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REVIEW

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An overview of food insecurity during the global COVID-19 outbreak: transformative change and priorities for the Middle East

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Abstract

The consequences of COVID-19 on the economy and agriculture have raised many concerns about global food security, especially in Middle Eastern countries, where unsustainable farming practices are widespread. Regarding the unprecedented crisis of the COVID-19 pandemic and the importance of early implementation of prevention programs, it is essential to understand better its potential impacts on various food security dimensions and indicators in these countries. In this scoping review, research databases were searched using a search strategy and keywords developed in collaboration with librarians. The review includes community trials and observational studies in all population groups. Two researchers separately conducted the literature search, study selection, and data extraction. A narrative synthesis was implemented to summarize the findings. The impacts of COVID-19 on three of four dimensions of food security through the food and nutrition system were identified: availability, accessibility, and stability. Disruption of financial exchanges, transportation, and closing of stores led to reduced production, processing, and distribution sub-systems. Rising unemployment, quitting some quarantined jobs, increasing medical healthcare costs, and increasing food basket prices in the consumption sub-system lead to lower access to required energy and nutrients, especially in the lower-income groups. Increased micronutrient deficiency and decreased immunity levels, increased overweight, obesity and non-communicable diseases would also occur. The current review results predict the effect of COVID-19 on food security, especially in vulnerable populations, and develop effective interventions. This review provides information for policymakers to better understand the factors influencing the implementation of these interventions and inform decision-making to improve food security.

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Keywords COVID-19 pandemic, Food and nutrition security, Availability, Access, Utilization, Stability, Review

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Introduction

The Coronavirus Disease 2019 (COVID-19) pandemic is a public health emergency affecting the food and nutrition security of millions of people throughout the world. COVID-19 impacts the four dimensions of food and nutrition security: availability, accessibility, consumption, and stability through the food and nutrition systems [1]. Disruptions in all stages of food and nutrition sub-systems (producer, consumer, nutrition) including production, processing, distribution, acquisition, preparation, consumption, digestion, transport, metabolism, and health [2] have been reported [3, 4].

The recent document analysis by B´en´eet al. in low and middle-income countries found that the dimension of food security that had the greatest impact was access, with compelling evidence that both financial and physical access to food was impaired. In contrast, there is no clear evidence that food availability is affected. Overall, the data suggest that food systems have withstood and adapted to the pandemic disruption. However, this flexibility came at a cost, and most system actors had to deal with severe disruptions in their activities. The effects of the pandemic on the utilization dimension (food safety and quality) are unclear due to limited information [5].

It seems that differences in the impact of the pandemic on countries' food security are based on the development and stability of their food systems. For example, COVID-19 created an expected "income shock" to increase the prevalence of food-insecure Canadian households. Despite some demand and supply chain disruptions, a broad and rapid appreciation of food prices was not observed. These conditions show the ability of the Canadian food system to ensure food supply in the short term. To ensure food availability in the long run, experts recommend prioritizing easy cash movements, international exchange, and sustainable transportation [6]. In the USA, preliminary results of the impact of COVID-19 showed approximately one-third increase in household food insecurity. Food insecurity, access issues, and utilizing coping methods were all more common among those who had lost their jobs. There were also significant potential effects on individual health, such as mental health, malnutrition, and future healthcare expenses [7].

There is a particular concern for the Western Cape in Africa regarding the short- and long-term shortage of food supply in domestic markets, fertilizers and plant protection products, and food insecurity in vulnerable communities. Monitoring food access in rural areas, and incredibly remote areas, controlling inflation in food prices, direct and indirect assistance to the most vulnerable households can be helpful in the short term. Over the long term, the expansion in the production of organic fertilizer on the farm regulates domestic food production chains and coordinates industries, importers/suppliers for the basic goods can improve food security in African households. Despite potentially adverse outcomes of the COVID-19 pandemic, it has highlighted the importance of sustainable food production for long-term country sustainability [8, 9].

The economic effects of COVID-19 were also disproportionately observed in developing countries[10]. When the COVID-19 epidemic was in its early stages in Iraq, food availability remained consistent due to stable international food trade flows and good local production. Basic food prices did not change significantly; however, vegetables particularly tomato—prices fluctuated wildly. The rising number of (COVID-19) cases in Iraq, combined with movement restrictions imposed to contain the virus, had a cascading effect on livelihoods, particularly for casual laborers and low-income workers, putting small and medium-sized businesses, including those operating in the food and agriculture sector. Importing from various sources, investing in a food security early warning system, and promoting social protection policies may help Iraq's food and agriculture sector be more resilient to present and future shocks [11]. These conditions can also be an opportunity to introduce digital innovation to increase food security [12]. In Indonesian urban areas, the poverty rate increased from 9.4% in 2019 to 9.8% in 2020 after the COVID-19 outbreak, primarily. Household consumption expenditure decreased by 5.5%, mainly due to the implementation of large-scale social distancing policies in various regions, business closures, lockdowns, and movement restrictions. The government of Indonesia continued supporting the most vulnerable groups through social protection programs. The Ministry of Agriculture has implemented its subsidized credit scheme program (KUR) to support the agricultural sector [13].

