



## RESEARCH ARTICLE

# A Statistical Study of the Influence of COVID-19 on the Agricultural Supply Chain (Vegetative) Production in Halabja Governorate

Shahen M. Faraj<sup>1</sup>, Hazhar T. A. Blbas<sup>2\*</sup>, Aymen I. Ahmed<sup>3</sup>

<sup>1</sup>Department of International Business, College of Law and Administrative, University of Halabja, Iraq, <sup>2</sup>Department of Statistics, College of Administration and Economics, Salahaddin University-Erbil, Kurdistan Region, Iraq, <sup>3</sup>Independent Researcher

## ABSTRACT

It is clear that the COVID-19 virus has affected human life and activities all over the world. Agricultural sector is not excluded from the affection of course. Importance of this issue encouraged us to carry out this statistical study aiming to show the impact of COVID-19 on the agricultural supply chain (Vegetative) production in Halabja. Three forms of self-administered questionnaire were used to collect data from three targets; farmers, wholesalers, and retailers using non-probability sampling method. Descriptive analysis was used to show frequencies, percentages, and mean scores, while Independent Sample *t*-test was used to find the relationship between variables using SPSS software V.26. Results show that there is no statistically significant relationship between the characteristic of production and residence. Lockdown had a major impact on the plant production and its supplying chain in the following sequence: fewer products were delivered to the wholesaling markets by farmers, retailers bought less so consumers got less products.

**Keywords:** Agricultural supply chain, farmers, wholesalers, retailers, independent sample *t*-test, Halabja governorate, COVID-19

## INTRODUCTION

The first case of COVID-19 virus attacked human was detected in China at the end of 2019,<sup>[1]</sup> The first case of the virus attacked human was detected in Iraq on February 24, 2020, and in the Kurdistan region on the 1<sup>st</sup> of March 2020.<sup>[2]</sup> Lockdown began almost by the early cases of COVID-19 attacks in Iraq, so in the Kurdistan region, until it reached a complete lockdown in all governorates and also the borders with neighboring countries at the end of March 2020.<sup>[3]</sup>

Food availability and agricultural production and how to provide food proportionate to the increasing population are one of the major issues globally.<sup>[4]</sup> Especially after the occurrence of the COVID-19 pandemic, and how the situation has become after the lockdown between countries and cities.<sup>[5]</sup> The effect of this, especially in non-developing countries such as Iraq, in which agricultural production declined due to the wars in the eighties and early nineties of the last century, which led to the exhaustion of the state and manpower,<sup>[6]</sup> as well as a sharp declination in government support of the agricultural sector, this declination became more severe after the 2003 occupation. This sector has retarded more and more with the governments that ruled Iraq until nowadays.<sup>[7]</sup>

Iraq has been changed from a food exporting country before the 1980s to a heavy food importer. It depends 70–80%

approximately on imported agricultural products from abroad.<sup>[8]</sup> Because of the lack of production or the absence of government support for the agricultural sector, the agricultural supply chain is usually short. Because Iraqi agricultural products are often fresh from the farm to the table not from seed to table, without going through any manufacturing or storage processes.<sup>[9]</sup>

This is in contrast to what was the circumstance before the 1980s, where the Agriculture supply chains were longer,<sup>[10]</sup> as it started from the government side, such as distributing the necessary supplies for agricultural production, such as seeds, and fertilizer as well as the delivering of water, the distribution of lands, the purchase of some products from farmers and their introduction into many of the food industries,<sup>[11]</sup> but

### Corresponding Author:

Hazhar T. A. Blbas, Department of Statistics, College of Administration and Economics, Salahaddin University-Erbil, Kurdistan Region, Iraq. E-mail: hazhar.abubaker@su.edu.krd

**Received:** November 12, 2021

**Accepted:** December 5, 2021

**Published:** January 30, 2022

**DOI:** 10.24086/cuesj.v6n1y2022.pp1-6

Copyright © 2022 Shahen M. Faraj, Hazhar T. A. Blbas, Aymen I. Ahmed. This is an open-access article distributed under the Creative Commons Attribution License (CC BY-NC-ND 4.0).

after these period hundreds of manufacturing and food processing laboratories were gradually closed due to wars, mismanagement, and corruption.

