Journal of Agricultural Economics & Development

Homepage: https://jead.um.ac.ir

Research Article
Vol. 39, No. 2, Summer 2025, p. 117-138

Rural-Urban Disparities in Animal-Source Food Demand and Welfare Losses during COVID-19 in Iran: A QUAIDS Approach

A. Karbasi[1], S. Jalalian[1*]

1- Department of Agricultural Economics, Faculty of Agriculture, Ferdowsi University of Mashhad, Mashhad, Iran
(*- Corresponding Author Email: jalalian.s@mail.um.ac.ir)

Received: 27-05-2024 Revised: 26-03-2025 Accepted: 22-04-2025 Available Online: 22-04-2025	**How to cite this article:** Karbasi, A., & Jalalian, S. (2025). Rural-urban disparities in animal-source food demand and welfare losses during COVID-19 in Iran: A QUAIDS approach. *Journal of Agricultural Economics & Development*, *39*(2), 117-138. https://doi.org/10.22067/jead.2025.88095.1267

Abstract

The COVID-19 pandemic presented major global challenges, including a decline in per capita income growth across all income groups in 2020. The protein sector, particularly Animal-Source Foods (ASF) faced increased pressure on both supply and demand, resulting in price volatility. This study examines how income shocks affected food expenditure patterns and consumption behavior, with a focus on protein-rich ASF. Utilizing the QUAIDS model, budget data from Iranian households in rural and urban areas were analyzed for 2019 (pre-pandemic) and 2020 (during pandemic). The findings yield three key insights: (1) The average food expenditure share rose from 37% to 42%, with a sharper increase in rural areas; (2) Positive expenditure elasticities were observed across the six ASF groups including livestock meat, poultry, aquatic animal products, dairy, eggs, and fats, while own-price elasticities were relatively smaller; and (3) Welfare losses across ASF groups ranged from 2% to 24.2%, driven by policy imbalances, supply chain disruptions, and unequal utility distribution. Rural households experienced greater welfare losses in all ASF categories except fats. The study recommends targeted interventions: price-based support for urban areas and expanded social services for rural regions. To strengthen policy responses and enhance long-term food security, future research should assess the potential for substituting plant-based proteins as sustainable and cost-effective alternatives. These findings offer valuable guidance for policymakers aiming to improve nutritional resilience and economic stability in the post-pandemic era.

Keywords: Animal-source food (ASF), COVID-19, Iran, QUAIDS model, Welfare losses
JEL Classifications: D12, Q11

Introduction

The outbreak of COVID-19 triggered an unprecedented global crisis. The pandemic disrupted supply chains, reduced economic activity, and caused simultaneous demand and supply shocks that affected all sectors including the food system (Sarani *et al*., 2025). While no country was spared, the effects were uneven across regions, income groups, and sectors, revealing deep structural vulnerabilities in global economies. Scholars across disciplines from health and economics to sociology have documented these impacts and explored adaptive policy responses to mitigate long-term consequences. Their reports highlighted shifts in government food strategies, altered consumer behaviors, changes in household priorities, and even reductions in food waste, all of which reflect the profound impact of the

https://doi.org/10.22067/jead.2025.88095.1267

pandemic on how societies produce, distribute, and consume food (Ahmed & Sarkodie, 2021; Ceylan *et al*., 2020; Fan *et al*., 2021).

The pandemic simultaneously disrupted both the supply and demand sides of markets. On the supply side, firms faced operational pressures due to partial or total closures, labor shortages caused by quarantine measures, and financial constraints within supply chains (Aday & Aday, 2020). Qualitative and quantitative fluctuations in raw materials (Grinberga-Zalite *et al*., 2021) and restrictions on international trade further compounded these challenges (Hayakawa & Mukunoki, 2021). Meanwhile, the demand side experienced shifts in consumer behavior, with increased precautionary savings, panic buying, and changes in dietary preferences shaped by health concerns and reduced incomes (Anderson *et al*., 2021). These dual pressures severely tested the resilience of global food chains, with the protein sector, particularly animal-sourced foods (ASF), standing at the center of the disruption.

ASFs, encompassing livestock meat, poultry, aquatic animal products, dairy, eggs, and animal-derived fats, encounter a distinct array of nutritional and sustainability challenges. On one hand, demand for high-quality protein increased due to its perceived role in boosting immune function during a health crisis (Akaichi & Revoredo-Giha, 2014). On the other hand, fears surrounding virus transmission through meat products, increased production costs from new hygiene protocols, and rising consumer sensitivity to food safety and quality created complex demand dynamics. The result was an environment of heightened price volatility and uncertain supply. These changes were further amplified by global campaigns advocating plant-based alternatives and by misinformation regarding the virus's origins, which affected ASF consumption trends (Tonsor *et al*., 2023).

Despite such challenges, protein remains a critical dietary component, especially during the pandemic. Adequate protein intake is essential for maintaining immune defense, reducing vulnerability to infections, preserving muscle mass, and ensuring proper metabolic function (Iddir *et al*., 2020). Protein deficiencies, particularly in low-income populations, can compromise immune response and elevate the risk of infectious diseases (Rodríguez *et al*., 2011). Globally, protein availability improved significantly between 2000 and 2017, with developing regions such as Asia, Africa, and Latin America experiencing above-average growth in protein supply (Fig. 1) (FAO, 2020a). While plant-based proteins remain dominant in many regions accounting for 78% of protein sources in Africa and 66% in Asia, the share of animal-origin proteins continues to rise worldwide, reflecting shifting dietary preferences and nutritional priorities. ASFs are recognized as a premier source of high-quality, nutrient-rich food, particularly for vulnerable populations such as children aged 6-23 months (WHO, 2014).

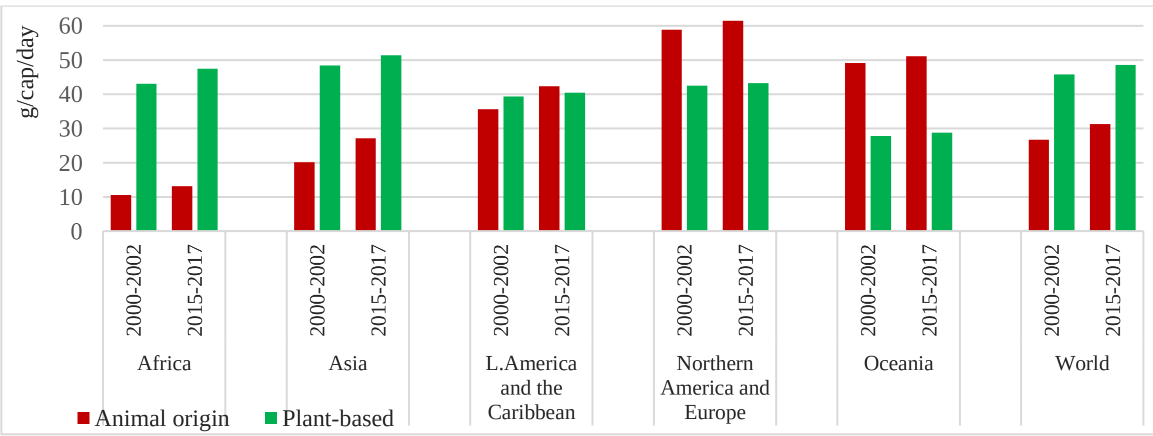

Figure 1- Average protein supply by region and origin

Source: FAOSTAT (2020a)

Nevertheless, the affordability and accessibility of ASF are highly sensitive to income changes. Classical microeconomic theory, particularly Engel's law, provides insight into how income shifts affect food consumption patterns. Engel (1857) observed that as income increases, the proportion of income spent on food declines, and vice versa. This principle remains critical in explaining household food behavior, especially during economic downturns. When incomes decline sharply as they did during the pandemic, households often increase the share of their budget allocated to food, potentially shifting consumption away from higher-value ASFs toward cheaper alternatives. In low-income (LI) and middle-income (MI) countries, demand for ASFs is more income-elastic, reflecting their perception as luxury items that are consumed less frequently (Gao, 2012). As income rises, consumers allocate a smaller budget share to food, consistent with Engel's Law, which states that the proportion of income spent on food decreases with increasing household income. This shift can lead to higher food consumption and changes in dietary composition, favoring more value-added and protein-rich products. According to FAO report from 2000 to 2017, the share of ASFs by weight was 29% in high-income countries, 20% in upper and lower-middle-income (LMI) countries, and 11% in LI countries (FAO, 2020b). Consequently, a decline in per capita income has negatively impacted ASF consumption. Therefore, fluctuations in income significantly influence dietary patterns and the substitution between staple foods and higher-value products.

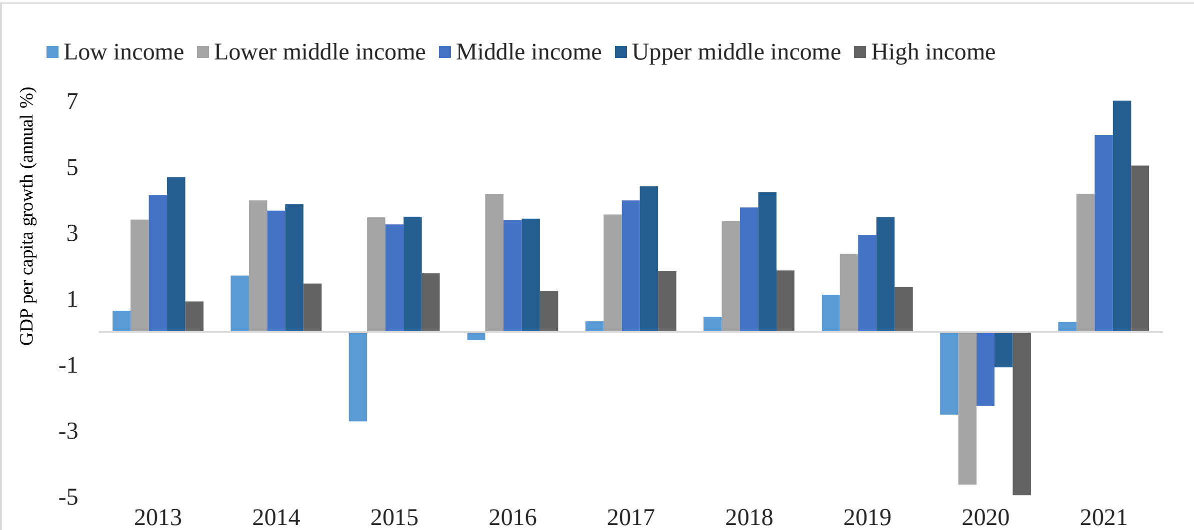

Figure 2- Annual percentage growth rate of GDP per capita based on constant local currency
Source: (*World Development Indicators|DataBank*, n.d.)