Studies indicated that during the early stages of COVID-19, Iranian households decreased their consumption of several food groups, particularly meat [14, 15]. Personal savings, occupation status, household income, and nutrition knowledge of household heads were the main socio-economic determinants of household food insecurity during COVID-19. Strategies to improve food security during a pandemic include e-commerce, free food baskets for poor households, nutrition education through media, and support for affected people [16]. Figure 1 shows an overview of COVID-19 food security pathways and interactions [17] based on the evidence from reviews [18].

While there are some studies on the worrying impacts of the COVID-19 pandemic on household incomes/purchasing power, food supply chains, food safety, agricultural livelihoods and food availability, diet quality,

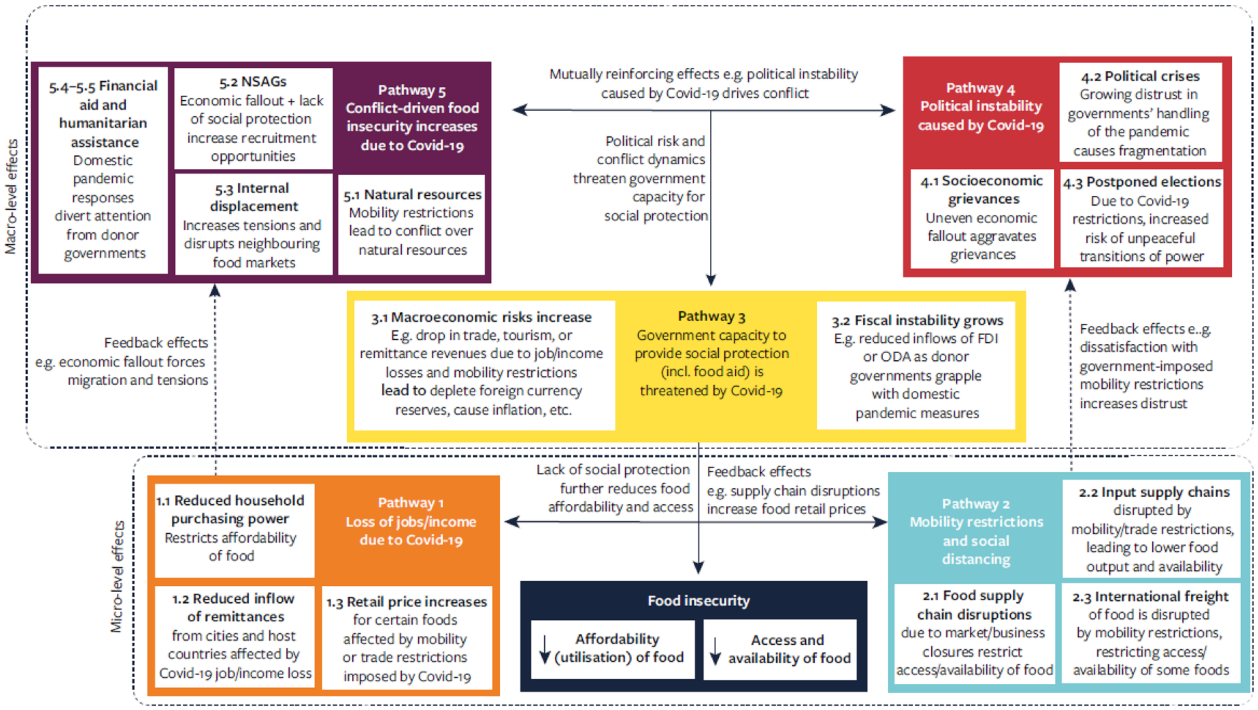

Fig. 1 COVID-19 food security pathways and interactions [17]. FDI = Foreign direct investment; NSAG, Non-state armed group; ODA, Official development assistance

and nutrition status [19–23], little is known about food security in the Middle East countries [24], where unsustainable farming practices are widespread [25]. Due to political turmoil, social upheaval, unprecedented mass immigration, and water scarcity, Middle Eastern countries such as Afghanistan, Bahrain, Djibouti, Egypt, Iran (the Islamic Republic of), Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, Sudan, Syrian Arab Republic, Tunisia, United Arab Emirates, and Yemen are facing unprecedented challenges to their food security [26, 27], and the COVID-19 crisis can exacerbate these challenges. Regarding the unprecedented crisis of the COVID-19 pandemic and the importance of early implementation of prevention programs, it is essential to understand better its potential impacts on various dimensions and indicators of food security in these regions.

The most basic step in making a final judgment about the possible effects of the current crisis on the population's food security is to refer to the evidence and review-related studies [28]. Scattered studies have been conducted in the Middle East and other parts of the world, but the common effects of COVID-19 on food security, the similarities and differences of each region, and the localized approach for each region, besides the general strategies to deal with these effects, are not known. Therefore, in this study, the critical food security indicators affected by this crisis were identified in at-risk populations to design effective interventions for maintaining and improving the food security status of all people under these conditions. The results can provide the information needed to design food and nutrition security programs in pandemics according to the conditions of each country and the factors influencing the successful implementation of these programs, especially in vulnerable groups.

