(10):1723-30.

v. International Institute for Population Sciences (IIPS) and ICF. (2021): National Family Health Survey (NFHS-5), 2019-21: India: Volume I. Mumbai: IIPS.

vi. Lokshin M., Radyakin, S. (2012): Month of birth and children's health in India. Journal of Human Resources; 47(1), 174–203.

vii. Mohsena M, Hossain M, Chakraborty B, Bayes A, Rahman A. N. M. (2018): Fragile environment, seasonality and maternal and childhood undernutrition in Bangladesh. J Biosoc Sci. Sep; 50(5):579-603.

viii. Nithya D.J. , Raju S., Pradhan A. (2018): Effect of Agricultural Seasons on Energy Intake: Evidence from Two Agro-Ecologically Different Rural Districts of India. Food and Nutrition Sciences; May 22, 542-555.

ix. Patterson K., Berrang-Ford L., Lwasa S., Namanya B. D., Ford J., Twebaze F., Clark S., Donnelly B., Harper L. S. (2017): Seasonal variation of food security among the Batwa Kanungu, Uganda. Public Health Nutr. Jan; 20(1): 1–11.

x. Ruela T. M., Quisumbinga R. A., Balagamwalab M. (2018): Nutrition-sensitive agriculture: What have we learned so far? Global Food Security, 17, 128–153.

xi. Stevens B., Watt K., Brimbecombe J. , Clough A. (2017): The role of seasonality on the diet and household food security of pregnant women living in rural Bangladesh: a cross-sectional study. Public Health Nutrition. Cambridge University Press. January, Volume 20, Issue 1, 121-129.

xii. Tirado MC., Crahay P., Mahy L., Zanev C., Neira M., Msangi S., Brown R., Scaramella C., Coitinho C. D., Müller A. (2013): Climate change and nutrition: creating a climate for nutrition security. Food Nutr Bull. Dec; 34(4):533-47.

xiii. Wandel M and Holmboe O G. (1992): Food Availability and Nutrition in a Seasonal Perspective: A Study from the Rukwa Region in Tanzania. Human Ecology; Mar., 20, (1) , 89-107.

xiv. Wijesinha-Bettoni R., Kennedy G., Dirorimwe C., Muehlhoff E. (2013): Considering Seasonal Variations in Food Availability and Caring Capacity when Planning Complementary Feeding Interventions in Developing Countries. International Journal of Child Health and Nutrition. 2, (4) , 335-352.