Therefore, it was necessary to execute a statistical study of how the Agricultural supply chain (Vegetative) production worked before the occurrence of the pandemic and in the period of pandemic to know its impact on both consumers and stakeholders who involved in the supply chain, including merchants, farmers, laborer, owners of wholesale and retail stores ...etc., in Halabja Governorate, which is an agricultural governorate in Kurdistan Region – Iraq and has abundance of surface and underground water, as well as it has fertile plains and mountainous areas that provide the possibility to cultivate different types of agricultural crops. The main hypotheses in this study are to determine whether or not there is a relationship between production characteristics and residency.

## MATERIALS AND METHODS

In 2014 Halabja has become a province by the Kurdistan region government, it is located to the east of Sulaymaniyah province and nearly 90 KM far from Sulaymaniyah, north of Iraq,<sup>[12]</sup> and it is an agricultural governorate, due to its availability of mountainous areas, as well as fertile plains and abundance of water. This is motivating to investigate this research to know how the COVID-19 affect the Agricultural supply chain (Vegetative) production in the Halabja governorate.

Data was collected via three forms of questionnaire including farmers, wholesalers, and retailers of Halabja Governorate between 1<sup>st</sup> of October, 2020 and 15<sup>th</sup> of February, 2021. Non-probability sampling method used to collect the data which is snowball sampling for farmers and Judgment sampling for wholesalers and retailers. The questionnaire of this study included three parts, first part was the demographic questions such as gender, age, residency location, number of experience years in the business earned by studying, and working for all of our targets (Farmers, Wholesalers, and retailers). The second part included some questions about production like (area of his property in donums<sup>1</sup>, yield of a product per donum in tons, and the total quantity produced) for the farmers, there were questions for retailers and some other ones for the wholesalers. The third part was a Likert scale (strongly disagree = 1, disagree = 2, neutral = 3, agree = 4, strongly agree = 5) for all of our targets (Farmers, Wholesalers and retailers). Data were analyzed using SPSS V.26 and descriptive analysis used to show frequency, percentage, and mean scores.<sup>[13]</sup>

Independent sample *t*-test to compare the mean between two variables,<sup>[14]</sup> it was used to find the statistically significant relationship between some characteristics of production and residency (live location) using significant level  $\alpha = 0.05$ . The researchers selected 15 forms randomly to conducted a pilot study for all three different types of questionnaire Farmers, Wholesalers, and Retailers before beginning the main investigation to confirm the validity of the questionnaires using Cronbach's alpha to assess the consistency of the data in which the values of Cronbach's alpha were (0.78, 0.82, 0.88) for Farmers, Wholesalers, and retailers respectively.<sup>[14,15]</sup>

1 1 Donum=2500m<sup>2</sup>

## RESULTS AND DISCUSSION

This research includes 74 participants which are farmers ( $n = 30$ ), wholesalers ( $n = 10$ ), and retailers ( $n = 34$ ), all of our participants are male (100.0%), Table 1 shows the

**Table 1:** Descriptive Statistics for demographic questions (farmers, retailers, and wholesalers)

Demographic Questions	F	Percent (%)
Age		
Farmers		
21–30	1	3.3
31–40	10	33.3
41–50	8	26.7
50+	11	36.7
Retailers		
21–30	7	20.6
31–40	14	41.2
41–50	4	11.8
50+	9	26.5
Wholesalers		
21–30	2	20
31–40	2	20
41–50	5	50
50+	1	10
Live location		
Farmers		
Inside	10	33.3
Outside	20	66.7
Retailers		
Inside	13	38.2
Outside	21	62.8
Wholesalers		
Inside	10	100
Outside	0	0
Years of Working		
Farmers		
5-Jan	3	10
10-Jun	4	13.3
15-Nov	5	16.7
16-20	6	20
21+	12	<b>40</b>
Retailers		
5-Jan	0	0
10-Jun	13	<b>38.2</b>
15-Nov	7	20.6
16-20	6	17.6
21+	8	23.5
Wholesalers		
5-Jan	3	30
10-Jun	0	0
15-Nov	2	20
16-20	4	40
21+	1	10