Research questions

a) What dimensions of food security have been affected by the COVID-19 outbreak?

We aimed to answer this question through a scoping review of related studies to summarize the impact of COVID-19 on food security and identify the more affected dimensions, including availability, access, utilization, and stability during the COVID-19 outbreak in the Middle East countries.

b) What are the principal policies and coping strategies of interventions?

We aimed to identify the main policies and strategies to cope with the food insecurity crisis during the COVID-19 outbreak in this region.

Sub-objectives, such as assessing obesity and mental health problems related to COVID-19 were also considered.

Methods

Study registration

The Preferred Reporting Items for Systematic Review and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR) Checklist [29] was used to guide the study design. This review was registered in the Prospective International Register of Systematic Reviews (PROSPERO) as the overall project entitled "The relationship between COVID-19 pandemic and food security at individual and household level: a systematic review" (NO. CRD42020185843).

Study selection criteria

Type of studies

A sensitive search strategy developed by a grouping of terms, phrases, and keywords associated with potential outcome measurements [e.g., (safety OR secur* OR insecur* OR povert* OR sufficen* OR insuffic* OR risk* OR uncertain* OR hygien* OR affluen* OR suppl* OR reserve* OR avail* OR access* OR stabil* OR utilize*) AND (covid* OR coronavir* OR sars)] was used. We worked closely with an experienced librarian to advice on and implement the search strategy (see Additional file 1).

The electronic databases, including PubMed, Scopus, and Web of Science were searched from December 2019 onwards for relevant studies. The authors reviewed 1777 studies (PubMed = 557, Scopus = 375, Web of Science = 845) related to the change in food security status and/or its indicators due to the COVID-19 pandemic and related interventions. Therefore, various community trials and observational studies, including cross-sectional, case–control, and longitudinal studies, were reviewed. Google Scholar was also searched to identify gray literature.

Type of populations

Various population groups, such as children and adults, as well as disadvantaged groups, were included.

Types of interventions

In the current study, COVID-19 is considered an intervention factor. Food security and/or its indicators at the individual, household, or country level were evaluated as factors influenced by the COVID-19 pandemic.

Types of outcomes of interests

Due to the complexity of food security, we assessed outcomes at different levels, including national, household, and individual. The results of our preliminary search revealed considerable various outcomes across food security and COVID-19. As a result, we included a structured approach to the outcomes according to the framework of food security definition [30–32]. Based on the available evidence [5, 31] and the approval of the research team [33], indicators of food security dimensions are presented as primary outcome measures in Table 1.

Our search yielded studies that assessed the relationship between the COVID-19 pandemic and the food security of individuals, households, and countries in different groups. To organize the recovered documents and eliminate duplicates, we used EndNote software. The Systematic Review-Assistant Deduplication Module (SRA-DM)was used to validate the de-duplication process [34].

Two people independently reviewed the titles and abstracts of articles using the inclusion criteria checklist. In case of disagreement, the inclusion decision of the article was finalized through discussion and exchange of views between the research team. At this screening stage, irrelevant items were removed according to the title and abstract. Then, two researchers reread the full text of the articles separately and included them based on the checklist of inclusion criteria.

Data extraction

Data were extracted separately by two authors (AD and FMN) on a standardized data extraction form. Extracted data included study characteristics (author (s), publication year, study design, setting, and time frame), population characteristics (sample size, age, and sex of subjects), and food insecurity outcomes (change in availability, access, utilization, and stability indicators, due to the COVID-19 pandemic).

Assessment of risk of bias

To assess the quality of the included studies, we used The Newcastle–Ottawa quality assessment scale (NOS) [35]. The total score of this scale is nine stars, and > 7 stars are considered high quality. One reviewer assessed the data quality, and a second reviewer checked it. Any disagreements were settled by discussion among the reviewers, and if required, a third reviewer was consulted.

Data analysis

For continuous outcomes with baseline data, we reported the mean difference (MD) between the change in food security and/or its indicators before and after the COVID-19 pandemic if all studies have used the

Table 1 Indicators of food security as the primary outcome of COVID-19 pandemic impacts

Food security dimensions	Food insecurity outcomes
Availability	Adequacy of dietary energy supply Food production value Dietary energy sources provided by cereals, roots, and tubers Adequacy of protein source Animal protein source
Access	Gross domestic product per capita (in purchasing power equivalent) Index of domestic food price Undernourishment prevalence Ratio of food expenditure of the poor to total expenditure Depths of the food deficit Prevalence of food inadequacy
Utilization	Wasting in under 5 year children Stunting in under 5 year children Underweight in adults and under 5 year children Anemia prevalence in pregnant women and under 5 year children Prevalence of Vitamin A deficiency
Stability	Cereal import dependency ratio Import-to-export ratio of foodstuffs-violence/terrorism and political stability Volatility in domestic food price Variability of per capita food production diversity Variability of per capita food supply diversity
Food insecurity score and/or prevalence based on validated perception-based measures	

GDP: gross domestic product

Adapted from ref No. [31, 32]

same measures for the outcomes. Differences in partial frequencies were presented for qualitative variables, too. A narrative summary of the findings was done by grouping the results based on the region and outcome measurement.