The global economic contraction induced by COVID-19 sharply illuminated disparities across income groups (Fig. 2). In 2020, all income brackets recorded negative per capita income growth, with high-income (HI) countries experiencing the most pronounced decline, driven by service sector disruptions from lockdowns. Upper-middle-income (UMI) countries, which boasted the highest GDP per capita growth in 2019, were unprepared for the crisis, their reliance on trade-sensitive industries and constrained fiscal capacity amplifying the shock. LI countries, despite marginal growth of 0.3% in 2021, struggled with structural weaknesses and inadequate policy responses, reversing pre-2020 gains. The pandemic underscored LI nations' vulnerability to external shocks, worsened by deficient healthcare systems and fiscal limitations. Recovery trajectories diverged significantly:

UMI economies capitalized on resilient sectors and supply chain adaptability, while HI countries stabilized more rapidly. Conversely, LI and select UMI nations faced protracted challenges. In developing countries like Iran, diminished purchasing power triggered nutritional trade-offs, intensifying inequalities in access to ASF and exposing food security fragilities. As a “great disruptor,” COVID-19 magnified pre-existing economic disparities, highlighting the urgent need for targeted policy frameworks to bolster resilience in LI and UMI contexts, where economic fragility remains a persistent barrier to recovery.

Research Background

The COVID-19 pandemic officially reached Iran on February 19, 2020, and by March 4, it had spread to all provinces. Nationwide vaccination began on February 9, 2021, but the sixth wave, triggered by the Omicron variant, continued until March 2022. The first day without a COVID-19 death was recorded on June 2, 2022. From 1987 to 2019, Iran was a LMI country for 19 years and an UMI country for 14 years, maintaining its UMI status since 2009 (GDP per capita: $4,046–$12,535). However, the Iranian economy faced significant challenges with growth rates of 3.8%, -4.7% and -8.2% in 2017, 2018 and 2019 respectively. Despite the continuous population growth, the national income decreased by 60%, from $444 billion in 2017 to $191 billion in 2020. Table 1 shows the economic situation of Iran in the two years of the study.

Table 1- Economic growth and inflation in Iran.

Years	Season	GDP Annual Growth Rate (Constant 2016)	Inflation rate
2019 pre-pandemic	Q1	-6.4	4
	Q2	-2.9	6.7
	Q3	5.1	21.6
	Q4	3.8	17
2020 during pandemic	Q1	7.9	9.8
	Q2	6.5	10
	Q3	1	12
	Q4	3.9	10

Source: Statistical Center of Iran

Urban residents comprise 76% of Iran’s population, and rapid urbanization has changed feeding habits and increased demand for livestock products. In 2019, per capita consumption of livestock products was 133 kg, with dairy products accounting for 90% (121.08 kg) and red meat for 12.04 kg. Iran’s poultry industry, which has a 140-year history, ranks 11th and 19th in the world in terms of chicken and egg production. In 2019, the per capita consumption of chicken and eggs was 28 kg and 11 kg respectively, reflecting their importance in the Iranian food supply chain.

The COVID-19 pandemic placed additional strain on the protein supply chain, resulting in price increases for animal source foods (ASF) (Fig. 3). The most significant price surges were observed in red meat and butter, while prices for milk, eggs, chicken, and cheese rose more gradually and with some delay. Butter prices rose sharply due to Iran’s reliance on imports of semi-finished products. ASF and cereals, bread, flour and pasta account for over 53% of Iran's basket of goods, with both groups recording a slight increase in 2020. The cereals group saw the largest increase, while vegetables and pulses declined, likely due to hygiene concerns in the vegetable supply chain. The consumption of fruits and nuts increased, which can be attributed to the quarantine conditions.

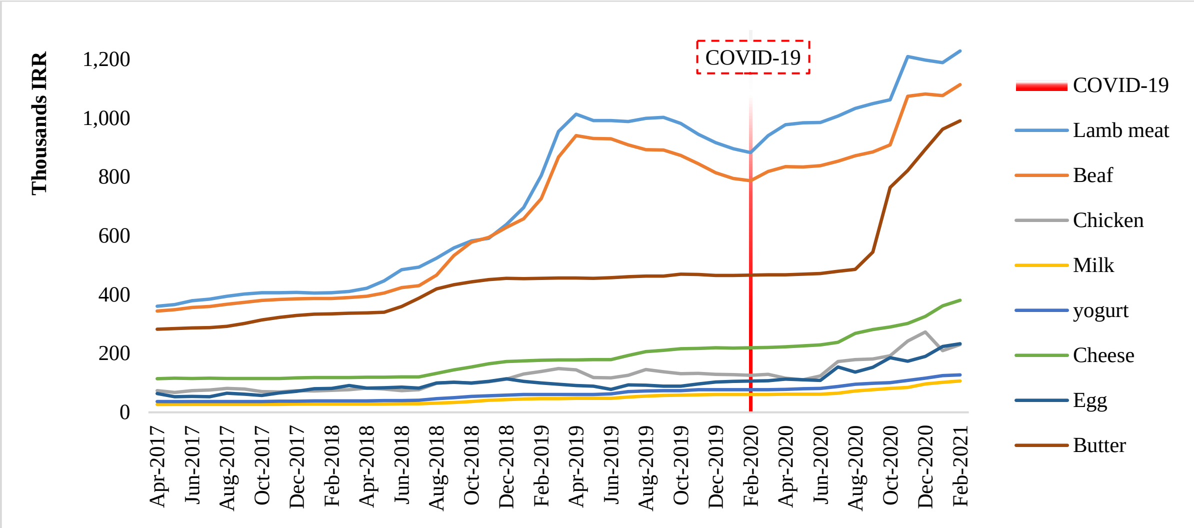

Figure 3- The Average price of selected food items in urban areas of Iran (IRR)
Source: Statistical Center of Iran

Fig. 4 shows that ASF and cereals, bread, flour and noodles account for more than 53% of Iran's basket and both will increase slightly in 2020. Cereals recorded the highest increase, while vegetables and pulses declined, likely due to hygiene issues in the supply chain. The consumption of fruit and nuts increased during the quarantine. Overall, the pandemic has disrupted the Iranian food supply chain, leading to dietary changes and price fluctuations, especially for ASF.

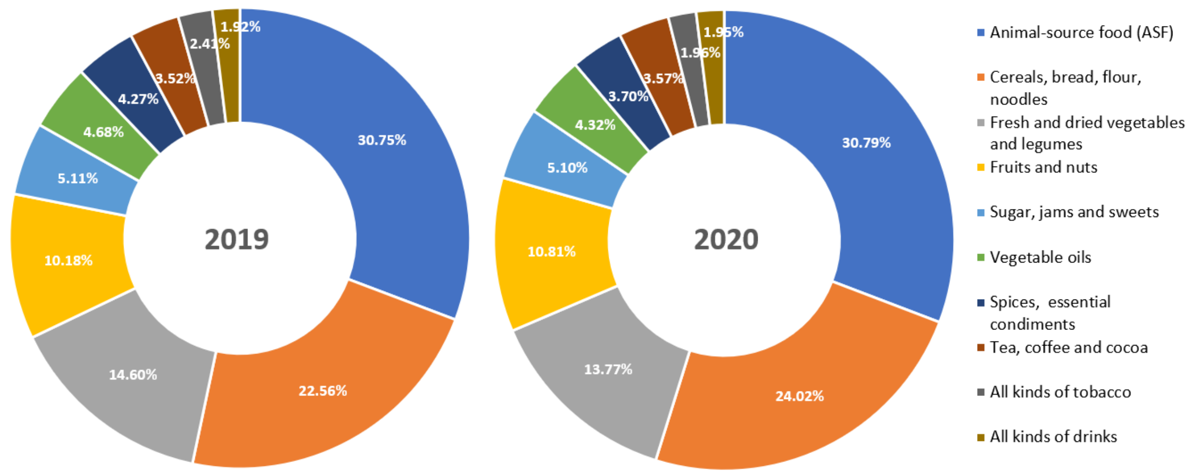

Figure 4- Expenditure share of household food consumption: 2019-20
Source: Author's own compilation

This study investigates the impact of the COVID-19 pandemic on the expenditure share and consumption patterns of ASF in Iranian households, focusing on the interplay between declining per capita income and rising food prices. ASF, encompassing livestock meat, poultry, aquatic products, dairy, eggs, and animal-derived fats, are prioritized due to their high-quality protein and essential micronutrients (e.g., iron, zinc, vitamin B12), which are critical for health, particularly during the disease outbreak crisis. Unlike plant-based proteins, ASF offer complete amino acid profiles and higher bioavailability, but their higher cost and vulnerability to supply chain disruptions make them a key focus for assessing food security risks in MI countries like Iran. The main research question of this study is: How economic and health-related shocks from the pandemic have affected household budget allocation and ASF consumption? The study addresses this by analyzing shifts in food demand, driven by reduced purchasing power and heightened awareness of immune-boosting diets. This research is vital for understanding the short-term effects of the pandemic on food demand and welfare, as inadequate ASF intake can weaken immune systems, exacerbating vulnerabilities (Batlle-Bayer *et al*., 2020). By examining these dynamics, the study aims to inform policies that mitigate nutritional deficits and enhance household welfare.

