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Review Article

Stability of Food Security in Iran; Challenges and Ways Forward: A Narrative Review

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Abstract

Food security, which is considered to be a public health-related socioeconomic factor, ensures the health of society's people and plays a significant role in improving governance. This concept is closely related to the concept of stability of food. The stability of food means that there should be adequate, quality, and nutritious food for all human beings, in all places and at all times, and no factor should prevent this important issue. Stability in food production and supply is at the heart of food security and makes food systems resilient in times of crisis. The negative impact of climate change on agricultural production, intensified inflationary trends, high food prices, increasing food waste, increasing the need for food imports, and, more significantly, ongoing international sanctions make it difficult to access affordable food and pose challenges to Iran's food security. Moreover, the COVID-19 crisis has reduced the incomes of families and government by intensifying economic pressures on government incomes as well as rising unemployment, which has directly exacerbated food insecurity. The link between indicators of food stability and food security in Iran is the subject of this article. The key indicators selected are the percent of arable land equipped for irrigation, the cereal imports dependency ratio, the value of food imports over total merchandise exports, per capita food production variability, and, per capita food supply variability. Results show Iran is vulnerable to the arable land equipped for irrigation, food imports over total merchandise exports, and the cereal imports dependency ratio while being resilient per capita food production and food supply variability.

Keywords: Stability; Food security; Food production; Food supply; Iran

Introduction

Food security is considered to be a health-related socio-political factor, "exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (1). It is an important issue on the agenda of the United Nations Sustainable Development Goals. There are many obstacles to eradicating hunger on the planet. Lack of equal concern of countries and global organizations on this issue, Continued population growth, poverty, economic crises, ongoing conflicts, and political and social crises in some parts of the world, the effects of which affect national and global economies, are among the important obstacles to eradicating hunger in the world.

Food security, which plays an important role in maintaining public health, follows various aspects from food production to consumption, and to

achieve it special policies related to the health conditions of production, processing, packaging, and supply of food, etc. are mandatory in every country around the world (2). Defining the concept of food security is a difficult task because not only can it be defined from different aspects, but also the geographical and climatic location of countries and also the extent of their development is effective in defining the concept of food security. "Food security has a quantitative dimension, which concerns the availability of safe and nutritious food, and a qualitative dimension, which concerns the hygienic conditions of food production and processing" (3). Given the complex and numerous definitions of the concept of food security, the definition of the Plan of Action of the World Food Summit in Rome in 1996 is the focus of this review article.

According to the concepts provided by the FAO (1), availability, access, utilization, and stability of adequate, quality, and nutritious food are embracing four basic dimensions of the concept of food security. The FAO aims to provide these four basic dimensions of food security, emphasizing the importance of providing adequate, quality, and nutritious food for all human beings, all over the world, at all hours of the day. Emphasizing the simultaneous importance of all four basic dimensions of food security, the main focus of this review article is food stability. In the basic dimension of food stability, it is emphasized that there should be adequate, quality, and nutritious food for all human beings, in all places and at all times, and no factor should prevent this important issue (3,4).

Given that each of the four main dimensions of food security addresses a specific issue, it seems that the concept of food stability among these four concepts is a more comprehensive approach to the various issues of production, processing, and supply in the required food basket people (5). Also, although important issues related to food are seen in most of the 17 SDGs and policies, in particular, the issue of food stability is not mentioned. This can have a negative effect on food stability and food security in general. The concept of stability in food security is perused in three cases: 1, the availability of food, 2, access to food, and 3, the consumption of food at all times without any risk. The main risks that have adverse effects on these dimensions are climate change, economic status, cultural status, and rate of development. Therefore, due to changes in conditions, the state of stability of food security also changes, and, as a result, the state of food security changes. Thus, it is important to emphasize the importance of ensuring access to a situation of stability of food security given the above risks (6).

In most previous research, food stability as a set of socioeconomic aspects was defined but there is no global consensus on aspects to guarantee food stability. Thus, in this review, five following aspects to guarantee food stability will be discussed:

- Attention to the percent of arable land equipped for irrigation, which is a comparison between the total arable land to the arable land equipped for irrigation (7);
- Attention to the cereal imports dependency ratio to the total imports (8);
- Attention to the value of food imports over total merchandise exports;
- Attention to per capita food production variability, which shows the changes in the net worth of food production in each country's international $ per capita (9); and,
- Attention to per capita food supply variability, which shows the per capita changes in the food supply in each country per person per kilocalorie per day (10).