percentage of the demographic questions regarding three types of participants, about the farmers their range of age was 25–75 with an average of 48 years, about retailers the range of their age was 23–70 with an average of 42 years and the range of the wholesalers age was 24–55 with 40 years as average. Furthermore, %33.3 of the farmers live inside of Halabja city, %38.2 of retailers live inside Halabja city, while %100 of wholesalers live inside Halabja city. On the other hand, the range of the years that farmers worked was 3–50 years with an average of 22 years of working, the range of years that retailers worked was 2–35 years with an average of 33 years of working and the years that wholesalers worked was 2–23 years with an average of 14 years of working.

According to Figure 1, 73.3% of the farmers learned farming from their fathers, 3.3% of them learned from their brothers and friends, and 20.0% of them learned from own self. About the retailers, 35.3% of them learned the business from their fathers, 20.6% of them from their brothers, 2.9% from friends, and 41.2% from own self. Furthermore, we see that exactly 30.0% of the wholesales learned the business from their fathers and 70.0% of them from own self.

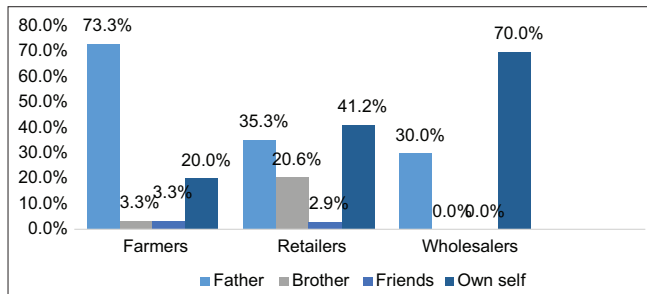


Figure 1: From whom did learn the profession

Mean and standard deviation in Table 2 shows that selling less products than before the COVID-19 pandemic is the first characteristic (factor) that farmers pointed because of COVID-19 pandemic and lockdown with mean and standard deviation (4.70, 0.837), followed by selling products cheaper than they did before to the agricultural wholesalers, people demand had less for products because of lockdown, due to COVID-19, products and needs were not been able to be transported to the wholesalers markets, agricultural offices were all closed to demand their needs during lockdown, products have been left ungathered and unsold in the farmlands due to COVID-19, farmers haven't been able to visit their farmlands enough during lockdown, products have been gathered but unsold in the farmlands due to COVID-19, farmers haven't been able to afford workers for their farmlands due to lockdown, products have been given more time than before the COVID-19 pandemic and agriculturalists weren't been able to visit farmlands enough due to COVID-19.

Table 3 shows the results of independent sample *t*-test which there is no statistically significant relationship between residence and some characteristics of production such as (area of their property in donums, yield of a product per donum in tons, tons of agricultural production sold, quantity production sold and the total quantity produced) with a *P*-value (0.482, 0.832, 0.849, 0.476 and 0.157) which are greater than our choosing significant level 0.05, respectively. It means, there was no difference between the mean score of inside and outside for each of the characteristics of production.

