REVIEW ARTICLE

Food Security Challenges Emanating from COVID-19

Shizma Junejo[1*], Quratulain Javaid[2], Mehreen Lateef[3]

SUMMARY

Food security is a multidimensional notion and it can be achieved at individual, domestic, regional, countrywide and global levels. This is achieved when all individuals, at all times, have physical and economic access to adequate, safe, and nutritious food to fulfill their intake needs and food choices for an active and healthy life. As a result of COVID-19, global activity has witnessed an exceptional decline. The physical distance, school closures, trade restrictions, and country lockdowns for controlling the COVID-19 pandemic have led to escalated nutritional challenges globally. Food insecurity is defined as the persistent concern about access to sufficient and affordable food at all times. Food insecurity causes stress in people. This review aimed to evaluate the extent of disruption and break in the chain of continuity of food security as a result of the COVID-19 pandemic. The review perused peculiar causes of food insecurity in the context of the COVID-19 pandemic along with measures to counter them for the attainment of sufficient food security. This review article methodology was inclusive of the utilization of three search engines. These included PubMed, Google as well as Google Scholar. The keywords included food security, food chain, challenges as well as COVID-19, and health outcomes. Articles were included based on being published from the year 2008-2023. Out of 66 articles, 50 were included (75%). The food availability having deteriorated due to the COVID-19 pandemic has affected food security globally leading to various adverse health outcomes. Also, this has added to the burden of hunger and malnutrition across the globe. A special focus on agriculture can aid in dealing with the shortage of food. The COVID-19 pandemic has culminated in tremendous detrimental repercussions on food security. Food chain improvement and efficiency can be of pivotal importance in connection with the food security challenges having ensued following the COVID-19 pandemic.

Keywords: *COVID-19, Food Chain, Food Security, SARS-CoV-2.*

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Introduction

COVID-19 first emerged in December 2019, when a group of patients with pneumonia of unknown source was recognized in Wuhan, China. According to WHO, until 2024, over seven million deaths are reported worldwide eversince commencement of pandemic.[1] The WHO affirmed the COVID-19 outburst as a pandemic.[2] As a peculiar ailment, COVID-19 onset constituted an unidentified infection for healthcare professionals. Furthermore, this called for extensive research as well as excessive updated knowledge related to the nature of the virus, also creating the need for continual basis tests for a successful vaccine outcome. The viral load of SARS-CoV-2 changes intensely during infection. Viral genome copiousness quickly upsurges after the onset of infection. Furthermore, patients have the capacity to transmit the disease as well as shed viral particles prior to the appearance of COVID-19 symptoms.[3] The utilization of genome sequencing testing at the scope of population level yields the benefit of keeping track of the viral strains disseminating in a population. As deemed compulsory by many countries a fraction of positive samples is utilized for whole-genome sequencing, consequently culminating in prompt in-process surveillance in connection with emerging as well

[1]*Department of Pharmacology/Anatomy*[2]*/MDRL*[3]
Bahria University Health Sciences Campus Karachi, Pakistan
Correspondence:
Dr. Shizma Junejo
Department of Pharmacology
Bahria University Health Sciences Campus Karachi, Pakistan
E-mail: shizjunejo@hotmail.com

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circulating variants.[4] An unanticipated diminished global activity has been crucial consequence of the COVID-19 pandemic. With the progressive intensification of the pandemic within developed and emerging economies eventual outcome was stringent lockdowns as well as large disturbances in economic activity following extraordinary pace and an extent of high degree. As evident within the second quarter of 2020, at the global level GDP lowered an additional 4.9% because of economic disruption. Consequent to diminished demand as well as supply, global trade remarkably diminished within the second quarter of 2020. Overall worldwide global supply chains were unsettled due to lockdowns culminating in lowered cumulative demands. Furthermore, as a result of overall income depreciation as well as feeble consumer confidence tremendous deterioration resulted in trade of goods as well as services.[5]

Methods

This review article was written by using three search engines: PubMed, Google and Google Scholar. The keywords include food, security, challenges, and COVID-19. Articles were included on the basis of them published from 2008-2023 with the keywords: food chain, food security, health outcomes, COVID-19, being in English language with detailed availability of methodology and results included. Articles not written in English and with deficient results and methodology were excluded. Out of 66 articles, 50 were included (75%).

Food Security

The currently utilized food security definition was initiated by the Food and Agriculture Organization (FAO) annual report on food security "The State of Food Insecurity in the World 2001": Food security implies a situation existing in the event of all individuals, at all times, having physical, social as well as economic access to adequate, safe as well as nutritious food meeting dietary needs as well as food preferences for attaining active as well as healthy life (FAO, 2002).