Results

Study characteristics

Characteristics of 20 studies included in the review conducted in the Middle Eastern countries on the food insecurity domains during the COVID-19 pandemic are summarized in Table 2.

A large number of the studies were done with the help of international organizations, including FAO (Food and Agriculture Organization) [36–39], IFPRI (International Food Policy Research Institute) [40–43], WFP (World Food Programme) [12, 44], World Bank [12], IFAD (The International Fund for Agricultural Development) [12], IOM (International Organization for Migration) [44], and CARE[45]. Some of them were cross-sectional online surveys that used questionnaires designed on different virtual platforms, and others analyzed the existing data and predicted the trends in food security.

Effects of COVID-19 on food availability, access, and stability are found; however, indicators of utilization were not reported in any of the studies reviewed. The dimensions of food stability and access have been more impacted by the COVID-19 pandemic in the region, and more people reported experiencing more severe degrees of food insecurity mainly because of a significant rise in all food prices, while the income was reduced due to quarantine or job loss.

Strategies to counteract food insecurity

Using different strategies to counteract the effects of the COVID-19 pandemic on the dimensions of food security has been reported in the countries of the region: gradually opening the economy again was critical for avoiding permanent job losses and increases in poverty and providing opportunities for fostering more private sectors [40, 46], distributing free food baskets for poor households [16, 47], extending e-marketing [12], providing nutrition consultative, encouraging donors to support families [48], economic diversification, greater resilience to withstand economic shocks [43], investing in a food security early warning system and restructuring social protection policy [12].

Quality of the studies

More than half of the studies have high quality, because they meet all criteria, especially in measuring food insecurity transparently. Failure to identify confounding factors and use strategies to deal with them was the main reason for the medium quality of the reviewed studies.

Table 2 Characteristics of the Middle East studies on the food insecurity domains during the COVID-19 pandemic outbreak

No	Author, date	Study design	Population, sampling, sample size	Food security measurement	Impact of COVID-19 outbreak on food security dimensions				Policies/ programs to cope	Quality of the study
					Availability	Access	Utilization	Stability		
Afghanistan										
1	FAO, 2021[36]	The two rounds of the agricultural household assessment	7200 rural households in 12 provinces (first round) and 20 provinces (second round), two-step cluster approach	Computer-assisted telephone interviews (first round) and in-person interviews (second round)	38% of respondents farmed a smaller area than the previous year	–	–	Households cited security and conflict as a shock more frequently than others (51%)	Almost all surveyed households reported the need for some form of assistance with their crop and livestock production	High
Egypt										
2	Breisinger, et al. 2020 [36]	Estimation via modeling	–	–	Impacts on Egypt's agri-food system are not severe. Most damage will occur in nonfarm components of the agri-food system due to falling consumer demand	Although higher income households face the largest income losses, lower income households also will see their incomes decline significantly	–	The level of social protection required to fully offset the income losses of poor households is likely to be prohibitive	Continuing to gradually open the economy again will be critical for avoiding permanent job losses and increases in poverty and provide opportunities for fostering more private sectors	High
Iran										
3	Pakravan et al. 2022 [48]	Cross-sectional	375 household heads living in the rural areas of Khorramabad county, using a three-stage cluster sampling method	Standard Household Food Insecurity Access Scale (HFIAS) and Household Dietary Diversity Score (HDDS) questionnaires		Consumption of meat, fruits, and eggs has decreased despite the increase in consumption of cereals, legumes, sweets, spices, condiments, and beverages		About 34.5% of rural households were in severe food insecurity before the COVID-19 pandemic, which increased to 52.5%	Emergency food assistance and cash payments to food-insecure households	Medium

Table 2 (continued)

No	Author, date	Study design	Population, sampling, sample size	Food security measurement	Impact of COVID-19 outbreak on food security dimensions				Policies/ programs to cope	Quality of the study
					Availability	Access	Utilization	Stability		
4	Kaviani-Radety et al., 2021 [20]	Survey	Various evidence, including indices and statistics from national databases, scientific reports, field observations, and interviews	Existing data	Reduce the capacity of the agricultural sector	30% decrease in the purchasing power parity in 2020; a significant increase in food prices compared to 2019		Food prices significantly increased	Paying subsidies to low-income households	Medium
5	Pakravan et al. 2020 [16, 47]	Cross-sectional analysis through an online survey	299 respondents, non-probability sampling	Online standard questionnaire, Household Food Insecurity Access Scale (HFIAS)		A significant insufficient quality and quantity of food intake		Food security of households improved at the early stage of COVID-19	Distributing free food baskets for poor households, extending e-marketing, providing nutrition consultative, and encouraging donors to support families	
Iraq										
6	WFP, World Bank, IFAD, FAO, 2020 [12]	Review	Secondary data	Food production, prices, imports, reserves, and consumption	Food availability remained stable due to steady international food trade flows and favorable domestic production	More than 50% eroding income sources and decreasing their ability to meet their food needs	–	The number of households with insufficient food consumption fluctuated. Price stability remained a concern	Diversifying import sources, investing in a food security early warning system, and restructuring social protection policy can increase the resilience of Iraq's agriculture and food system to current and future shocks	High