Figure 2 demonstrates that 100.0% of our respondents (retailers) closed their markets during lockdown so that they faced a decline during lockdown (97.1%), 5.9% of retailers said that they had delivery services to houses before lockdown while 8.8% of them said that they had delivery services to

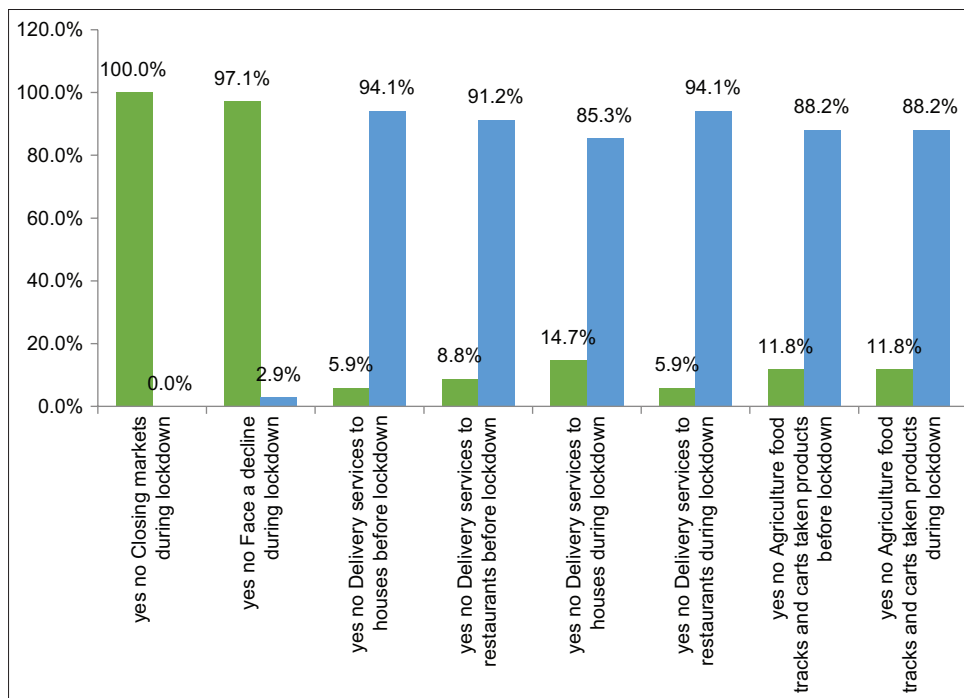


Figure2: What happened in the markets before and during the time of the pandemic?

**Table 2:** Descriptive statistic for farmers survey questions

Questions	Strongly disagree	Disagree	Natural	Agree	Strongly agree	Mean	Std. Deviation
We sell our products cheaper than we did before to the Agricultural Wholesalers	0.00%	6.70%	0.00%	16.70%	76.70%	4.63	0.809
Products have been left un gathered and unsold in the farmlands due to COVID-19.	3.30%	6.70%	13.30%	33.30%	43.30%	4.07	1.081
Products have been gathered but unsold in the farmlands due to COVID-19.	10.00%	20.00%	13.30%	23.30%	33.30%	3.5	1.408
We sell less products than before the COVID-19 pandemic.	0.00%	6.70%	3.30%	3.30%	86.70%	4.7	0.837
Products have been given more time than before the COVID-19 pandemic.	0.00%	30.00%	23.30%	16.70%	30.00%	3.47	1.224
People demand had less for products because of lockdown.	3.30%	3.30%	6.70%	3.30%	83.30%	4.6	1.003
We haven't been able to afford workers for our farmlands due to lockdown.	10.00%	20.00%	13.30%	26.70%	30.00%	3.47	1.383
We haven't been able to visit our farmlands enough during lockdown.	6.70%	13.30%	3.30%	33.30%	43.30%	3.93	1.285
Due to COVID-19, products and needs were not been able to be transported.	0.00%	6.70%	6.70%	23.30%	63.30%	4.43	0.898
Agricultural offices were all closed to demand our needs during lockdown.	3.30%	13.30%	3.30%	26.70%	53.30%	4.13	1.196
Agriculturalists were not been able to visit farmlands enough due to COVID-19.	10.00%	20.00%	30.00%	13.30%	26.70%	3.27	1.337