At the 2009 World Summit on Food Security, this definition underwent the last revision, consequently adding a fourth dimension, stability. Stability was added in the context of being precise time duration indicative of the capacity of food systems to withstand shocks, (FAO, 2009).[6] Food security as well as food insecurity are effective, reciprocated, and depend on time. The conclusive element emanates from interaction between stresses of food insecurity and coping strategy. Food security anywhere along its linked path inclusive of availability, accessibility, utilization, and stability may get obstacles by food insecurity. Hence this elicits a response to cope at the national, household or individual level.

Both responses have linear interrelated relationships incorporating continual feedback loops, as a result of which stress culminates in coping response that can be sufficient or insufficient necessitating modification within coping strategies till there is regaining of food security.[7]

The COVID-19 pandemic constituted a potential threat to food access via having an impact on food costs and infrastructure, inclusive of modified food assistance distribution, public transit access, as well as a shortage of particular food items. Food utilization was also remarkably worst hit by COVID-19, with reports from markets indicative of a global change in food purchasing behavior.[7]

Tremendous health hazards are correlated to the escalation of food insecurity. Food insecurity has negative correlating endpoints in relation to health. On the contrary, as documented poor diet quality has been linked to food insecurity. Furthermore, within food-insecure households, there is escalated prevalence of anxiety and mental health disorders in children cum adults. It is noteworthy that consequent to disruption of regular eating patterns within households with food insecurity, there is decreased immune function as well as offsetting ramifications on mental and emotional health.[8]

Food security constitutes a multidimensional notion. Food security calls for achievement at levels including individual, domestic, regional, countrywide as well and global levels, when all individuals, around the clock, possess physical as well as economic approach to adequate, safe as well as nutritious food to accomplish intake needs plus required food choices to lead active as well as healthy life.[9] On the contrary, the inability to access adequate food quantity as well as quality for fulfilling minimum dietary needs, constitutes a highly basic type of human deprivation.[10] Irrespective of incessant efforts, the situation within comparatively

less industrialized countries is bereft.[11] They are suffering from a higher degree of predominance of poverty as well as food insecurity prevails in these countries.[12] Food insecurity constitutes a huge problem in South Asia as well as Sub-Saharan Africa. It is found that in both regions, energy intake shortage incidence is very much.[13] Since decades food security and nutrition have had a special place as part of the international development agenda. Yet with the passage of time development priorities as well as challenges have pivoted. This ensures food security and excludes hunger as well as malnutrition of all types, to attain burgeoning economies, human as well as planetary health, and sustainable development.[14] Identification of multidisciplinary as well as multidimensional characteristics of food security and assessment of its scope constitutes currently a challenge for researchers as well as practitioners. Recommendation exists regarding devising long-term food security strategy inclusive of agricultural food production interventions as well as nonagricultural aspects to add diversity to living. Furthermore, the focus of food security measurements must, in contrast to distal proxy indicators, be directed increasingly to fundamental measures, including subjective and psychological experiences of food insecurity.[15]

Nutrition security comprehension at organism level incorporates the achievement of adequate nutrition by cells, tissues as well as organs constituting human body. Nutrition security and health security have an interrelationship amongst the two components. Thus, nutritional security is achieved by means of access to a healthy diet, and preventive as well as curative healthcare. Food security as well as health have in turn important connection to available household income. Furthermore, having available multifarious nutrient-rich foods at local, regional, national level has an impact on food security.

Regarding foods being available at the national level, this counts in an amalgamated way on local production for local consumption and success in importing diverse healthy as well as nutritious foods.[16] Food insecurity exhibits a harmful impact on health outcomes in a circuitous way by means of a few mechanisms. This includes highly ingrained concept of food insecurity being linked to obesity and obesity eventually being linked to negative health outcomes, most significantly diabetes.[17] In connection with women evidence yet restricted exists regarding food insecurity being linked on a short-term basis only to obesity.[18] Global food security achievement is depicted at the level of all individuals at any point as, having access to sufficient, effective cost-effective, safe as well as nutrient rich food for satisfying dietary requirements as well as food preferences for a productive as well as healthy life. Although food availability is indicative of the physical presence of food required at a particular location, food accessibility is the mode of acquiring food needed by individuals and food utilization is indicative of the mode of usage of food.[19] In all respects the three pillars are effective as part of a nested hierarchical way. These are also at large interlinked. Although sufficient food access is a significant requirement, yet this is devoid of ensuring unvarying access to adequate, safe as well as nutritious food due to largely being linked to, individual food choices, income, and current prices as well as access via safety net arrangements. Assessment of utilization incorporates checking on, households utilizing food within their reach along with enriching on a necessary basis dietary quality, more so to avoid micronutrient deficiencies linked to insufficient intake of essential minerals as well as vitamins.[20] Currently, food security is being sabotaged due to several challenges. These include rapidly expanding demand as well as changes in consumption patterns, constant struggle existing in connection with the utilization of agricultural lands in different ways, the impact of global environmental change, agricultural soil being crucially degraded, erosion of the genetic base of agricultural biodiversity, water insufficiency as well as substandard monitoring.[21] Escalated level of competition as well as various ranking levels in the economic sector in connection with trade and investment , pertaining to corporate as well as multinational food processors, manufacturers as well as retailers, have assisted in lowering cost and elevating the available extensively processed foods. This has contributed to diet-related NCDs. It is speculated that less affluent households can face enhanced food insecurity via constant exhilaration in global food prices as