Table 2 (continued)

No	Author, date	Study design	Population, sampling, sample size	Food security measurement	Impact of COVID-19 outbreak on food security dimensions				Policies/ programs to cope	Quality of the study
					Availability	Access	Utilization	Stability		
Jordan										
7	Raouf et al. 2021 [43]				Food systems in Jordan are estimated to have experienced a reduction in output by almost 40%	Employment losses during the lockdown were estimated at over 20%, mainly driven by job losses in services, followed by agriculture		Household income fell on average by around one-fifth due to the lockdown	Economic diversification, greater resilience to withstand economic shocks and job creation	High
8	Elsahoryi et al. 2020 [49]	A cross-sectional study	3129 Jordanians aged more than 18 years	Web-based validated questionnaire, The Food Insecurity Experience Scale	Unavailability of the food, especially for long time, limitations on migrant workers who work in the food sectors, the lockdowns, and movement control during the quarantine, creating food deserts in most areas	Reduced wages and loss of income affecting the most vulnerable	–	The price of all products increased	The government co-pays the price of bread, which makes it available for most individuals, and distributes bread during quarantine at a reasonable price	High
Kuwait										
10	AlTarrah et al. 2021 [50]	Cross-sectional study	841 adults aged over 18 years; the snowball sampling method	A web-based online self-administered questionnaire	The large majority of study participants were confident in the country's ability to provide food to meet consumer needs	Significant differences in less money as reasons for decreased food consumption between Kuwaiti and non-Kuwaiti ones	–	Around 40% of participants reported no change in the type of food they consumed	The governments' immediate response to the pandemic and the implementation of robust public health measures to control the spread of the virus	Medium

Table 2 (continued)

No	Author, date	Study design	Population, sampling, sample size	Food security measurement	Impact of COVID-19 outbreak on food security dimensions				Policies/ programs to cope	Quality of the study
					Availability	Access	Utilization	Stability		
Lebanon										
11	Kharroubi et al. 2021 [51]	Forecasting the trends of food insecurity (2018–2022) using the GWP data while considering multiple income reduction scenarios	Nationally representative adults aged 15 years and older (n = 3000), three-stage stratified cluster sampling approach	Gallup World Poll (GWP) 2015–2017 Household data, Food Insecurity Experience Scale (FIES)		Post crises, food insecurity was estimated to reach an average of 36–39% in 2021 and between 36 and 39% by 2022, considering a 50–70% income reduction		More than half the population is expected to be below the national poverty line, and suffering from plummeting purchasing power	An emergency agriculture plan recommending an increase in local agricultural production, particularly of high-value "cash crops", as well as a reduction in the gap between food supply and food demand; providing in-kind aid and small loans to the local farmer	High
Libya										
12	IOM, WFP, 2021 [44]	Web-based and face-to-face surveys (quantitative and qualitative data)	Up to 1in 5 migrants interviewed	Key indicators, including food consumption, economic vulnerability, and asset depletion	While mobility restrictions have eased, the economic situation in Libya remains heavily affected	More than half are considered marginally food secure. Migrants' income had been affected negatively particularly among daily wage workers	–	Some migrants are further eroding their capacity to deal with future shocks, thereby increasing their vulnerability to food insecurity	The use of crisis or emergency livelihood coping strategies, such as reducing essential expenditure on health care or education, or engaging in high-risk jobs or activities to mitigate food consumption challenges increased	High

Table 2 (continued)

No	Author, date	Study design	Population, sampling, sample size	Food security measurement	Impact of COVID-19 outbreak on food security dimensions				Policies/ programs to cope	Quality of the study
					Availability	Access	Utilization	Stability		
Morocco										
13	Bilali et al. 2021 [52]	An online survey	340 adult consumers, The snowball-sampling approach	A standardized questionnaire	The extraordinary hoarding caused by the epidemic, pasta, wheat, and salt shelves have been depleted	A rush toward supermarkets has been observed, and demand for flour and grains has jumped. A surge in food prices	–	52.65% of the participants said they had stocked up on food	Despite promises from the government and stores that the food supply system could satisfy, depletion of food items occurred	Medium
Oman										
14	Ben Hassen et al. 2022 [53]	Survey	356 Omani adult consumers, The snowball sampling with a non-probability sample technique	An online questionnaire using the Survey Monkey platform	The epidemic, however, had little effect on food supplies or	The epidemic, however, had little effect on food prices	–	Stocking up food by the non-Omani was mainly motivated by concerns about obtaining enough food and rising food prices	The authority has made full preparations to confront the Coronavirus pandemic and made continuous efforts to monitor markets and regulate prices	Medium
Qatar										
15	Ben Hassen et al. 2020 [54]	Online survey	579 voluntary respondents	Structured questionnaire	Hypermarkets reported no major hindrance to the supply chain of food items	Prices remained stable with no impact on the abundance of goods, food, and consumer products	–	Non-Qatari respondents stocked up on more food than Qataris	Diversifying its global supply chains, improving its ports and rail infrastructures as well as increasing the local production	Medium