The research employs the Quadratic Almost Ideal Demand System (QUAIDS) model to analyze household budget data from 2019 (pre-pandemic) and 2020 (during pandemic) across rural and urban areas in Iran, a country facing additional economic pressures from sanctions and inflation. The QUAIDS model estimates price and income elasticities for six ASF categories, capturing how households prioritize food during economic shocks. Additionally, the study calculates welfare losses using compensating variation (CV) and compensated (Hicksian) price elasticities, offering a robust framework to assess the pandemic's economic impact. By distinguishing between rural and urban households, the analysis highlights regional disparities in food demand and welfare losses, providing nuanced insights into the uneven effects of the crisis.

The results underscore the need for targeted interventions to address nutritional gaps, particularly for vulnerable populations. Furthermore, the study prompts consideration of sustainable protein alternatives, such as plant-based options, in future food resilience strategies. By providing empirical evidence on the pandemic's disruption of food demand in Iran, this research fills a critical gap in the literature. Its policy-relevant insights support the development of regionally tailored interventions to mitigate nutritional risks and welfare losses. The findings are particularly timely given global economic and health disruptions, contributing to the broader goal of ensuring access to nutrient-rich diets and enhancing food security for diverse populations.

Literature review

The emergence of new coronavirus variants is being observed in many countries, especially in developing countries such as Iran, which are still facing challenges. Due to the limited data available in these countries, there have been few studies analyzing the changes in food demand under pandemic conditions. Most of them have also used the QUAIDS model and found it useful.

Coelho *et al*. (2010) estimated a QUAIDS for 18 food products using data from a Brazilian Household Budget Survey for the years 2002 and 2003. They showed that purchase probabilities of staple foods were negatively related to family monthly income, while meat, milk, and other products showed a positive relation. They also find that regional, educational, and urbanization variables are also important.

Khoiriyah *et al*. (2020) analyzed the impact of the price change, income, and household size on the demand for five commodity groups, i.e. eggs, chicken, beef, fish, and powder milk in the Indonesian National Socio-Economic Survey 2016. They used 291,414 data from households in Indonesia which were analyzed by QUAIDS. The result showed that all of the price elasticity was negative and the income elasticity was positive.

Nicola *et al*. (2020) summarized the socio-economic effects of COVID-19 on individual aspects of the world economy. They showed that the need for commodities and manufactured products has decreased and the food sector is also facing increased demand due to panic-buying and stockpiling of food products.

Poudel *et al*. (2020) reviewed the possible impacts of the global pandemic COVID-19 on Food and Agriculture across the globe. They pointed the pandemic protocols and provisions interfere with the supply chain of the market with impaired production and distribution accompanied by a lack of labor and supply of inputs. This vastly affects livestock, poultry, fishery as well as dairy production.

Khan *et al.* (2021) reviewed COVID-19's effects on the agricultural sectors. They showed COVID-19 affects the profit of agriculture, livestock, and fisheries and has opened up inequalities within the food chain. As a result, the epidemic has shown that the food chain is fragile.

Vargas-Lopez *et al.* (2022) examined how household culinary traditions and food management have changed in Mexico as a result of COVID-19-related restrictions, and their impact on food waste. The results show that the participating households increased their monetary expenditure on groceries and reduced food waste during the pandemic. The estimation of consumer responsiveness to waste, through the introduction of a framework based on QUAIDS, confirmed that, even more during the lockdown, food waste has become a luxury good.

Kaicker *et al.* (2022) examined covariates of food security and the impact of COVID-19-induced shocks, among households in India using a nationally representative survey. Using a 2SLS panel regression model, found an important role of incomes, relative food prices, household characteristics, as well as mobility restrictions in response to the rising number of infections in a given region in explaining varying food expenditure shares before and during the COVID-19 pandemic.

The literature highlights the significant impact of economic and health crises, such as COVID-19, on food demand and consumption patterns across various countries. Coelho *et al.* (2010) and Khoiriyah *et al.* (2020) demonstrated the effectiveness of the QUAIDS model in analyzing food demand, showing how income, prices, and household characteristics influence consumption. Nicola *et al.* (2020) and Poudel *et al.* (2020) emphasized the pandemic's disruption of food supply chains and increased demand for essential goods. Khan *et al.* (2021) and Kaicker *et al.* (2022) further illustrated how COVID-19 exacerbated inequalities in food security and altered household expenditure. Vargas-Lopez *et al.* (2022) explored changes in food management and waste during the pandemic. Collectively, these studies underscore the need for robust models like QUAIDS to understand and address food demand shifts during crises.

Material and Methods

QUAIDS Methodology

Structural econometric modeling, in contrast to non-structural modeling, that lacks economic theoretical foundations, is based on economic theories and takes into account the theoretical relationships between the dependent variable and the explanatory variables. A large proportion of demand models are based on consumer behavior and the maximization of total utility. Several structural models have been presented in the literature. Linear Expenditure System (LES) (Stone, 1954), Rotterdam Model (Barten, 1969), Translog System (Christensen *et al*., 1973), Indirect Transfer System (ITS) (Christensen *et al*., 1975), Quadratic Expenditure System (QES) (Pollak & Wales, 1978), Almost Ideal Demand System (AIDS) (Deaton & Muellbauer, 1980), all of which have attempted to provide more flexible systems and adapt theories to experimental studies. More recently, the most popular approach, especially in the food field, has been the Quadratic Almost Ideal Demand System (QUAIDS). Aiming at a more flexible performance and a nonlinear Engel curve coverage more in line with reality, the QUAIDS was introduced by Banks *et al.* (1997). QUAIDS shows the non-linear responses of price and expenditures changes to demand and provides an estimate of a higher order between consumption of goods and income (Engel curve). The QUAIDS model is derived from an indirect utility function that has the following form Equation ((1):

$$Ln\, V(P,m) = \left[\left\{\frac{\ln m - \ln a(P)}{b(P)}\right\}^{-1} + \lambda(P)\right]^{-1} \quad (1)$$

Where:

1) $\ln a(P) = \alpha_0 + \sum_{i=1}^{k} \alpha_i \ln p_i + 1/2 \sum_{i=1}^{k} \sum_{j=1}^{k} \gamma_{ij} \ln p_i \ln p_k$

2) $b(P) = \prod_{i=1}^{k} p_{i=1}^{\beta_i}$
3) $\lambda(P) = \sum_{i=1}^{k} \lambda_i \ln p_i$

The index i stands for the number of goods in the demand system, P is the price of good i, m is the total expenditure, (1) is the translog expansion and (2) is the Cobb-Douglas price aggregator. (3) The household expenditure function is similar to AIDS when $\lambda = 0$. Using Roy's identity in equation ((1), the share equations can be written as follows equation ((2):

(2)

$$w_i = \alpha_i + \sum_{j=1}^{k} \gamma_{ij} \ln p_j + \beta_i \ln\left(\frac{m}{a(P)}\right) + \frac{\lambda_i}{b(P)}\left[\ln\left(\frac{m}{a(P)}\right)\right]^2$$

s.t:
1) $\sum_{i=1}^{k} w_i = 1$
2) $\sum_{i=1}^{k} \alpha_i = 1$
3) $\sum_{i=1}^{k} \beta_i = 0$
4) $\sum_{i=1}^{k} \lambda_i = 0$
5) $\sum_{i=1}^{k} \gamma_{ij} = 0$
6) $\gamma_{ij} = \gamma_{ji}$

To align with economic theory and limit the number of parameters to estimate, certain restrictions are imposed. The *Restriction (Rst.) 1* to *5* refer to the Adding-up condition. *Rst.5* refers to the homogeneity condition and *Rst.6* refers to the Slutsky symmetry condition. The method introduced by Ray (1983) and further developed by Poi (2002) is used to take demographic characteristics into account. In this method, z is defined as a representative vector of household demographic characteristics. If $e^R(P,u)$ is the expenditure function of the reference household, the expenditure function for each household has the form of $e(p,z,u) = m_0(p,z,u) \times e^R(p,u)$. The function m_0 scales the expenditure function to take into account the household characteristics. Roy decomposes a scalar function in the form $m_0(p,z,u) = \overline{m}_0(z) \times \emptyset(p,z,u)$, where the first term measures the increase in a household's expenditure as a function of z. The second term controls for changes in relative prices and goods actually consumed. Equation ((3) shows the equations for the expenditure shares taking z into account:

(3)

$$w_i = \alpha_i + \sum_{j=1}^{k} \gamma_{ij} \ln p_j + (\beta_i + \eta_i') \ln\left(\frac{m}{\overline{m}_0(z)a(P)}\right) + \frac{\lambda_i}{b(P)c(P,z)}\left[\ln\left(\frac{m}{\overline{m}_0(z)a(P)}\right)\right]^2$$

Where:

$$\mathrm{c(P,z)} = \prod_{j=1}^{k} p_j^{\eta_j' z}$$

$$\sum_{j=1}^{k} \eta_{rj} = 0 \; for \; r = 1, \dots, s.$$

η_j' represents the j-th column of the parameter matrix $\eta_{s\times k}$. *Rst.2* should be considered for the Adding-up condition. Different approaches have been used to estimate equation (3). Banks *et al*. (1997) proposed a two-step GMM method for estimating the system of nonlinear equations to account for the endogeneity and nonlinearity of the regressions. Poi (2008) proposed a nonlinear seemingly unrelated regression (NSUR) method. The NSUR approach was followed in this study. By partially differencing equation (3) in the form $\mu_i = \partial w_i / \partial \ln m$ and $\mu_{ij} = \partial w_i / \partial \ln p_j$, the expenditure elasticity e_i in equation (4) and uncompensated price elasticities (Marshallian) e_{ij}^u in equation (5) are obtained. Using these values and the Slutsky equation, the compensated price elasticity can be estimated (Hicksian) e_{ij}^c using equation ((6). δ_{ij} is Kronecker delta, which is equal to one if $j = 1$ and zero otherwise.