In the light of the imposed effect of stability on national food security, this article aims to improve the understanding of the indicators of stability of food security in Iran. The main question is considered what are the status indicators of stability of food security in Iran? The role of affective factors in the food security of Iran has been mostly explored in relation to impacts on crop productivity or the food availability aspects of food security with little focus on other key dimensions, for example, the indicators of stability of the food security of Iran. This review will follow up a food security approach to gain a wider approach on food security issues in Iran. In this review, possible links

between stability indicators and food security of Iran will be emphasized, and stability indicators of food security and key knowledge gaps in the literature related to food security in Iran will be identified.

Food stability and food security in Iran

Despite the plans of national governments and regional and global organizations to reduce the rate of hunger and malnutrition around the world, unfortunately the number of people involved in the issue of hunger and malnutrition in the world is increasing (11) and in recent years, the COVID-19 crisis has also reduced the economic incomes of families and some national governments by intensifying economic pressures on government incomes as well as rising unemployment, which has directly exacerbated food insecurity (12). Also, the problem of increasing global food insecurity exists in West Asia. Although there are different opinions about the West Asian region among geopolitical thinkers, the authors in this study identify the countries in West Asia including Iran, Turkey, Iraq, Tajikistan, Afghanistan, and Pakistan. This is obviously the countries of northern Iran are classified in the region of Central Asia and the Caucasus, and the countries of southern Iran are classified in the Persian Gulf region. Therefore, the focus of this article is on West Asia with a focus on Iran. With regards to international sanctions, the food security of Iran is a serious problem. With the intensification of sanctions against Iran in 2018, due to the decrease in Iran's foreign exchange earnings, imports decreased and unprecedented inflation occurred in the Iranian food market, which has undoubtedly affected the food security of the Iranian people.

Despite the fact that in Iran, due to the existence of a sufficient number of food retailers and wholesalers, there is no problem of timely access to adequate, quality, and nutritious food (13), the WHO reports on food security policies in Iran suggest that Iran's efforts to become a food secure country should be accelerated. Although food insecurity is one of the main concerns of the National Development Programs of the Islamic Republic of Iran and declined number of malnourished people from 5.2% in 2004-2006 to 4.7% in 2017-2019, "a meta-analysis on Iranian experiential/perception-based studies showed it has failed to achieve the Millennium Development Goal of halving this rate" (14). The Global Hunger Index by integrating three indicators of malnutrition, child underweight, and child mortality, ranked Iran as 39th out of 107 countries. It is worth noting although Iran has better conditions than its neighboring countries in West Asia, with a score of 7.9, Iran has a level of hunger that is low (15). In the last decade, Iranian officials have emphasized the growth of national production, which has led to an increase in production in both agriculture and food industries, but the consumption of some foods by the Iranian people is still below the required average and reasonable standards and an important challenge in stability of food security in Iran (16,17). An important indicator in the stability of food security is the degree of self-sufficiency in strategic agricultural products that Iran continues to meet an important part of its needs through imports. With the beginning of a new round of sanctions against Iran during the Trump era, with the reduction of Iran's foreign exchange resources, the import of these two products, like some other key products, decreased and increased the prices of these two products and their related products.

Concerning that the stability of food security in Iran depends on access to food anywhere and anytime the country, in the current of the country and better facing economic sanctions, achieving food security, focusing on natural resources and human factors are essential to ensure the food stability of Iran is essential because increasing the resilience and tolerance growth of a food system over time can lead to increased stability of its food security.

Food stability indicators in Iran

Attention to percent of arable land equipped for irrigation

Arable land as land equipped with sustainable irrigation systems and methods is one of the indicators of FAO stability indicators of food security. "It includes areas equipped for full and partial control irrigation, equipped lowland areas, pastures,

and areas equipped for spate irrigation" (18). This indicator, which is presented in a three-year average, plays an important role in the resistance of the country's agricultural sector to natural disasters caused by low or high rainfall, such as drought or flood (7).

According to the FAO, the ratio of irrigated land in Iran compared to the total arable land in the country according to the latest available statistics (2015-2017) was 50.1% (18,19). In 1970, the total area of lands equipped with irrigation systems in Iran was 5200 thousand hectares, which with an annual growth of 1.32%, in 2019 reached 9600 thousand hectares (20,21). On the other hand, due to the low and unsustainable quality of nearly 50% of Iran's agricultural lands, the development of agricultural lands is facing a serious challenge from a quantitative perspective, which plays a key role in the instability of Iran's food security (22).

The FAO report shows that during the mentioned period, the average global percentage of arable land equipped with irrigation indicator was 24.1 at the global level, 47.6 in Asia, and 39.2 in West Asia. Table 1 shows the average of this indicator for Iran's neighboring countries in West Asia.