Table 2 (continued)

No	Author, date	Study design	Population, sampling, sample size	Food security measurement	Impact of COVID-19 outbreak on food security dimensions				Policies/ programs to cope	Quality of the study
					Availability	Access	Utilization	Stability		
Saudi Arabia										
16	Hanbazaza, 2021 [55]	Cross-sectional study	605 adult residents of all provinces in Saudi Arabia, aged 20 years or more, and willing to participate in the study	An online questionnaire	Low quality and limited food available in the supermarkets	About one-third of the population was experiencing food insecurity. Increased food prices	–	The economic lowdown caused by the pandemic has had a devastating effect on jobs, incomes, and businesses,	Providing funds to support the private sector, small businesses, economic activities, as well as assistance to those most affected by this pandemic; free food baskets to families in need	Medium
17	Almoraie, 2021 [55]	Cross-sectional study	968 participants from all Western regions and comprised both men and women within the age range of 18–60 years	An online self-administered questionnaire	Absence of grocery stores in the neighborhood and food unavailability in the neighboring grocery stores and supermarkets	The majority of participants indicated not having any difficulties with the availability of food sources; a small percentage of low-income reported eating less or undesired food, as well as eating fewer than three meals a day	–	A rise in food prices	The support given to food supply chains across the country, which eased the process of food supplies reaching the consumer, including securing food supplies quickly and reliably in case of an emergency shortage	Medium
Somalia										
18	FAO, 2021 [37]	Household survey	2720 rural households, 52 extension workers, 56 agricultural input vendors and 52 food traders across 17 regions every 3 months	Computer-assisted telephone interviews	24% reported a decline in their planted area compared to normal	86% of households consumed between 5 and 12 food groups according to their Household Dietary Diversity Scores		35% of households reported experiencing some type of shock (drought, higher food prices, higher crop and livestock production costs, conflict, and insecurity)	To obtain food or income, 66 $ of households engaged in negative livelihood-based coping strategies. Cash assistance, as well as access to water, animal feed, and veterinary services	High

Table 2 (continued)

No	Author, date	Study design	Population, sampling, sample size	Food security measurement	Impact of COVID-19 outbreak on food security dimensions				Policies/ programs to cope	Quality of the study
					Availability	Access	Utilization	Stability		
Sudan										
19	FAO, 2021 [39]	An assessment using primary and secondary data	A sample of 448 key informants working for the Ministry of Agriculture was interviewed across 16 states	–	Limited internal and cross-border trading has hampered the food supply system. The closure of food markets across the country decreased the availability of basic food commodities	Hindering physical access of many poor households to areas, where they normally generate income through labor, increased food commodity prices	–	Prices of feed and animal drugs were reported to be much higher	The depletion of productive assets due to the adoption of negative coping mechanisms (reducing non-essential food expenditures, selling agricultural productive assets (e.g., livestock and tools), and seed consumption might erode the capacity of rural households to prepare for the following agricultural season; no further increases in new agricultural programs	High
Tunisia										
20	ElKadhi et al. 2020 [41]	Estimation via modeling	–	–	Agriculture output fell by 16.2%	Higher income urban households will see the largest income losses, although lower income urban households also will experience significant income reductions			Social transfers toward poorer households and re-opening the economy will be critical to reducing employment and income losses, especially in manufacturing and retail	High

Table 2 (continued)

No	Author, date	Study design	Population, sampling, sample size	Food security measurement	Impact of COVID-19 outbreak on food security dimensions				Policies/ programs to cope	Quality of the study
					Availability	Access	Utilization	Stability		
Yemen										
21	FAO, 2021 [38]	Survey	1775 households, eight agricultural extension officers and 90 food traders key informant interviews (KII) of agricultural extension officers	Food Insecurity Experience Scale (FIES) module, Computer-assisted telephone interviews	About 70% of the food traders reported a decrease in food commodity supply, and 87% reported price increases in main food commodities	53.6% of the households find themselves in a state of moderate food insecurity or worse; 19% mainly to COVID-19		Over one-third of the surveyed households reported more than a 50% decrease in their main source of income	The majority of households have been resorting to borrowing money or buying food on credit; reducing essential non-food expenditures; and reducing expenses on agricultural, livestock, or fisheries inputs. Establishment of a regular food security and livelihood monitoring system	High
22	CARE, 2021 [45]	Quantitative and qualitative approaches, Literature review	In the two rural and urban districts, 22 key informants interviews with community leaders, health professionals, government offices and humanitarian actors; 410 household survey; 12 Focus group discussions, 10 case studies	The Food Insecurity Experience Scale (FIES)	Some humanitarian partners (but not CARE) decided to reduce the frequency of the emergency food assistance delivered	The most commonly reported areas of their life that have been most impacted were income and livelihood (84%), food/nutrition (58%), Unemployment increased		57.7% of households experienced 'moderate' and 'severe' food insecurity, and 26.1% experienced 'severe' food insecurity	About 61% of respondents reported that they are purchasing food on credit or borrowed money. The already dire humanitarian situation is urgent in response to meeting priority life-saving humanitarian needs for food security and livelihoods	High