(4)

$$e_i = \frac{\mu_i}{w_i} + 1$$

(5)

$$e_{ij}^u = \frac{\mu_{ij}}{w_i} - \delta_{ij}$$

(6)

$$e_{ij}^c = e_{ij}^u + e_i w_j$$

Welfare Change Indicator

Understanding changes in welfare requires the use of welfare change indicators such as compensating variation (CV), which have been used in many studies related to the food sector, e.g. in Adekunle *et al*. (2020) and Mokari-Yamchi *et al*. (2022). CV is the monetary compensation required to bring the consumer back to the original utility level after the price change (Araar & Verme, 2016). The CV can be written as the difference between two values of the cost function (Equation (7); where $e(U, P)$ is the expenditure function, P is the vector of prices and U is the utility. These changes are measured by the level under the compensated demand curve (Hicksian) following an economic change such as the economic impact of COVID-19.

$$CV = e(U_0, P_1) - e(U_0, P_0) \tag{7}$$

Using a second-order Taylor series and Shephard's lemma for equation ((7), the impact of price changes on the consumer is obtained (Badolo & Traoré, 2015):

$$\frac{CV}{x_0} \cong \frac{p_{0,i}q_i(p_0,x_0)}{x_0}\frac{\Delta p}{p_{0,i}} + \frac{1}{2}e_i\frac{p_{0,i}q_i(p_0,x_0)}{x_0}\left(\frac{\Delta p}{p_{0,i}}\right)^2 \tag{8}$$

Where q_i and p_i are the quantity demanded and food group price respectively. x_0 is the ASF expenditure and e_i is the Hicks own-price elasticity of demand for a particular food group.

Data

The data for the estimation of equations 3 to 8 come from the Iran Households Expenditure and Income Survey (IHEIS), which has been conducted annually by the Statistical Center of Iran (SCI) since 1935. The survey, which balances urban and rural households, covers 31 provinces and includes data from 38,099 households in 2019 (pre-pandemic) and 37,294 households in 2020 (during pandemic). The questionnaire comprises four sections: social characteristics of the household, information on place of residence, expenditure on food and other goods and household income. In the food expenditure section, over 630,000 observations were collected for 228 food items, including 58 ASF, which were categorized into six groups (Table 2). Nominal food consumption was calculated on the basis of retail prices, with values recorded monthly.

Table 2- ASF items in the IHEIS questionnaire

ASF group title	Scope
Livestock meat	The meat of *sheep*, *goat*, and *yeanling*. *Calf* and organ meats Other bushmeats, cured meats, sausage, Cold meats Meat cans, cured meats, precooked meats including hamburgers, kebab steak, and so on.
Poultry meat	*Hen*, *rooster*, *chicken*, *ostrich*, *turkey*, *goose*, *duck*, *quail*, and *hunting* birds Other birds, their offal. and bird meat cans Ready to cook meats such as chicken barbecue schnitzel and…
Aquatic meat	Fresh and frozen fish, smoked and salted fish Different fish cans, fresh frozen and cured *shrimp* *Oysters* & *Caviar* Other types of ready-to-cook Fish
Dairy products	Kinds of milk, milk powder, and milkshake Creams, kinds of ice creams, yogurt, dough, cheese, *pietra cheese*, and kinds of whey Kinds of mixed cheese, and *Nagorno qrvt*
Eggs	Local and industrial eggs *Duck*, *goose*, *turkey*, and others
Animal-derived Fats	Kinds of animal oil, fat, and tallow Pasteurized and unpasteurized animal butter

Source: Extracted from the IHEIS questionnaire

Due to the high proportion of informal economic activities, shadow activities (Angrist *et al.*, 2021), and self-employment in developing countries, total household demand was considered as income. Total household demand is calculated from the sum of expenditure on food and beverages, clothing, housing, health, communication and transportation, culture and leisure, education, durable goods and investment based on the data in Part3 of the questionnaire. For a more detailed analysis, the demographic variables of household size and residential status of the household were used as dummies (rural=1/urban=0).

Results

The results of the analysis include descriptive analysis, estimated elasticities, and welfare losses based on data and parameters. Stata/MP14.0 software was used for statistical analysis.

Descriptive Statistics

The descriptive statistics section provides an overview of the key variables and their distribution of the dataset. This analysis offers insights into household expenditure patterns, particularly for ASF, across urban and rural areas in Iran before and during the COVID-19 pandemic. Table 3 and Fig. 5 summarize the mean, standard deviation, and other relevant statistics, highlighting the changes in consumption and expenditure trends over the study period.

Table 3- Summary table of sample characteristics for datasets

Variables	2019 pre-pandemic			2020 during pandemic		
	All	**Urban**	**Rural**	**All**	**Urban**	**Rural**
Households	38,099	19,793	18,306	37,294	19,178	18,116
Population ratio (%)		52.0	48.0		51.4	48.6
Household size (Mode)	3.46 (4)	3.43 (4)	3.49 (4)	3.43 (4)	3.40 (4)	3.47 (4)
Age of household head in years	51.5	50.9	52.1	51.8	51.5	52.2
Median age in years	32	32	33	33	32	33
Female-headed household (%)	14	13	15	15	14	15
Ratio of food expenditure (%)	37.87	34.25	41.79	42.08	31.37	53.41
Ratio of Non-Animal food expenditure (%)	69.25	68.47	70.08	69.21	68.39	70.08
Ratio of Animal food expenditure (%)	30.75	31.53	29.92	30.79	31.61	29.92
Expenditure share on livestock meat (%)	20.79	23.01	18.40	21.76	24.08	19.31
Expenditure share on poultry meat (%)	32.27	29.84	34.90	31.84	29.57	34.24
Expenditure share on aquatic meat (%)	5.55	6.16	4.90	5.19	5.71	4.63
Expenditure share on dairy products (%)	29.37	29.67	29.05	27.78	27.93	27.61
Expenditure share on eggs (%)	9.48	8.62	10.41	11.10	10.21	12.05
Expenditure share on Animal-derived Fats (%)	2.53	2.70	2.35	2.34	2.50	2.16
Price of livestock meat (IRR)	667,813	683,496	650.857	820,001 (23%↑)	845,719 (24%↑)	792,775 (22%↑)
Price of poultry meat (IRR)	127,688	128,249	127,080	189,620 (49%↑)	190,864 (49%)	188,304 (48%↑)
Price of aquatic meat (IRR)	417,519	419,092	415,818	582,488 (40%↑)	599,873 (43%↑)	564,084 (36%↑)
Price of dairy products (IRR)	112,630	116,114	108,863	165,240 (47%↑)	171,474 (48%↑)	158,640 (46%↑)
Price of eggs (IRR)	97,069	94,742	99,586	164,749 (70%↑)	161,838 (71%↑)	167,831 (69%↑)
Price of Animal-derived Fats (IRR)	463,726	463,054	464,452	701,863 (51%↑)	703,109 (52%↑)	700,544 (51%↑)

Source: Author’s own compilation

The demographic characteristics of households remained relatively consistent between 2019 and 2020. The most common household size was four members, and the average age of the household head was 51 years, with a marginal increase of 0.7% in 2020. The median age of the statistical population was 33 years, aligning closely with the global median age of 31.7 years reported by Worlddata.info, which ranks Iran 60th globally. Female-headed households accounted for 14% in 2019, rising slightly to 15% in 2020, reflecting a modest shift in household dynamics.

A significant change was observed in the share of food expenditure, which increased from 37% in 2019 to 42% in 2020. This rise was particularly pronounced in rural areas, where food expenditure surged from 41% to 53%, likely driven by economic pressures exacerbated by the COVID-19 pandemic. In contrast, urban households experienced a 2% decrease in the share of food expenditure. This divergence can be attributed to differing economic vulnerabilities and access to resources between urban and rural populations. The increase in food expenditure aligns with the decline in GDP per capita, as illustrated in figure Source: , which reflects the broader economic contraction during the pandemic.

In 2019, an average of 30.75% of total food expenditure was allocated to ASF, with urban households spending 2% more on ASF than rural households. Despite the overall increase in food expenditure by 5% in 2020, the share of ASF remained stable at 30.7%. This stability occurred despite significant price hikes across ASF categories, ranging from a 22% increase for livestock meat in rural areas to a 71% surge for eggs in urban areas. These price increases are consistent with global trends highlighted by studies such as Akter (2020) and Bai *et al*. (2022), which noted a widespread rise in food prices following the onset of the pandemic.

The persistence of ASF expenditure share, despite rising prices, suggests that ASF remains a critical component of the Iranian diet, with households prioritizing these foods even under economic strain. This finding underscores the importance of ASF in the food security and dietary patterns of Iranian households, particularly in the context of economic shocks. The data also highlights the resilience of food consumption patterns in the face of price volatility, as households adjusted their budgets to maintain access to essential food groups. Overall, these trends reflect the complex interplay between economic conditions, food prices, and consumption behavior during the COVID-19 pandemic.

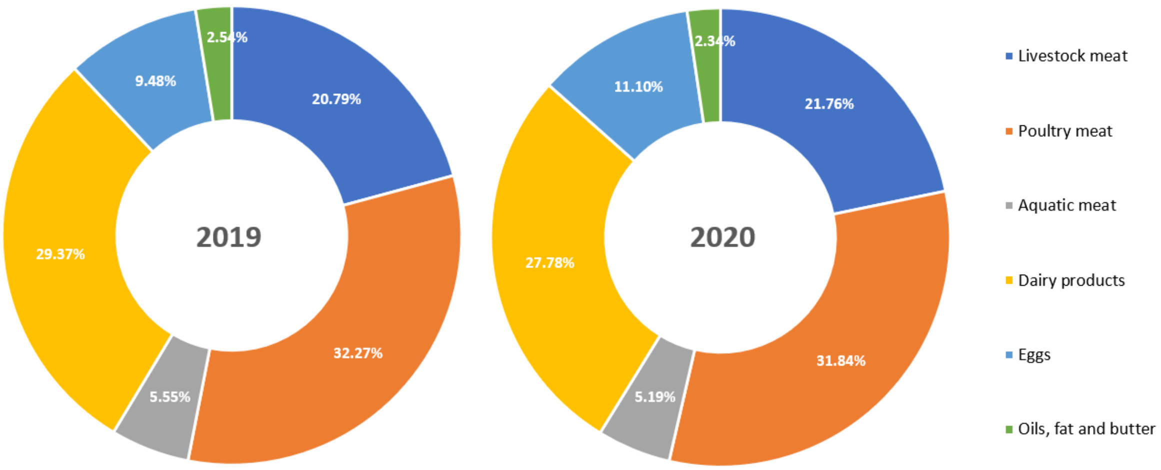

Figure 5- Expenditure share of household ASF consumption: 2019-20
Source: Author’s own compilation

Fig. 5 graphically shows that the poultry group constitutes the largest share of ASF. The group of eggs increased the most, and the group of dairy products decreased the most. The details show that it was the same in rural and urban areas.