Table 1: Percentage of arable land equipped for irrigation (18)

Country	*Percentage of arable land equipped for irrigation*
Iraq	81.7
Pakistan	57.6
Iran	50.1
Afghanistan	41.7
Turkey	19.8

As Table 1 shows, among Iran's neighboring countries in West Asia, 81.7% of Iraq's arable land is equipped with irrigation systems. LPF mentioned Pakistan with 57.6% is ahead of Iran and more of its arable land is equipped with irrigation systems than Iran. After Iran, Afghanistan with 41.7%, and Turkey with 19.8% have the lowest amount of irrigated land (18). The statistics in the table show the average position of Iran among its neighbors. Given that from the point of view of FAO, this indicator has been introduced as one of the indicators of food security vulnerability assessment for many years; it is important because this indicator shows the agricultural dependence of a country or a region on irrigation. In other words, according to this indicator compared to a country like Turkey with 19.8% of lands equipped with irrigation equipment, Iran has almost twice more water needs (18). The need for water is one of the most significant factors of the stability of the food security of countries.

Attention to the cereal imports dependency ratio

The cereal imports dependency ratio, which is a three-year indicator and shows how dependent a country is on cereal imports, is one of the indicators of FAO stability indicators of food security (8). Cereals, which play both a quantitative and important role in the human food basket and a qualitatively key role in the general health of society, must be guaranteed access to people at all times and places. With these interpretations, the lack of need to import cereals from abroad has a positive role in maintaining the stability of food security of countries, and in contrast, dependence on grain imports from abroad, challenges the stability of food security of countries.

In 2004, the cereal import dependency ratio of Iran in Iran was 19%, which has increased to 36% in 2018. In other words, this indicator has grown by an average of 4.5% annually (21), which is high according to the constant emphasis of the country's officials on relying on domestic production, non-dependence on imports of strategic agricultural products and reduction of the country's foreign exchange resources due to sanctions. More importantly, due to the effect of climate change, such as reduced rainfall and rising temperatures on cereal production, increasing population and growth in cereal consumption, and increasing

waste cereal, the trend of cereal imports in Iran will continue in the coming years (23). Also, the reduction of rainfall due to recent droughts and the reduction of water consumption efficiency in cereals, intensifies the need to import cereals in Iran.

Table 2: Percentage of cereal import dependency ratio (18)

Country	*Percentage of cereal import dependency ratio*
Iraq	58.8
Iran	36
Afghanistan	33
Turkey	1
Pakistan	-17.2

FAO reports show the cereal imports dependency ratio in West Asia is 46.2% (21), therefore, in this indicator, in terms of regional average, Iran is in good conditions among its neighbors. As Table 2 shows, among Iran's neighboring countries in West Asia, the cereal import dependency ratio of Iraq is 58.8%. It shows Iraq needs more cereal imports than Iran, which is a negative point for the food security of Iraq. Also, the percentage of cereal import dependency ratio of Afghanistan is 33% which shows Afghanistan has a better position than Iran in terms of dependence on cereal imports. Among Iran's neighbors in terms of cereal imports dependency, Turkey is much less dependent on Iran and the best position with -17.2% is related to Pakistan, which is in fact one of the main exporters of cereal to other countries. As a result, according to this indicator, the best position of stability of food security among Iran's neighbors is related to Pakistan and then Turkey.

Attention to the value of food imports over total merchandise exports

This indicator, which is measured on a three-year average, is another FAO suite of stability indicators of food security that focuses on comparing food imports with a country's total exports. In other words, what is the amount of foreign exchange income of a country from its total exports and how much of this foreign exchange income is needed for food imports from abroad, shows the degree of resistance and stability of a food system that It has an effective role in food security of food systems. "This indicator provides a measure of the adequacy of foreign exchange reserves of a country" (24). For a country, the higher the value of food imports than the total value of exports, the more vulnerable that country is in terms of food security.

FAO reports show this indicator in Iran increased to 10% in 2018. This is while the fact that the global average is reported at 6%, the average for low-income countries at 24%, and 6% for high-income countries (21) and the need to import more food in Iran due to population growth and growth in food demand, will continue in the coming years (25). Also, the report shows that due to the effect of climate change, such as reduced rainfall and rising temperatures on food production, increasing population and growth in food consumption, and increasing waste food, the trend of food imports in Iran will continue in the coming years (23).