well as unfavorable impingements on employment.[22] Novel food science yields tremendous information regarding functions as well as mechanisms of chief food constituents connected to health promotion as well having a role in preventing ailments. As a result of demands from highly health-conscious consumers, worldwide food industries are inclined towards translating nutritional information into consumer reality through formulating food products yielding superior sensory appeal and nutritional as well as health benefits. The current hustling way of living constitutes a pivotal driving force for flourishing the trend of convenience foods.[23] A highly compelling necessity exists for expediting advancements in the efficiency as well as the efficacy of food chains. This challenge is complicated by a number of extensive issues. These include enhanced complexity within food supply chains, environmental restraints, an escalated aging population as well as variability amongst patterning exhibited by consumer choice as well as food consumption.[24]

Lately research has revealed adverse effects that microplastics have had on wildlife. Microplastics existing within aquatic species utilized by humans, coupled to escalated seafood consumption within a few countries raise unease regarding creditable implications in connection with human well-being. The detoxification of oceans by microplastics has lethal outcomes due to harmful ecological effects as well as putting in jeopardy food security, food safety, and ultimately human health. Prior research studies are extensive in connection with climate variations impacting crops. Furthermore, ramifications impacting fisheries as well as livestock yield are equally as grave as climate variations impacting crops.[25] Food constitutes an energy source, hence restricted availability of food has via various means an impingement on health. There is insufficient intake of macronutrients as well as micronutrients by those who are malnourished. Macronutrients are constituted by protein, fat as well as caloric content. Micronutrients comprise necessary minerals as well as vitamins. Macronutrient malnutrition culminates in deprived immunity underdeveloped physical as well as mental growth, lethargy as well as skinniness.[26] Micronutrients under nutrition incorporating deficiencies of iron, vitamin A, as well as iodine, lead to anemia, diminished immune system function, cretinism, blindness as well as cognitive impairment. Keeping with the way food security is defined, ambits pertaining to food security have been established. In connection with local food products as well as foods requiring import from abroad, consumers have these available only after having sufficient money to buy these foods. Cultural acceptability of food constitutes a significant avenue to be satisfied. Furthermore, it is also ensured that there is existence of social protection nets for helping those who are less well-to-do.[27]

COVID-19 Impact On Food Security

Currently, worldwide considerable heed is directed towards food safety and security. COVID-19 has impacted the supply chain severely. This has imposed significant threat to food security of extremely weak fraction, within the population. This problem is also compounded by hazard inclusive of loss of jobs being faced by migrant, informal, seasonal farm workers. This can have significant effect on food requirements. Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) is responsible for this transmissible disease COVID-19.[28] As a result of pandemic, the harmful consequences having an impact on supply as well as demand of nourishment pose huge hazard to food security. In the wake of the COVID-19 pandemic majority of countries advocated stringent rules including home confinement, travel bans as well as trade cessation to limit the spread of infection. Amongst these most predominantly due to travel restrictions, all aspects of the food supply chain have been worst hit having oversized implications with effect on food distribution.[29]

Increasing globalization of the food supply chain has culminated in the union as well as the evolution of transnational companies. This has been possible by vertical or horizontal integration, as well as developing business clusters. Potential advantages emerge from such highly ranked economic sectors. These include particularly enhanced purchasing power as well as enhanced production resources available at administrative levels facilitating the provision of diverse customer requirements.[30] Myriad of food quality problems have grassroots briefly vested in attitude towards supply chain.

Within the supply chain inadequacy of caliber of the relationship constitutes significant inciting factor leading to suppliers engaging in opportunistic behavior. Therefore, immense necessity exists regarding establishing of successful supply chain relationship for controlling and improving the food quality.[31] Worldwide population increase is the cause of enhanced food production requirement as well as coupled to it is processing industry. This eventually has led to emerging problems, including food wastage in excessive quantities. The extent of adverse brunt emanating from the COVID-19 pandemic is variable, chiefly based on the industry that was affected. Subjecting the food supply chain to purposeful reasonable as well as requisite management has a potential effect exhibited as diminished food losses.[32,33] Evaluation of food supply chains in the context of fine and precise risk assessment has significant results. These include diminished quality information aberration, diminished food quality incidents, as well as promotion of interspersed systems targeted toward food quality.[34] All industries globally forecast COVID-19 impact on the manufacturing industry. In this particular context likewise is expected for the food industry.[35] It is well known that the closure of a single factory affected only a few individuals, working within these factories consequently risk of being without food due to loss of income from jobs. On the contrary, as a result of infective disease, processors as well as distributors are infected, posing risk to all individuals.[36]