Table 2 (continued)

No	Author, date	Study design	Population, sampling, sample size	Food security measurement	Impact of COVID-19 outbreak on food security dimensions				Policies/ programs to cope	Quality of the study
					Availability	Access	Utilization	Stability		
23	Elsabbagh et al. 2021 [42]	Modeling an 80% decline in remittance volumes	Information on personal tax rates and household savings rates structure	SAM-based multiplier model	National GDP is estimated to have fallen by 8.5%. Agriculture was estimated to drop in output by more than 9%	Household income fell on average by 12.5%. The poorest households suffered a severe income loss of approximately 21%	–	–	Options for local recovery measures are limited. Nonetheless, Saudi Arabia and other Gulf countries could enact concrete policies to help Yemeni migrant workers survive the adverse impacts of COVID-19 in their labor markets	High

Food insecurity in Middle Eastern countries during the COVID-19 Pandemic

Table 3 categorizes the food insecurity studies conducted in the Middle Eastern countries based on the World Bank classification of their national income [56] during the COVID-19 pandemic. However, there are some exceptions; Lebanon and Iran, as two upper-middle-income countries for many years, now move to the lower-middle-income group, and in contrast, Iraq is an upper-middle-income one. International organizations conducted most of the studies in the low/lower-middle-income countries using primary and secondary data from qualitative and quantitative methods, whereas researchers from the high/upper-middle countries conducted the studies during the COVID-19 pandemic mostly via an online survey using FI-measuring questionnaires. In the first group of countries, severe disruption of food sub-systems occurred, food prices rose, and many poor people also suffered as their employment due to the breakdown of supply chains-transporting, marketing, and selling food, increasing food insecurity, energy, and nutrient deficiency for both urban and rural poor. In high/upper middle-income countries, unaffected food supply led to a rush toward supermarkets and stocking, less food price increase occurred (with some exceptions, e.g., Iran due to the special conditions of sanction), and income loss mostly affected vulnerable people, e.g., refugees.

Discussion

The review of the effects of the COVID-19 pandemic on food security shows that some governments have often succeeded in providing enough food supply (availability), but they acted differently in terms of population accessibility to food and its price stability. An increase in food prices in most countries yielded in stocking and decreased the purchasing power of the community. No effect on the utilization dimension was found; only in a National Food and Nutrition Surveillance of Iran protocol by Resekhi et al. [11] assessing the effects of the COVID-19 pandemic on anthropometric indices of under 5-year-old children was proposed. It seems that differences in the impact of the pandemic on countries' food security are based on the development and stability of their food systems; however, this interpretation of data needs to be studied and examined more closely in different countries with different degrees of development and speeding of the disease.

Based on the reports of FAO and the World Bank, the prevalence of undernourishment (percentage of the population with insufficient energy intake) and food insecurity increased slightly in the COVID-19 pandemic-affected MENA countries; however, the most increases were found in conflict-affected countries (availability domain). The rate of price increases over this period has been moderate, and it seems that the expected decline in incomes of the different social groups, especially the informal sector and vulnerable poor segments of society, represents a major risk on the demand side (access and stability domains). The prevalence of underweight, wasting, and stunting in children under 5 years of age has declined steadily since 2000 (utilization domain) [57, 58]. A study in Sub-Saharan Africa found that COVID-19 negatively affects all four indicators of food security without exception [59].

The findings of the current study confirm that the final outcomes of COVID-19 will most certainly vary from country to country, depending not only on the epidemiological scenario but also on the pre-COVID socioeconomic development level, baseline situation, and shock resilience [52, 54]. Conflict, siege, and locust invasion further undermine food security in Middle Eastern and East African nations, such as Yemen and Somalia. Due to record low oil prices, countries that rely on oil for the majority of their export revenues may face challenges. Algeria and Iran, both of which have low hard currency reserves, will be affected. The COVID-19 threat is exacerbated in areas of conflict and crisis, such as the Middle East and East Africa, by sieges, embargos, and other barriers to food access imposed by political and military forces. Millions of Syrian refugees now reside in camps in Turkey, Lebanon, Syria, and Jordan, relying on food aid and cannot practice social distancing [60]. They are more vulnerable than the citizens of the country, and policies should be adopted to protect their food security separately.