QUAIDS Estimation for the Whole Sample

The coefficients of the quadratic term (λ_i) in the QUAIDS model were statistically significant for all six food groups (P<0.001), underscoring the superiority of the QUAIDS model over the simpler AIDS model in capturing the nonlinear relationship between expenditure and food demand. Notably, the λ value for the aquatic meat group was closer to zero compared to other groups, suggesting a less pronounced quadratic effect in this category. Tables 4 and 5 present the estimated expenditure elasticities, as well as compensated and uncompensated price elasticities derived from the QUAIDS analysis. Across both years (2019 and 2020), expenditure elasticities were positive for all food groups, indicating the absence of inferior goods. In 2019, the elasticities ranged from 0.33% to 1.90%, while in 2020, they ranged from 0.37% to 1.88%. The groups of livestock, aquatic products, and fats exhibited elasticity values greater than one, classifying them as luxury goods. This implies that consumption of these groups is highly sensitive to income changes, and households are more likely to reduce their consumption of these items during economic downturns.

In Iran, where approximately 71% of cooking fats used in frying are solid vegetable fats (Salehzadeh *et al*., 2019), the classification of animal fats as luxury goods aligns with dietary patterns and preferences. Other food groups, such as eggs and poultry meat, displayed positive expenditure elasticities below unity, categorizing them as necessity goods. Eggs, in particular, exhibited the lowest elasticity, reflecting their essential role in Iranian diets. Poultry meat, with an elasticity closer to one, behaved more like a normal good, indicating a more proportional response to income changes compared to other groups. Overall, the QUAIDS model provides a nuanced understanding of food demand in Iran, revealing how income fluctuations differentially impact the consumption of luxury and necessity goods, particularly during periods of economic stress.

The primary diagonal of the matrices presented in Tables 4 and 5 delineates the own-price elasticities, which, as anticipated by theoretical frameworks, exhibit all negative values. The magnitude of these values inversely correlates with the relative significance of each food group among households. Analysis of the data reveals that eggs registered the lowest Hicksian elasticity at -0.34, a figure that remained unchanged in 2020. In 2019, per capita egg consumption in Iran was recorded at 8.33 kg, reflecting a 0.483 percent increase from the previous year. In a global context, Iran is ranked 73rd out of 161 countries regarding per capita egg consumption, as reported by FAO (2020b). While aquatic meat is recognized as an excellent source of protein and omega-3 fatty acids, it is perceived as a luxury item within the dietary preferences of Iranian households.

Based on the own-price elasticities, it was found that the demand for aquatic meat and animal fats was particularly sensitive to price fluctuations. The compensated own-price elasticity for fats in 2019, solely indicating the substitution effect, was measured at -1.14, categorizing it as a product with price-elastic demand. In contrast, the groups associated with eggs and poultry meat exhibited a lower sensitivity to price changes. With the exception of aquatic meat (-2.59) and fats (-1.14), the remaining groups were categorized as having own-price inelastic demand, as their elasticity values fell below one when responding to respective price alterations. It is notable that the own-price elasticity for the fats category experienced a substantial increase in 2020, escalating from -1.14 to -1.72.

The principal diagonal of the matrices in Tables 4-3 and 5-3 illustrates the uncompensated own-price elasticities (Marshallian), which account for the income effects of price changes and are generally larger than their compensated counterparts. A comparative analysis of the uncompensated values between 2019 and 2020 highlights an increase for livestock meat, rising from -0.86 to -1. In contrast, the dairy group remained unchanged at -0.89. Additionally, the values denoted as e_{ij} in the matrices of Tables 4 and 5 represent cross-price elasticities. The variation in the signs of certain values indicates that some food items are substitutes for one another, while others complement each other.

QUAIDS Estimation for the Subsample

Within the span of a single year, the proportion of food expenditure in rural regions rose from 41.79% to 53.41%, whereas in urban regions, this proportion shifted from 34% to 31% (Fig. 6). This pattern may be attributed to the phenomenon that, in addition to previous outlays, urban households have allocated part of their income towards preventive and therapeutic health measures. Conversely, rural households, facing diminished income, have concentrated their efforts on sustaining their nutritional intake. The analysis conducted using the QUAIDS model yields moderate evidence countering the significant hypothesis regarding the demographic characteristics associated with residential status (P-Value=0.07). Nevertheless, with a diminished level of confidence, the estimated parameters for both urban and rural settings were scrutinized. Estimates of elasticities for the years 2019-20 are presented in Tables 6 and 7.

Table 4- Whole sample: pre-pandemic (2019)

	L. meat	P. meat	A. meat	Dairy	Eggs	A.Fats
4-1: Expenditure elasticity						
	1.90	0.77	1.52	0.68	0.33	1.44
4-2: Hicksian (Compensated)						
L. meat	-0.47	0.12	0.019	0.27	0.02	0.02
P. meat	0.08	-0.63	0.17	0.25	0.06	0.05
A. meat	0.07	1.01	-2.59	0.94	0.33	0.22
Dairy	0.19	0.27	0.17	-0.69	0.01	0.03
Eggs	0.05	0.22	0.19	0.03	-0.34	-0.16
A.Fats	0.18	0.70	0.49	0.37	-0.61	-1.14
4-3: Marshallian (uncompensated)						
L. meat	-0.86	-0.49	-0.08	-0.28	-0.15	-0.02
P. meat	-0.07	-0.87	0.13	0.02	-0.008	0.036
A. meat	-0.24	0.52	-2.68	0.49	0.188	0.18
Dairy	0.05	0.05	0.14	-0.89	-0.05	0.01
Eggs	-0.1	0.11	0.17	-0.06	-0.37	-0.17
A.Fats	-0.11	0.23	0.41	-0.04	-0.75	-1.17

Source: Author's own compilation

Table 5- Whole sample: during pandemic (2020)

	L. meat	P. meat	A. meat	Dairy	Eggs	A.Fats
5-1: Expenditure elasticity						
	1.88	0.76	1.50	0.68	0.37	1.56
5-2: Hicksian (Compensated)						
L. meat	-0.59	0.18	0.08	0.28	0.02	0.01
P. meat	0.12	-0.49	0.07	0.19	0.05	0.04
A. meat	0.35	0.47	-2.54	0.99	0.35	0.35
Dairy	0.22	0.22	0.18	-0.70	0.02	0.04
Eggs	0.05	0.14	0.16	0.06	-0.34	-0.08
A.Fats	0.12	0.63	0.79	0.55	-0.38	-1.72
5-3: Marshallian (uncompensated)						
L. meat	-1.00	-0.41	-0.01	-0.23	-0.18	-0.03
P. meat	-0.03	-0.74	0.03	-0.02	-0.03	0.02
A. meat	0.02	-0.0007	-2.61	0.57	0.18	0.32
Dairy	0.07	0.003	0.15	-0.89	-0.05	0.03
Eggs	-0.02	0.02	0.14	-0.04	-0.38	-0.09
A.Fats	-0.21	0.13	0.71	0.12	-0.56	-1.76

Source: Author's own compilation

The analysis of Tables 6 and 7 offers key insights into the consumption behavior of rural and urban households before and during the COVID-19 pandemic. In 2019, rural households demonstrated greater sensitivity to income changes than their urban counterparts, as indicated by a wider range of expenditure elasticities across ASF groups, varying from 0.27 to 2.03. This disparity narrowed in 2020, likely reflecting the economic disruptions caused by the pandemic. Rural households also demonstrated higher sensitivity to price changes, with Hicksian price elasticities for ASF groups showing steeper values in rural areas (e.g., -0.38 for eggs to -2.82 for aquatic meat) compared to urban regions.

A notable observation is the stability of dairy product price elasticity (-0.69) for both rural and urban households during the pandemic, suggesting consistent demand patterns despite the crisis. Conversely, livestock meat and fat groups experienced increased price elasticity in both regions, with rural areas witnessing a more pronounced shift (e.g., fat group elasticity rising from -1.15 to -1.78 in rural areas versus -1.12 to -1.67 in urban areas). This heightened sensitivity underscores rural households' vulnerability to price fluctuations. Meanwhile, poultry and aquatic meat groups showed decreased price elasticity in both regions, indicating reduced responsiveness, possibly due to altered consumption priorities during the pandemic. These findings highlight the differential impacts of economic shocks on rural and urban households, emphasizing the need for targeted policy interventions to address rural vulnerabilities.