Table 3: Percentage of value of food imports over total merchandise exports (18)

Country	*Percentage of value of food imports over total merchandise exports*
Turkey	6
Iran	10
Iraq	16
Pakistan	23
Afghanistan	355

The reports show global average in the value of food imports over total merchandise exports is 6% (21), therefore, in this indicator, in terms of regional average, Iran is in good condition among its

neighbors. As Table 3 shows, among Iran's neighboring countries in West Asia, the value of food imports over the total merchandise exports of Turkey is 6%. It shows this country has the lowest dependence on food imports compared to total exports of merchandise among Iran's neighbors. After Turkey, Iran has a better position in this indicator in West Asia. After Iran, Iraq is next with 16% and Pakistan with 23%. The highest dependence on food imports compared to total exports of merchandise is related to Afghanistan with 355%. Afghanistan is the neediest country in West Asia to food imports.

Attention to per capita food production variability

This indicator, which is another FAO suite of stability indicators of food security, is calculated on a five-year average (26) and shows the changes in the net worth of food production in each country's international $ per capita. Per capita variability in food production compares per capita changes in food production in countries and time (9). To calculate per capita food production, the total value of the country's food production is divided by the total population, and this indicator is a measure of the strength of the food production sector in countries, which shows the strength of food systems in emergency moments of need for food.

FAO reports show the per capita food production variability of the global average is 1.6 $, While this indicator for Iran is 6 times the global average and equal to 9.6 (21). In this regard, Reddy et. Al. report per capita food production variability for developed countries is 7.2 (26). "The rate of variability in per capita food production in Iran from the year 2000 to 2018 reveals a very high level of variability and thus unpredictability in per capita food production. This unpredictability is questionable. A three-year average of food deficit in kcal per capita per day in the country from 1999 to 2016 shows that the food deficit was at its peak between 2014 and 2015. Then, Iran was having an average food-deficit between 2016 and 2018" (21).

Table 4: The per capita food production variability (18)

Country	*Per capita food production variability*
Turkey	13.8
Iran	9.6
Iraq	7
Afghanistan	3.5
Pakistan	3.2

As Table 4 shows, among Iran's neighboring countries in West Asia, the per capita food production variability of Turkey with 13.8 is better than Iran with 9.6, then, Iraq with 7, after that Afghanistan with 3.5 and finally, Pakistan with 3.2. These results show that Afghanistan and Pakistan are not in a good position, but the position of Iran is good among its neighbors in this indicator. Given the utility of this indicator for comparing trends in the stability of adequate, quality, and nutritious food production anywhere and anytime, As Table 4 shows, Iran's position in the trend of stability of food production over time is better than the global average and the average of neighboring countries.

Attention to per capita food supply variability

Food supply variability is another FAO suite of stability indicators of food security. This indicator, which measures changes in food supply per person per kilocalorie per day, directly affects stability of food security (10). "Food supply variability results from a combination of instability and responses in production, trade, consumption, and storage, in addition to changes in government policies such as trade restrictions, taxes and subsidies, stockholding, and public distribution" (21,28). Stability of supply of adequate, quality, and nutritious food and price of food, which is directly affected by food supply, in addition to the government, it also helps households to plan to improve the health of individuals and society, which plays a key role in increasing the general health of society (27). Stability of food supply is an important

factor in the resilience of food systems, and a correct understanding of the fact, increases the resilience of food systems in critical situation.

Reports show the trend of changes in this indicator for Iran has been a volatile and sinusoidal trend this is not a good sign for the stability of food security in Iran. During the years 1999 to 2016 per capita food supply variability was at the minimum level in 2002 (19 kcal per day). After that it began to increase, reaching 43 kcal per day in 2011. To some extent, this increase can be attributed to the sanctions. FAO reports show the per capita food supply variability of Iran is 29 kcal/capita/day (21).

Table 5: The per capita food supply variability (18)

Country	*The per capita food production variability*
Turkey	63
Iraq	43
Iran	29
Afghanistan	20
Pakistan	16

As Table 5 shows, among Iran's neighboring countries in West Asia, the per capita food supply variability of Turkey with 63 and Iraq with 43 are better than Iran with 29, then, Afghanistan with 20, after that Pakistan with 16 kcal/capita/day. These results show that Afghanistan and Pakistan are not in a good position, but the position of Iran is good among its neighbors in this indicator (29). Given the utility of this indicator for comparing trends in the stability of adequate, quality, and nutritious food supply anywhere and anytime, As Table 4 shows, Iran's position in the trend of stability of food production over time is better than the global average and the average of neighboring countries.

Challenges and ways forward

The dimension of stability of food security is in fact complementary to the other three dimensions of food security, namely the availability, access, and utilization of food at all times, without any risk. This dimension states that food should be available in sufficient quantities, should have sufficient access to the food and utilize it properly, and these three should continue over time. In other words, stability of food security shows vulnerability to food security in the future. In this review, focusing on the importance of the concept of stability of food security, the stability of food security of Iran was examined.