Based on IFPRI reports, in the Middle East and North Africa region, the pandemic led to falling remittances and incomes, especially in the service and industry sectors. Food services and tourism-related businesses suffered the most severe disruptions, proportionately harming urban dwellers employed in those sectors, while other parts of the agrifood system have proved more resilient. In particular, the pandemic continues to test the functioning of national food systems and expose the vulnerabilities that come with the heavy dependency of most MENA countries on food imports. All national economies in the region have experienced severe disruptions. The impacts vary across countries and sectors, reflecting differences in both the spread of the pandemic and government responses. The pandemic has caused GDP losses ranging from 1.1% expected in Egypt to 23.0% in Jordan during 2020 [61].In a systematic review of the first-year experience of COVID-19 on food security, disruptions in food production (availability) were reported due to persistently low household incomes and insufficient savings [17].

Table 3 Categorizing the Middle East studies on the food insecurity domains in the COVID-19pandemic

	Low/lower middle income	High/upper middle income
Countries	Afghanistan, Iraq, Libya, Somalia, Sudan, Yemen	Bahrain, Egypt, Iran, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, United Arab Emirates
Conducted by	WFP, Word Bank, IFAD, IFPRI, FAO, IOM, Care	Researchers from the country
Study method	Qualitative and quantitative methods using primary and secondary data	Cross-sectional analysis through an online survey using FI measuring questionnaires
Findings	Reduced production, processing, and distribution sub-systems A rise in food prices Lower access to required energy and nutrients	Food supplies are relatively unaffected Less food price increase Reduced wages and Loss of income affects the most vulnerable A rush toward supermarkets and stocking

Along with several advanced technologies and adaptations for population screening and early disease diagnosis [62, 63], general strategies like supporting vulnerable groups through social protection programs are suggested and used in various countries to prevent increasing food insecurity in the COVID-19 epidemic, while different countries, depending on their circumstances, may need localized and specific solutions. Strengthening sustainable agriculture, resilience, and social protection systems are recommended to promote food security in future pandemics [64, 65]. Some unexpected findings from countries [16] can be attributed to the limitations of the studies, especially the generalizability of the sample to the study population, which should be improved in future studies.

In the present conditions, international organizations and developed countries should help low- and middle-income countries to provide the capacity to expand health and social support programs, strengthen food supply chains, and ensure adequate and affordable food sources with the necessary fiscal space and import [66]. While some economic strategies, such as social assistance, can help individuals manage food insecurity during COVID-19, international sanctions can make implementing these solutions extremely difficult, if not impossible [47]. The pandemic is also a strong reminder for countries to rethink their agricultural investment priorities to include (climate), nutrition, and the environment, diversifying food imports and exports, local/traditional foods, and improving the business environment to allow farmers, food producers, and traders to thrive and grow[61, 66–68].

The limitation of this systematic review was the limited number of included studies (n = 23), which may reduce the chances of a better interpretation of the results. In addition, although we had planned the systematic review and registered it in PROSPERO under the following title, "The relationship between COVID-19 pandemic and food security at individual and household level: a systematic review", due to the multisectoral impacts of COVID-19 on food security, the lack of access to full-text articles as well as the exclusion of published articles in a language other than English, the research team conducted the study as a scoping review in the Middle East countries. Future systematic reviews in different parts of the world, especially on the main individual, regional, and governmental policies and strategies to cope with the impacts of pandemics on food insecurity and their cost-effectiveness evaluation, can be very helpful.

Conclusion

An increase in food prices in most countries yielded in stocking and decreased the purchasing power of the community. Despite providing enough food supply (availability) in most countries of the region, they acted differently in terms of population accessibility to food and its price stability. The high/upper middle-income countries of the region had little problem in providing food despite their dependence on food imports and their focus was more on price stabilization and access to vulnerable groups. While in low/lower-income countries, almost all parts of the food and nutrition system were disturbed.

The current review results can predict the effect of COVID-19 on the food security of individuals and households, especially in vulnerable groups, and develop effective interventions. In addition, this review can provide policymakers with the information to better understand the factors influencing the implementation of interventions toward mitigating the effects of the pandemic on food security and evidence-informed policy-making to improve food security.

Abbreviations

COVID-19 Coronavirus disease 2019
SRA-DM Systematic review-assistant deduplication module
NOS Newcastle–Ottawa Quality Assessment Scale

Supplementary Information

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Additional file 1: Table S1. Database search strategy.

Additional file 2: Table S2. Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist.

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AD, FMN, and GF conceived and designed the study. AD, FMN, SA, and MHS developed the search strategy. AD and FMN extracted the data. All authors have read and agreed to the published version of the manuscript.

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Availability of data and materials
Not applicable.

Declarations

Ethics approval and consent to participate
This study was approved by the ethics committee of the National Nutrition and Food Technology Research Institute, Shahid Beheshti, University of Medical Sciences (No: IR.SBMU.NNFTRI.REC.1399.041).

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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