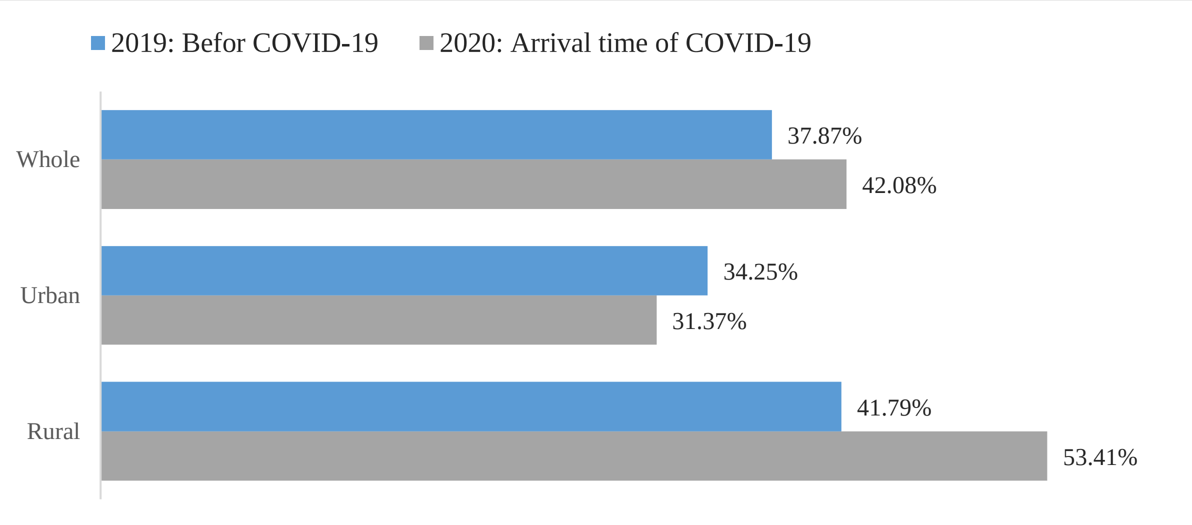

Figure 6- The ratio of food expenditure in Iran

Source: Author’s own compilation

Table 6- Rural and Urban regions: pre-pandemic (2019)

	L. meat	P. meat	A. meat	Dairy	Eggs	A.Fats
Expenditure elasticity						
Rural	2.03	0.78	1.60	0.682	0.39	1.48
Urban	1.81	0.75	1.47	0.685	0.27	1.41
Hicksian (Compensated)						
Rural						
L. meat	-0.48	0.16	0.003	0.27	0.02	0.01
P. meat	0.08	-0.63	0.16	0.25	0.08	0.05
A. meat	0.015	1.15	-2.82	1.03	0.37	0.24
Dairy	0.17	0.30	0.17	-0.69	0.01	0.03
Eggs	0.04	0.27	0.17	0.04	-0.38	-0.14
A.Fats	0.15	0.75	0.52	0.38	-0.66	-1.15
Urban						
L. meat	-0.45	0.09	0.03	0.28	0.02	0.02
P. meat	0.07	-0.62	0.18	0.25	0.04	0.06
A. meat	0.12	0.91	-2.42	0.87	0.30	0.20
Dairy	0.21	0.25	0.18	-0.69	0.004	0.03
Eggs	0.06	0.17	0.21	0.1	-0.29	-0.18
A.Fats	0.20	0.66	0.47	0.37	-0.58	-1.12

Source: Author’s own compilation

Table 7- Rural and Urban regions: during pandemic (2020)

	L. meat	P. meat	A. meat	Dairy	Eggs	A.Fats
Expenditure elasticity						
Rural	1.99	0.78	1.57	0.68	0.41	1.61
Urban	1.79	0.75	1.45	0.68	0.32	1.53
Hicksian (Compensated)						
			Rural			
L. meat	-0.62	0.22	0.07	0.28	0.02	0.007
P. meat	0.12	-0.50	0.07	0.19	0.06	0.04
A. meat	0.31	0.55	-2.74	1.08	0.39	0.39
Dairy	0.19	0.24	0.18	-0.70	0.03	0.04
Eggs	0.04	0.17	0.15	0.07	-0.37	-0.07
A.Fats	0.07	0.70	0.84	0.57	-0.41	-1.78
			Urban			
L. meat	-0.56	0.15	0.09	0.28	0.02	0.01
P. meat	0.12	-0.48	0.08	0.18	0.03	0.04
A. meat	0.38	0.41	-2.38	0.93	0.32	0.33
Dairy	0.24	0.19	0.19	-0.69	0.01	0.04
Eggs	0.05	0.11	0.17	0.04	-0.30	-0.09
A.Fats	0.17	0.57	0.75	0.54	-0.37	-1.67

Source: Author's own compilation

The Welfare Effects

Welfare effects analysis provides critical insights into how COVID-19 pandemic, influence household welfare and purchasing power. This section examines the welfare implications of price and income changes on rural and urban households, focusing on variations in consumption patterns across ASF groups. The assessment leverages economic models to estimate compensating variation, offering a comprehensive understanding of disparities in welfare losses between regions and ASF categories. The IHEIS contains the required data for equation (8). Table 8 shows per capita consumption values in kilograms per month ($\sum q_i / \sum n_h$) for the households, where q_i and n_h are the quantity consumed and the number of household members respectively.

Table 8- ASF Consumption, 2019-20 (kg per month)

ASF Group	Per capita consumption: Whole	Urban	Rural	World average* (Kg monthly)
8-1: pre-pandemic (2019)				
Livestock meat	0.493	0.433	0.558	2.9
Poultry meat	1.633	1.616	1.651	1.2
Aquatic meat	0.190	0.208	0.171	1.5
Dairy products	3.338	3.172	3.514	1.5
Eggs	0.522	0.528	0.516	2
Animal-derived Fats	0.055	0.061	0.048	1
8-2: during pandemic (2020)				
Livestock meat	0.530▲	0.506▲	0.554▼	
Poultry meat	1.539▼	1.559▼	1.518▼	
Aquatic meat	0.179▼	0.201▼	0.156▼	
Dairy products	2.976▼	2.882▼	3.074▼	
Eggs	0.519▼	0.531▲	0.506▼	
Animal-derived Fats	0.050▼	0.056▼	0.043▼	

* On average from official sources.

The direction of the change (▲▼): The green upward arrow indicates an increase and the red downward arrow indicates a decrease.

Source: Authors

The per capita consumption of most ASF groups declined in 2020 compared to 2019, with the exception of livestock meat and eggs. Urban households notably increased their livestock meat consumption (from 433g to 506g) and slightly raised egg intake (from 528g to 531g). Conversely, dairy products experienced the sharpest decline, with rural consumption dropping from 3.1 to 2.8 kg per person monthly and urban from 3.5 to 3 kg. This reduction highlights shifting dietary patterns, potentially driven by economic constraints or supply chain disruptions during the pandemic. Across the sample, ASF consumption predominantly decreased, except for livestock meat, reflecting uneven impacts on household nutrition and food priorities.

Table 9- CV due to change in ASF group prices, 2019-20

ASF Group	Whole	Urban	Rural
Livestock meat	9.4%	8.6%	10.2%
Poultry meat	13.8%	13.5%	14.2%
Aquatic meat	5.6%	6.6%	4.6%
Dairy products	24.2%	23.7%	24.7%
Eggs	4.7%	4.5%	4.9%
Animal-derived Fats	2.0%	2.2%	1.8%

Source: Author's own compilation

Table 9 highlights welfare losses due to price changes in ASF groups, with losses ranging from 1.8% (fats group in rural areas) to 24.7% (dairy products in rural areas). Rural households generally experienced higher welfare losses, reflecting their greater vulnerability to price fluctuations. However, urban regions incurred greater losses in specific groups such as livestock, aquatic, and fats, potentially due to differing consumption patterns or income constraints. The average welfare loss across all groups was 9.9%, with a standard deviation of 8% and a range of 23%, indicating significant variability in impacts. These disparities underscore the unequal burden of economic shocks on rural and urban populations, emphasizing the need for targeted policies to mitigate adverse welfare effects, particularly in vulnerable rural communities.

Conclusion

This study examined the economic impacts of the COVID-19 pandemic on Iranian households, with a specific focus on ASF. ASFs were prioritized due to their critical role in providing high-quality protein and essential micronutrients, including iron, zinc, and vitamin B12, that are vital for maintaining health during crises. Unlike plant-based proteins, ASFs offer complete amino acid profiles and higher nutrient bioavailability. However, their higher cost and sensitivity to supply chain disruptions make them particularly vulnerable during economic shocks, thereby posing heightened food security risks. The decision to focus on ASFs reflects both their nutritional significance and their disproportionate burden on household budgets, particularly in MI countries.

The pandemic-induced economic shock led to negative GDP per capita growth across all income groups in 2020, reversing a previously upward trend. Against this backdrop, the study investigated how income and price shocks influenced household consumption patterns, food expenditure allocation, and welfare losses. Using cross-sectional data from 2019 and 2020 and applying QUAIDS model, the analysis covered six ASF groups: livestock meat, poultry meat, aquatic meat, dairy products, eggs, and animal fats.

The results reveal substantial disparities between rural and urban households in terms of expenditure behavior and vulnerability. Eggs, poultry meat, and dairy products were identified as necessary goods, with relatively low expenditure elasticities of 0.33, 0.77, and 0.68, respectively. In contrast, livestock meat, aquatic meat, and animal fats displayed higher elasticities, classifying them as luxury goods more sensitive to income changes. Welfare losses were most pronounced for dairy products, with an overall decline of 24.2%, rising to 24.7% among rural households. Poultry meat also saw significant welfare losses, particularly in rural areas, where losses reached 13.8%. Notably, price elasticities were more pronounced than expenditure elasticities, suggesting that households were more responsive to price fluctuations than income changes. This trend was especially evident among rural households, which displayed higher price sensitivity despite facing relatively smaller price increases, highlighting their limited budgetary resilience.

These findings underscore the fragility of food security during systemic shocks, especially for rural populations that depend heavily on ASFs for protein intake. The Iranian case aligns with similar patterns observed in other MI economies. For example, Tian *et al*. (2022) found that rural households in China faced greater vulnerability to ASF price volatility during the pandemic, mirroring trends observed in Iran. Likewise, Adelaja *et al*. (2021) reported that rural communities in Sub-Saharan Africa allocated a growing share of their budgets to food in response to crises, a finding consistent with the increase in rural Iranian food expenditure from 47% to 53%. The classification of ASFs into necessary and luxury goods also resonates with prior literature, including Alston *et al*. (1995), who found that staple items like eggs and dairy generally exhibit lower income elasticities than higher-value proteins such as livestock meat.