**Table 3:** Independent Sample *t*-test between residence (where do you live) and some characteristics of production

Characteristic of production	<i>n</i>	Mean	Std. Deviation	<i>t</i>	<i>P</i> -values
How many donums of land have you farmed					
Inside	10	13.3	4.739	-0.713	0.482
Outside	20	30.53	75.673		
How many tons of agricultural products have you had during the COVID-19 pandemic					
Inside	10	98.9	107.103	-0.215	0.832
Outside	20	129.55	441.645		
How many tons of agricultural production you sold during the COVID-19 pandemic					
Inside	10	96.9	108.625	-0.192	0.849
Outside	20	124.45	442.76		
From the quantity production sold how many were had as revenue					
Inside	10	10.3	15.896	-0.723	0.476
Outside	20	46	154.488		
How many tons of your products have been outdated because of the COVID-19 pandemic					
Inside	10	22.5	45.822	1.455	0.157
Outside	20	6.95	11.283		

restaurants before lockdown, sourly that means people could reach their necessities and did not need delivery services. However, 14.7% of them said that they had delivery services to houses during lockdown and 5.9% said that they had delivery services to restaurants during lockdown, as we see delivery services were decreased during the lockdown and this belongs to the truth that people did not believe of healthy of the foods at restaurants, on the other hand, 11.8% of the retailers said that agriculture food trucks and carts taken products from them before and during lockdown.

Table 4 shows that with a higher percentage our respondents (retailers) said that less products are brought into markets during lockdown with mean (4.82), followed by people demand have decreased due to COVID-19, products are not brought into the markets daily due to COVID-19 pandemic, both of product prices have lowered due to COVID-19 pandemic and products were bought more expensively form wholesale markets during lockdown with the same percentage, transportation services couldn't have been provided for the products due to COVID-19, products have been sold in a wider

range during lockdown, so that customers could have saved them later on and workers couldn't have been provided during lockdown for the purpose of transportation with mean (4.79, 4.62, 4.24, 3.41, 2.82 and 2.53).

As we see in Figure 3, 50.0% of the wholesalers said that corona virus affected the products purchase of the people, 100.0% of them said that agriculture food trucks and carts taken food them and delivered to houses before and during COVID-19 pandemic and 90.0% of them said that it is increased during COVID-19, finally 100.0% of wholesale markets said that they have send their products to the middle or south of Iraq during lockdown.

Table 5 shows that most of the wholesalers said that less products in the agricultural wholesale during the COVID-19

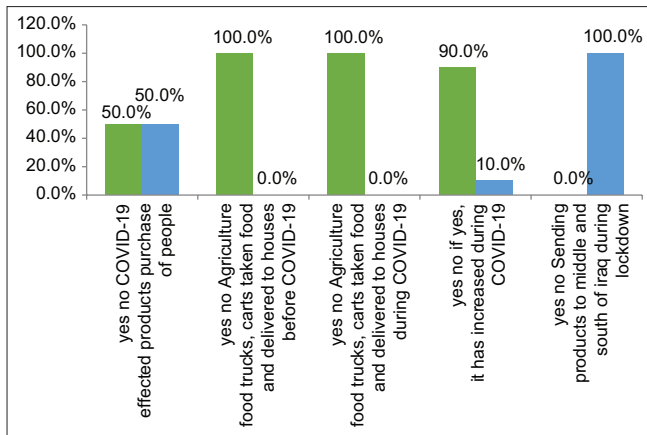
pandemic have the most disadvantage to wholesale (with higher mean 3.800), followed by (they haven't been able to afford workers for transportation during lockdown and neighbor country products such as Iran, have been transported much more to the agricultural wholesale than before) with the same mean 3.700. On the other hand, transportation problems have increased to the middle and south of Iraq than before the COVID-19 pandemic with mean 3.000, because of COVID-19, products have been left unsold in the agricultural wholesale with mean 2.700, selling products cheaper than before because of the pandemic with mean 2.400, transportation services couldn't have been provided for the products due to COVID-19 with mean 2.100 and wholesale markets have bought products from farmers with less amount of money during the COVID-19 pandemic with mean 2.000.