Notwithstanding significant economic progress in the past decades, Iran faces a number of issues that threaten its food security. The negative impact of climate change on agricultural production, intensified inflationary trends, high food prices, increasing food waste, increasing the need for food imports, and, more significantly, ongoing international sanctions make it difficult to access affordable food and are creating challenges for Iran's long-term food security. Furthermore, the COVID-19 crisis has also reduced the economic incomes of families by intensifying economic pressures on government incomes as well as rising unemployment. Although the number of people experiencing hunger in Iran is lower than ever, the decrease in the stability of the food security of Iran is leading to increased rates of malnutrition. Although progress in the field of agriculture in Iran can be seen, but the growth of food production has not been able to increase the quantity of consumption by the people, and as a result, despite these developments, Iran's food security remains a challenge (16,17). In recent years, the self-sufficiency of the country in basic agricultural products, is a very important indicator of food security, is growing but for some types of strategic food, it is not high enough.

In this review, to evaluate the stability of food security in Iran, the key indicators were selected, which are the percentage of arable land equipped for irrigation, the cereal imports dependency ratio, the value of food imports over total merchandise exports, per capita food production variability and, per capita food supply variability. The review showed that the arable land equipped for irrigation for Iran is 50.1%. It was higher than the global average and made the country's agriculture more in

need of water, and therefore, given the current climate change, is a serious challenge to the stability of food security of the food system of Iran because of water stress and climatic shocks and make agriculture vulnerable. Also, it was shown that the cereal imports dependency ratio for Iran is 36%, which was not only not a good position among its neighbors, also is a challenge to the stability of food security of Iran. Also, by studying the value of food imports over total merchandise exports, it was found this indicator for Iran was 10. although it showed a good position for the adequacy of Iran's foreign exchange reserves compared to among its neighbors and the global average, the growth of this indicator in the second decade of the 21st century compared to the first decade is challenging for the stability of food security of Iran because Iran's food system due to dependence on foreign trade is vulnerable to the variation in exchange rates. The final two indicators of this review examined the per capita food production and supply variability in Iran. FAO reports showed the per capita food production variability for Iran was 9.6 int$1000 and the per capita food of Iran was 29 kcal/capita/day (30). They showed trends in the stability of food production and supply over time for Iran is better than the global average and the average of Iran's neighboring countries. As a result, these two indicators showed the stability of the food security of Iran.

Finally, this review argued Iran is vulnerable to the arable land equipped for irrigation, food imports over total merchandise exports, and the cereal imports dependency ratio while being resilient per capita food production and supply variability. Also, although the stability of the food security of Iran is moderate compared to neighboring countries, the effects of climate change show significant concerns for the stability of the food security of Iran that resolving them requires operational solutions, some of which are listed below:

- Iran's reliance on the need for food imports increases its vulnerability to the stability of food security in Iran, especially as sanctions limited its oil revenue. so, a decrease in the need for food imports and increase agricultural production is necessary and replacing the import of basic agricultural products should be a strategic priority for Iran,
- In order to pursue the strategy of replacing the import in basic agricultural products, it is necessary to consider investment in agricultural infrastructure and innovation in this industry to increase the quantity and quality of agricultural products produced,
- Given that "only 2.6% of Iran's land is suitable for agriculture" (22), in order to make optimal use of the country's geographical area, it is necessary to expand intelligently irrigable agricultural areas and improve uncultivable land in Iran,
- It is necessary to pay attention to the importance of agriculture in the economies of rural areas because food systems that have a stronger rural food system have greater stability of food security in times of crisis. Therefore, policy-making is necessary to strengthen the agricultural economy in rural areas.
- Increasing food waste is one of the drastic problems facing Iran. So, it is necessary to pay attention to changing the style of food consumption in the country.

Conclusion

The negative impact of climate change on agricultural production, intensified inflationary trends, high food prices, increasing food waste, increasing the need for food imports, and, more significantly, ongoing international sanctions make it difficult to access affordable food and pose challenges to Iran's food security. Moreover, the COVID-19 crisis has reduced the incomes of families and government by intensifying economic pressures on government incomes as well as rising unemployment, which has directly exacerbated food insecurity. Iran is vulnerable to the arable land equipped for irrigation, food imports over total merchandise exports, and the cereal imports dependency ratio while being resilient per capita food production and food supply variability.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors

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Conflicts of interest

No potential conflict of interest was reported by the authors.

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