In conclusion, the study contributes to a broader understanding of the nutritional and economic vulnerabilities exposed by the COVID-19 pandemic. By highlighting the differentiated impacts across ASF categories and between urban and rural populations, the findings offer valuable insights for policymakers seeking to design targeted interventions to safeguard food security during future crises. Efforts to stabilize prices, support household incomes, and ensure access to essential nutrients will be critical in enhancing resilience among the most vulnerable groups.

Policy Implications

The findings of this study offer valuable insights for the development of targeted policy measures aimed at enhancing food security and economic resilience in the post-COVID-19 period. Although the acute phase of the pandemic has passed, households continue to face long-term challenges such as income instability and rising food prices. By analyzing food demand for 39,000 Iranian households during the pandemic, this study contributes critical evidence for shaping effective strategies to mitigate the impacts of similar future crises, especially across urban and rural settings.

ASFs remain a central component of Iranian diets, maintaining a substantial share of household food expenditure despite significant price increases. The focus on ASFs, rather than plant-based foods, reflects both their nutritional importance and their heightened sensitivity to income and price fluctuations, making them a crucial marker of household food security. The observed rise in ASF expenditures in 2020 was influenced by supply chain disruptions, inflation, and reduced purchasing power stemming from economic contraction. Rural households, in particular, exhibited greater price sensitivity due to limited income diversification and heavier reliance on local markets.

To address these vulnerabilities, policymakers must prioritize the resilience of ASF supply chains. Key actions include investments in infrastructure, improved storage and distribution systems, and financial support mechanisms for producers to buffer against future economic shocks. Promoting local production and diversifying supply sources can reduce import dependency and help stabilize domestic prices. Strengthening regulatory oversight and fostering public-private partnerships will also be essential to ensure more efficient supply chain management during periods of disruption.

Given the divergent needs of urban and rural populations, a differentiated policy approach is warranted. For urban households, who experienced a decline in the share of food expenditure-price-based interventions such as subsidies or price controls on essential ASFs could alleviate the financial burden. In contrast, rural households where food expenditure shares rose significantly would benefit more from expanded social services, including access to healthcare, education, and targeted financial aid. This recommendation is consistent with

Engel's Law, which suggests that rural households allocate a larger portion of their income to food, underscoring the importance of non-food support mechanisms to enhance overall welfare.

To support urban households more effectively, policies should aim to stabilize food prices, increase access to affordable ASFs, and extend income support to low-income populations. Government-led price stabilization programs could reduce volatility and enhance affordability. For rural populations, interventions should focus on infrastructure development, capacity-building initiatives for small-scale farmers, and targeted subsidies to lower both production and consumption costs. Expanding social safety nets and fostering community-based agricultural initiatives can empower rural households to meet their nutritional needs more sustainably.

Although the focus of this study is on ASFs, it also highlights the long-term importance of promoting dietary diversification through plant-based protein alternatives. Compared to ASFs, plant-based proteins are typically more affordable, environmentally sustainable, and less susceptible to supply chain disruptions. Exploring substitution strategies especially in culturally receptive regions, can help bolster resilience and align with broader global movements toward sustainable diets. Future research in this area can inform policies that encourage gradual shifts toward more diverse and resilient dietary patterns.

In sum, this study calls for a comprehensive, multi-faceted policy response to food insecurity—one that accounts for the distinct needs of both urban and rural households. Strengthening ASF supply chains, tailoring support policies, and promoting sustainable dietary diversification are all essential steps toward improving household welfare and economic stability in the post-pandemic era. These recommendations are aligned with existing literature, such as Barrett *et al.* (2020), who emphasize the need for targeted rural interventions, and Willett *et al*. (2019), who advocate for dietary shifts to enhance sustainability and resilience. Collectively, these insights reinforce the relevance and applicability of the current study's policy guidance.

References

1. Aday, S., & Aday, M.S. (2020). Impact of COVID-19 on the food supply chain. *Food Quality and Safety*, *4*(4), 167–180. https://doi.org/10.1093/fqsafe/fyaa024
2. Adekunle, C.P., Akinbode, S.O., Shittu, A.M., & Momoh, S. (2020). Food price changes and farm households' welfare in Nigeria: direct and indirect approach. *Journal of Applied Economics*, *23*(1), 409–425. https://doi.org/10.1080/15140326.2020.1743103
3. Adelaja, A., George, J., Fox, L., Fuglie, K., & Jayne, T. (2021). Shocks, Resilience and Structural Transformation in Sub-Saharan Africa. *Sustainability*, *13*(24), 13620. https://doi.org/10.3390/SU132413620
4. Ahmed, M.Y., & Sarkodie, S.A. (2021). How COVID-19 pandemic may hamper sustainable economic development. *Journal of Public Affairs*, *21*(4). https://doi.org/10.1002/pa.2675
5. Akaichi, F., & Revoredo-Giha, C. (2014). The demand for dairy products in Malawi. *African Journal of Agricultural and Resource Economics*, *9*(3), 214–225. https://doi.org/10.22004/AG.ECON.183894
6. Akter, S. (2020). The impact of COVID-19 related 'stay-at-home' restrictions on food prices in Europe: findings from a preliminary analysis. *Food Security*, *12*(4), 719–725. https://doi.org/10.1007/S12571-020-01082-3/TABLES/3
7. Alston, J.M., Norton, G.W., & Pardey, P.G. (1995). *Science under scarcity : principles and practice for agricultural research evaluation and priority setting*. 585.
8. Anderson, J.D., Mitchell, J.L., & Maples, J.G. (2021). Invited Review: Lessons from the COVID-19 pandemic for food supply chains. *Applied Animal Science*, *37*(6), 738–747.

https://doi.org/10.15232/aas.2021-02223
9. Angrist, N., Goldberg, P.K., & Jolliffe, D. (2021). Why is growth in developing countries so hard to measure? *Journal of Economic Perspectives*, *35*(3), 215–242. https://doi.org/10.1257/JEP.35.3.215
10. Araar, A., & Verme, P. (2016). *Prices and Welfare*. World Bank, Washington, DC. https://doi.org/10.1596/1813-9450-7566
11. Badolo, F., & Traoré, F. (2015). Impact of rising world rice prices on poverty and inequality in Burkina Faso. *Development Policy Review*, *33*(2), 221–244. https://doi.org/10.1111/dpr.12099
12. Bai, Y., Costlow, L., Ebel, A., Laves, S., Ueda, Y., Volin, N., Zamek, M., & Masters, W.A. (2022). Retail prices of nutritious food rose more in countries with higher COVID-19 case counts. *Nature Food*, *3*(5), 325–330. https://doi.org/10.1038/s43016-022-00502-1
13. Banks, J., Blundell, R., & Lewbel, A. (1997). Quadratic engel curves and consumer demand on JSTOR. *The Review of Economics and Statistics*. https://www.jstor.org/stable/2951405
14. Barrett, C.B., Benton, T.G., Cooper, K.A., Fanzo, J., Gandhi, R., Herrero, M., James, S., Kahn, M., Mason-D'Croz, D., Mathys, A., Nelson, R. J., Shen, J., Thornton, P., Bageant, E., Fan, S., Mude, A.G., Sibanda, L.M., & Wood, S. (2020). Bundling innovations to transform agri-food systems. *Nature Sustainability*, *3*(12), 974–976. https://doi.org/10.1038/s41893-020-00661-8
15. Barten, A.P. (1969). Maximum likelihood estimation of a complete system of demand equations. *European Economic Review*, *1*(1), 7–73. https://doi.org/10.1016/0014-2921(69)90017-8
16. Batlle-Bayer, L., Aldaco, R., Bala, A., Puig, R., Laso, J., Margallo, M., Vázquez-Rowe, I., Antó, J.M., & Fullana-i-Palmer, P. (2020). Environmental and nutritional impacts of dietary changes in Spain during the COVID-19 lockdown. *Science of the Total Environment*, *748*, 141410. https://doi.org/10.1016/J.SCITOTENV.2020.141410
17. Ceylan, R.F., Ozkan, B., & Mulazimogullari, E. (2020). Historical evidence for economic effects of COVID-19. *The European Journal of Health Economics*, *21*(6), 817–823. https://doi.org/10.1007/s10198-020-01206-8
18. Christensen, L.R., Jorgenson, D., & Lau, L.J. (1975). Transcendental logarithmic utility functions. *American Economic Review*, *65*(3), 367–383. https://EconPapers.repec.org/RePEc:aea:aecrev:v:65:y:1975:i:3:p:367-83
19. Christensen, L.R., Jorgenson, D.W., & Lau, L.J. (1973). Transcendental logarithmic production frontiers. *The Review of Economics and Statistics*, *55*(1), 28. https://doi.org/10.2307/1927992
20. Coelho, A.B., Aguiar, D.R.D. de, & Eales, J.S. (2010). Food demand in Brazil: an application of Shonkwiler & Yen Two-Step estimation method. *Estudos Econômicos (São Paulo)*, *40*(1), 186–211. https://doi.org/10.1590/S0101-41612010000100007
21. Deaton, A., & Muellbauer, J. (1980). An almost ideal demand system. *American Economic Review*, *70*, 312–376. https://www.scirp.org/reference/referencespapers?referenceid=2020105
22. Engel, E. (1857). Die productions- und consumtionsverhältnisse des Königreichs Sachsen. *Zeitschrift Des Statistischen Bureaus Des Königlich Sächsischen Ministerium Des Inneren*, *8*, 28–29. https://www.statsmodels.org/stable/datasets/generated/engel.html
23. Fan, S., Teng, P., Chew, P., Smith, G., & Copeland, L. (2021). Food system resilience and COVID-19 – Lessons from the Asian experience. *Global Food Security*, *28*, 100501. https://doi.org/10.1016/j.gfs.2021.100501
24. FAO. (2020a). FIGURE 53. Average protein supply by region and origin. In *FAO Statistical Yearbook 2020 Datasets*. Food and Agriculture Organization of the United Nations. https://doi.org/10.4060/cb1329en-fig53
25. FAO. (2020b). Global and regional food availability from 2000 to 2017-an analysis based on supply utilization accounts data. https://doi.org/10.4060/cb1120en
26. Gao, G. (2012). World Food Demand. *American Journal of Agricultural Economics*, *94*(1), 25–51. https://doi.org/10.1093/ajae/aar133