**Table 4:** Descriptive statistic for retailers survey questions

Questions	Strongly disagree	Disagree	Natural	Agree	Strongly agree	Mean	Std. deviation
Product prices have lowered due to COVID-19 pandemic.	5.90%	8.80%	5.90%	14.70%	64.70%	4.24	1.257
People demand have decreased due to COVID-19.	0.00%	2.90%	0.00%	11.80%	85.30%	4.79	0.592
Products have been sold in a wider range during lockdown, so that customers could have saved them later on.	32.40%	23.50%	2.90%	11.80%	29.40%	2.82	1.696
Products were bought more expensively form wholesale markets during lockdown.	5.90%	8.80%	8.80%	8.80%	67.60%	4.24	1.281
Less products are brought into markets during lockdown.	0.00%	2.90%	0.00%	8.80%	88.20%	4.82	0.576
Products are not brought into the markets daily due to COVID-19 pandemic.	5.90%	2.90%	0.00%	5.90%	85.30%	4.62	1.074
Workers couldn't have been provided during lockdown for the purpose of transportation.	38.20%	20.60%	11.80%	8.80%	20.60%	2.53	1.581
Transportation services couldn't have been provided for the products due to COVID-19.	14.70%	20.60%	11.80%	14.70%	38.20%	3.41	1.54

**Table 5:** Descriptive statistic for wholesale markets survey questions

Questions	Strongly disagree	Disagree	Natural	Agree	strongly agree	Mean	Std. deviation
We have had less products in the Agricultural Wholesale during the COVID-19 pandemic.	30.00%	0.00%	0.00%	0.00%	70.00%	3.8	1.932
We have bought products from farmers with less amount of money during the COVID-19 pandemic.	40.00%	40.00%	10.00%	0.00%	10.00%	2	1.247
We have sold products cheaper than before because of the COVID-19 pandemic.	20.00%	40.00%	30.00%	0.00%	10.00%	2.4	1.174
Because of COVID-19, products have been left unsold in the Agricultural Wholesale.	20.00%	40.00%	10.00%	10.00%	20.00%	2.7	1.494
We haven't been able to afford workers for transportation during lockdown.	10.00%	30.00%	0.00%	0.00%	60.00%	3.7	1.703
Transportation services couldn't have been provided for the products due to COVID-19.	60.00%	10.00%	0.00%	20.00%	10.00%	2.1	1.595
Transportation problems have increased to the middle and south of Iraq than before the COVID-19 pandemic.	10.00%	40.00%	10.00%	20.00%	20.00%	3	1.414
During lockdown, neighbor country products such as Iran, have been transported much more to the Agricultural Wholesale than before.	10.00%	30.00%	0.00%	0.00%	60.00%	3.7	1.703



**Figure 3:** How the pandemic affects wholesale markets before and after its occurs?

## CONCLUSION

After studying and analyzing to know the impact of the COVID-19 virus on the agriculture supply chain (Vegetative) statistically, according to the responders ( $n = 74$ ) we reached the following results:

- 1- Most of the Farmers and Retailers are aged between 31 and 40 years while most of the wholesale markets are aged between 41 and 50 years.
- 2- Majority of farmers and retailers are living outside the city while all of the Wholesale are living inside the Halabja city.
- 3- Most of the farmers have more than 20 years' experience of farming, while most of the Retailers have 6–10 years' experience of marketing. On the other hand, most of the wholesale markets have 16–20 years of working.
- 4- The highest percentage of the farmers have learned farming from of their fathers, while most of the retailers and wholesale markets learned business by themselves.
- 5- It is clear that, selling less products by farmers (Mean = 4.70), brought less products into markets (Mean = 4.82) and less products in the agricultural wholesale (Mean = 3.800) during the COVID-19 pandemic and lockdown has the most impact on the agriculture supply chain production in Halabja governorate.
- 6- Market owner reported that 100.0% of them closed their markets and 97.1% of them faced a decline during lockdown.
- 7- With a percentage 50.0%, wholesale markets said that COVID-19 effected products purchase of people, 100.0% of them said that agriculture food trucks and carts taken food of them and delivered to houses before and during lockdown and with a percentage 90.0% it is increased during COVID-19.
- 8- Wholesale markets reported that with a percentage of 100.0%, they could not send products to middle and south of Iraq during lockdown.
- 9- There was no difference between the mean score of inside and outside living for each of the characteristics of

production including donum of farmer's land, having tons of agricultural products during COVID-19, having tons of sold agricultural production during COVID-19, revenue quantity production and outdated tons' production because of COVID-19.