As presumed, the worldwide population can be at least 9 billion by 2050. This would call for seventy percent enhanced food demand as well as requiring more food production systems along with food chain to be completely sustainable.[37] There exists the possibility of a psycho-emotional pathway incorporating anguish as well as panic. Most importantly this psych-emotional pathway can also lead to displeasing families as well as social interactions amongst individuals experiencing food insecurity.[38] Global economic prospects have been subjected to the evident brunt by the COVID-19 pandemic. COVID-19 pandemic advancement led to the worsening of status of food security within developing as well as less developed countries.[39]

With particular emphasis on economic conditions food industry constitutes an immensely significant sector. Nevertheless, challenges faced by the food sector are disparate types of challenges as opposed to challenges posed by the pandemic to sectors including tourism as well as aviation. This due to the fact that these sectors do not have crucial importance in terms of daily living. In connection with the food processing industry, supply chain management facilitates efficacious required materials transit. Furthermore, it also facilitates reporting as well as the transporting final products originating at levels of factories towards markets near the customers. Currently, immediate attention is required for accelerating progress linked to better efficaciousness of food chains as well as effectivity. Complicating this ultimatum are a few enveloping problems. These include enhanced complicatedness within food supply chains, and environmental restraints. These problems are furthermore compounded by an escalating aging population, variability exhibited by consumer choice trends, as well as food utilization. Enclosed as part of such background, food safety essentially constitutes promoter rather than preventer at the aggrandized level, of worldwide food security. Enhanced actions as part of food policy call for ensuring aggrandized capability along with involvement in food systems individually and at the level of society. This can be achieved by a robust social protection program. This also requires strengthening of a grassroots level framework for upholding right to food as well as even-handed accessibility towards productive resources.[40] The implementation of broad ways requiring corporate sector incorporation is necessitated for concerted efforts in connection with food systems.[41]

In the meantime, prior research advocates industrially processed food being linked to escalated impact on the environment, as opposed to fresh food made at home. The environmental impacts of industrially processed foods emanate from utilizing excess energy as well as refrigeration and packaging.[42] The environment level implication yielding from such activities within food systems has immense significance due to processed as well as ultra-processed foods currently contributing

excessively worldwide towards the diet of individuals globally.[43]

Currently, a highly challenging issue at demographic as well as environmental levels is high food requirement. This is further augmented by the overlap of the expanding world population and less utilization of naturally produced food. On the contrary, there is excessive reliance on industrialized processed foods, which also increases costs and consequently diminishes food supply in comparison to excessive food demand. Such a grave situation constitutes a food security concern globally.[44] Food insecurity results from the unavailability of food, diminished purchase power, incorrectly distributed food as well as discordant food utilization The advent of the concept of food security, has culminated in multifarious studies defining, measuring, as well as evaluating food security, analyzing various elements that affect it and investigating linkage of environment with food production via analyzing the factors affecting it.[45]

Globally farmers utilize maintaining biodiversity due to providing food security as well as sustainable livelihood along with proving beneficial for guarding against climatic transition hazards. Limited prior research has unfolded urban agriculture having impact on sustainable food security.[46] Also research advocates diversifying as well as using micronutrients to improve dietary quality.[47] Yet irrespective of significance of nutritional quality in connection with sustainable food security, limited prior research has been done for improving nutrition quality.[48]

In connection with COVID-19, it is reiterated that irrespective of research inclination towards COVID-19 impacting food security, the scope is restricted towards its directly affecting physical as well as economic access to food. Consequently, diminished information has been gathered in relation to COVID-19 along with correlated lockdown policies impacting entire overall food system, inclusive of food safety, food policy as well as governance and sustainable food supply.[49]

On a noteworthy basis, studies in future should take into account impact of linkage of consequences of natural calamities and catastrophes, with food requirement and food provision, keeping with repercussions of natural calamities and catastrophes, inclusive of climate change, land utilization change, loss of biodiversity and disease as exhibited by COVID-19 pandemic, affecting the entire horizon related to food security.[50]

Conclusion

Global activity witnessed an exceptional decline immediately after the eruption of the COVID-19 pandemic. This has affected food security globally leading to various adverse health outcomes. Also, this has added to the burden of hunger and malnutrition across the globe. A special focus on agriculture can aid in dealing with the shortage of food. Consequently food chain improvement and efficiency can be of pivotal importance, in connection with the food security challenges faced globally due to covid-19.

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Authors Contribution

SJ: Idea conception, study designing, manuscript writing and proofreading
QJ: Manuscript writing and proofreading
ML: Study designing and manuscript writing

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