27. Grinberga-Zalite, G., Pilvere, I., Muska, A., & Kruzmetra, Z. (2021). Resilience of Meat Supply Chains during and after COVID-19 Crisis. *Emerging Science Journal*, *5*(1), 57–66. https://doi.org/10.28991/esj-2021-01257
28. Hayakawa, K., & Mukunoki, H. (2021). The impact of COVID-19 on international trade: Evidence from the first shock. *Journal of the Japanese and International Economies*, *60*, 101135. https://doi.org/10.1016/j.jjie.2021.101135
29. Iddir, M., Brito, A., Dingeo, G., Fernandez Del Campo, S.S., Samouda, H., La Frano, M.R., & Bohn, T. (2020). Strengthening the immune system and reducing inflammation and oxidative stress through diet and nutrition: Considerations during the COVID-19 crisis. *Nutrients*, *12*(6), 1562. https://doi.org/10.3390/nu12061562
30. Kaicker, N., Gupta, A., & Gaiha, R. (2022). Covid-19 pandemic and food security in India: Can authorities alleviate the disproportionate burden on the disadvantaged? *Journal of Policy Modeling*, *44*(5), 963–980. https://doi.org/10.1016/j.jpolmod.2022.08.001
31. Khan, A.U., Ema, I.J., Afsana, A. S., Khan, A.U., Zannaty, A., & Faruk, Md.R. (2021). Effects of coronavirus disease (COVID-19) on agricultural sectors in Bangladesh: A Review. *Nternational Journal for Asian Contemporary Research*, 89–97.
32. Khoiriyah, N., Anindita, R., Hanani, N., & Muhaimin, A.W. (2020). Animal food demand in Indonesia: A quadratic almost ideal demand system approach. *Agris On-Line Papers in Economics and Informatics*, *12*(2), 85–97. https://doi.org/10.7160/aol.2020.120208
33. Mokari-Yamchi, A., Omidvar, N., Tahamipour Zarandi, M., & Eini-Zinab, H. (2022). The effects of food taxes and subsidies on promoting healthier diets in Iranian households. *Frontiers in Nutrition*, *9*. https://doi.org/10.3389/fnut.2022.917932
34. Nicola, M., Alsafi, Z., Sohrabi, C., Kerwan, A., Al-Jabir, A., Iosifidis, C., Agha, M., & Agha, R. (2020). The socio-economic implications of the coronavirus pandemic (COVID-19): A review. *International Journal of Surgery*, *78*, 185–193. https://doi.org/10.1016/j.ijsu.2020.04.018
35. Poi. (2002). Three essays in applied econometrics - Brian P. Poi - Google Books. *University of Michigan*. https://books.google.fr/books?id=cfodAQAAMAAJ&redir_esc=y
36. Poi, B.P. (2008). Demand-system estimation: Update. *The Stata Journal: Promoting Communications on Statistics and Stata*, *8*(4), 554–556. https://doi.org/10.1177/1536867X0800800407
37. Pollak, R.A., & Wales, T.J. (1978). Estimation of complete demand systems from household budget data: The linear and quadratic expenditure systems. *The American Economic Review*, *68*(3), 348-359. http://www.jstor.org/stable/1805266
38. Poudel, P.B., Poudel, M.R., Gautam, A., Phuyal, S., Tiwari, C.K., Bashyal, N., & Bashyal, S. (2020). COVID-19 and its Global Impact on Food and Agriculture. 生物学与当今世界杂志, *9*(5). https://chinese.iomcworld.org/abstract/covid19-and-its-global-impact-on-food-and-agriculture-53429.html
39. Ray, R. (1983). Measuring the costs of children. *Journal of Public Economics*, *22*(1), 89–102. https://doi.org/10.1016/0047-2727(83)90058-0
40. Rodríguez, L., Cervantes, E., & Ortiz, R. (2011). Malnutrition and gastrointestinal and respiratory infections in children: A public health problem. *International Journal of Environmental Research and Public Health*, *8*(4), 1174–1205. https://doi.org/10.3390/ijerph8041174
41. Salehzadeh, H., Soori, M.M., Sadeghi, S., Shahsawari, S., Mohammadi, S., Saifi, M., & Mozaffari, P. (2019). The type and amount of household oil consumption and the influential factors in Sanandaj city, Iran. *Journal Advanced Environment Health Research*, *7*, 1–7. https://doi.org/10.22102/JAEHR.2019.125492.1070
42. Sarani, P., Shahraki, A., & Banihashemi, S. (2024). Identifying and prioritizing factors affecting the sustainability of the agricultural supply chain with the Fuzzy DEMATEL and Fuzzy SWARA

approach in the Era of Covid-19: A case study. *Journal of Agricultural Economics & Development*, *38*(1), 1-18. https://doi.org/10.22067/jead.2024.82402.1193

43. Stone, R. (1954). Linear expenditure systems and demand analysis: An application to the pattern of British demand. *The Economic Journal*, *64*(255), 511. https://doi.org/10.2307/2227743
44. Tian, X., Zhou, Y., & Wang, H. (2022). The impact of COVID-19 on food consumption and dietary quality of rural households in China. *Foods*, *11*(4), 510. https://doi.org/10.3390/foods11040510
45. Tonsor, G.T., Lusk, J.L., & Schroeder, T.C. (2023). Market potential of new plant-based protein alternatives: Insights from four US consumer experiments. *Applied Economic Perspectives and Policy*, *45*(1), 164–181. https://doi.org/10.1002/aepp.13253
46. Vargas-Lopez, A., Cicatiello, C., Principato, L., & Secondi, L. (2022). Consumer expenditure, elasticity and value of food waste: A Quadratic Almost Ideal Demand System for evaluating changes in Mexico during COVID-19. *Socio-Economic Planning Sciences*, *82*, 101065. https://doi.org/10.1016/j.seps.2021.101065
47. WHO. (2014). Global Nutrition Targets 2025: Low birth weight policy brief. *Geneva. World Health Organization*.
48. Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L.J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J.A., De Vries, W., Majele Sibanda, L., & Murray, C. J. L. (2019). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, *393*(10170), 447–492. https://doi.org/10.1016/S0140-6736(18)31788-4
49. *World Development Indicators | DataBank*. (n.d.). Retrieved May 30, 2025, from https://databank.worldbank.org/source/world-development-indicators

نشریه اقتصاد و توسعه کشاورزی
https://jead.um.ac.ir

مقاله پژوهشی

جلد ۳۹، شماره ۲، تابستان ۱۴۰۴، ص. ۱۳۸-۱۱۷

نابرابری‌های روستایی-شهری در تقاضای غذای حیوانی و زیان‌های رفاهی در ایران طی کووید-۱۹: رویکرد QUAIDS

علیرضا کرباسی [۱]- **سعید جلالیان** [۱*]

تاریخ دریافت: ۱۴۰۳/۰۳/۷
تاریخ پذیرش: ۱۴۰۴/۰۲/۲

چکیده

پاندمی کووید-۱۹، چالش‌های جهانی عمده‌ای ایجاد کرد، از جمله نرخ رشد منفی درآمد سرانه در تمامی گروه‌های درآمدی کشورها در سال ۲۰۲۰. زنجیره تأمین پروتئین، به‌ویژه با منشأ حیوانی (ASF)، با فشارهای فزاینده‌ای از هر دو سوی عرضه و تقاضا مواجه شد که منجر به نوسانات قیمتی گردید. این مطالعه، تأثیر شوک درآمدی بر الگوهای مخارج غذایی و رفتار مصرفی را با تمرکز بر این نوع غذاها بررسی می‌کند. داده‌های بودجه خانوارهای ایرانی برای سال‌های ۲۰۱۹ (پیش از پاندمی) و ۲۰۲۰ (طی پاندمی) با بکارگیری مدل سیستم تقاضای تقریباً ایده‌آل درجه دوم (QUAIDS) تحلیل شد. یافته‌ها سه بینش کلیدی ارائه دادند: ۱) سهم متوسط مخارج غذایی از ۳۷٪ به ۴۲٪ افزایش یافته است، ضمن رشد شدیدتر در مناطق روستایی؛ ۲) کشش‌های مخارج برای هر شش گروه ASF شامل گوشت دام، آبزیان، طیور، محصولات لبنی، تخم‌مرغ و چربی‌ها، مثبت مشاهده شد در حالی‌که کشش‌های خودقیمتی به‌طور نسبی کوچکتر بودند؛ و ۳) زیان‌های رفاهی در این شش گروه، از ۲٪ تا ۲۴٪ متغیر بود، که ناشی از عدم تعادل سیاستی و اختلالات زنجیره تأمین بود. خانوارهای روستایی به جز در گروه چربی‌ها، زیان‌های رفاهی بیشتری متحمل شدند. این مطالعه مداخلات هدفمند به شکل سیاست های حمایتی قیمتی برای مناطق شهری و حمایت اجتماعی برای مناطق روستایی، پیشنهاد می‌کند. برای تقویت واکنش‌های سیاستی و بهبود امنیت غذایی بلندمدت، تحقیقات آتی می‌تواند پتانسیل جایگزینی پروتئین‌های گیاهی را به‌عنوان گزینه‌های پایدار و مقرون‌به‌صرفه ارزیابی کند. این یافته‌ها راهنمایی ارزشمندی برای سیاست‌گذاران در راستای بهبود تاب‌آوری و ثبات اقتصادی در دوران پساپاندمی ارائه می‌دهند.

واژه‌های کلیدی: زیان رفاهی، کووید-۱۹، غذاهای با منبع حیوانی (ASF)، مدل QUAIDS، ایران

۱- گروه اقتصاد کشاورزی، دانشکده کشاورزی، دانشگاه فردوسی مشهد، مشهد، ایران
(*- نویسنده مسئول: Email: jalalian.s@mail.um.ac.ir)

https://doi.org/10.22067/jead.2025.88095.1267