## REFERENCES

1. World Health Organization. *Novel Coronavirus (2019-nCoV) Situation Reports*. Geneva: World Health Organization, 2020. Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports> [Last accessed on 2021 Sep 01].
2. Iraq: *WHO Coronavirus Disease (COVID-19) Dashboard*. n.d. Available from: <https://covid19.who.int/region/emro/country/iq> [Last accessed on 2021 Oct 05].
3. M. K. Al-Malkey and M. A. Al-Sammak. Incidence of the COVID-19 in Iraq implications for travellers. *Travel Medicine and Infectious Disease*, vol. 38, p. 101739.
4. K. K. Lima, A. Pasqualetto, T. Calil, and S. D. de Castro. Management of the Goiás Supply Center (CEASA-GO): Its numbers and proposals for improvements. *Qualitas Revista Eletronica*, vol. 18, no. 3, p. 1.
5. D. de Paulo Farias and F. F. F. de Araújo. Will COVID-19 affect food supply in distribution centers of Brazilian regions affected by the pandemic? *Trends in Food Science and Technology*, vol. 103, pp. 361-366, 2020.
6. International Food Policy Research Institute. *Yield gaps and potential agricultural growth in West and Central Africa*. Washington, D.C., USA: International Food Policy Research Institute, 2011.
7. FAOSTAT. Available from: <http://faostat.fao.org> [Last accessed on 2021 Oct 11].
8. R. D. Schnepf and Library of Congress. *Congressional Research Service, Iraq Agriculture and Food Supply: Background and Issues*. Washington, DC: Congressional Research Service Library of Congress, 2003.
9. S. Aday and M. S. Aday. Impacts of COVID-19 on food supply chain. *Food Quality and Safety*, vol. 4, no. 4, pp. 167-180, 2020.
10. A. Al-Haboby, C. Breisinger, D. Debowicz, A. H. El-Hakim, J. Ferguson, R. Telleria and Van Rheenen. The role of agriculture for economic development and gender in Iraq: A computable general equilibrium model approach. *The Journal of Developing Areas*, vol. 50, no. 2, pp. 431-451, 2016.
11. G. R. Gibson, J. B. Campbell and R. H. Wynne. Three decades of war and food insecurity in Iraq. *Photogrammetric Engineering and Remote Sensing*, vol. 78, no. 8, pp. 885-895, 2012.
12. A. H. Abudlqadir, B. E. Hama and S. M. Faraj. The effects of financial crisis on birth rates in Halabja Province from 2014 to 2018. *Economics, Management and Sustainability*, vol. 5, no. 2, pp. 132-137, 2020.
13. K. Aroian, N. Uddin and H. Blbas. Longitudinal study of stress, social support, and depression in married Arab immigrant women. *Health Care for Women International*, vol. 38, no. 2, pp. 100-117, 2016.
14. H. T. A. Blbas, K. F. Aziz, S. H. Nejad and A. A. Barzinjy. Phenomenon of depression and anxiety related to precautions for prevention among population during the outbreak of COVID-19 in Kurdistan Region of Iraq: Based on questionnaire survey. *Journal of Public Health*, vol. 42, pp. 1-5, 2020.
15. H. Blbas. Statistical analysis for the most influential reasons for divorce between men and women in Erbil-Iraq. *International Journal of Innovation, Creativity and Change*, vol. 6, no. 2, pp. 207-216, 2019.