



Analysis of Milk Production and Trade in Iraq

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Article Info

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Received : 15/04/2022

Accepted in revised form : 20/04/2022

Published : 30/04/2022

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Keywords :

Dairy, Milk Production,
Trade, Iraq

Abstract

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Dairy farming plays an important role in rural economies, not only creating new jobs for rural landless and marginal farm laborers, but also contributing to the national economy. This sector also contributes to rural poverty reduction and inequity, while providing nutritional assistance to thousands of rural households. The production and trade of milk and dairy products have been increasing throughout the world due to their importance to human health and nutrition. The aim of this research is to analyze the production and trade of Iraqi milk and dairy products. For this purpose, the FAOSTAT dataset was used. World milk production was 886.86 million tons in 2020, and it is expected to increase by 2025. The most significant milk producers are India (21.74%) and the United States of America (11.42%), followed by Pakistan, China, Brazil and Germany. According to FAO data, the total number of dairy animals in Iraq increased by 16.2% in 2020 (12.4 million heads) compared to 2010 (10.4 million heads). Iraq's dairy market is heavily reliant on imports, as the country's domestic manufacturers can only meet less than 10% of domestic demand. However, the country is also among the top ten milk importers in the Middle East. The countries from which Iraq imports milk and dairy products have changed over the years due to political problems. For example, while the rate of milk imports from Türkiye varies between 7% and 20%, it is between 0% and 85% for Kuwait.



1. Introduction

Dairy farming remains the economic backbone of high-potential livestock farming. It is estimated that there are approximately 250 million dairy cows in the world. More than 70% of all herds can be found in developing countries. However, non-industrial countries account for only 30% of total world milk production. More than one-fourth of the 570 million farm-holdings around the world keep at least one dairy animal, including buffaloes, camels, cows, sheep, and goats. There are estimated to be 202.4 million buffalo, 38.1 million camel, 1.51 billion holdings keeping dairy cattle, and sheep and goats with 1.1 and 1.2 billion heads respectively (FAOSTAT, 2022).

The world dairy industry is one of the most fiercely protected in the agro-food sector. Exports of milk products are dominated by the EU, the US, New Zealand, and Australia. The European Union, the United States, Mexico, Japan, Russia, and a number of other countries are major importers of dairy products (Meilke et al., 2001). The average global per capita milk and milk product consumption for 2009 was 103 kg. The average level of consumption in developed countries is 245 kg while it is only 66.2 kg in developing countries. Changes based on consumption patterns in different countries are mainly influenced by changes in per capita income, production, and urbanization (Blasko, 2011).

The Iraqi people depend heavily on milk and other livestock-based products in their regular diet. Due to the insufficient production of milk and dairy products, a significant part of the demand is imported from other countries. Total milk imports into Iraq are mainly from the Gulf States and Türkiye.

As a result, the government has identified this drain of foreign exchange resources that flow out of the country and, as a relief measure, various policies have been implemented to regulate the dairy sector towards development, especially to increase domestic production (Abid-Al et al., 2017).

The general purpose of this article is to analyze the production, consumption and trade, as well as predict the quantity of Iraqi milk production.

2. Material and Method

The data about milk production and number of dairy animals between 1990 and 2020 were taken from FAO-STAT. Self-sufficiency rate (SSR) data were calculated using production, imports, and exports data from FAO based on the formula below.

$$SSR = \text{Production} * 100 / (\text{Production} + \text{Imports} - \text{exports})$$

This study represents the first use of ARIMA models to evaluate global milk production, Iraqi milk production, cow milk production and the number of cattle in Iraq.

The main objective of time series analysis is the prediction of future values to determine the production of milk in Iraq during the period 2020–2025. Gretl was used to analyze the data.

It is popularly known as Box – Jenkins (BJ) Methodology. Autoregressive Integrated Moving Average Models were used in many studies (Kazemipour et al., 2017).

The general form of the ARIMA (p,d,q) is;

$$Y_t = \phi_1 Y_{t-1} + \phi_2 Y_{t-2} \dots + \phi_p Y_{t-p} + \epsilon_t + \theta_1 \epsilon_{t-1} + \theta_2 \epsilon_{t-2} + \dots + \theta_q \epsilon_{t-q}$$



3. Results and Discussion

3.1 Milk Production in the World

World milk production increased by 23.75% in 2020

compared to 2010 and amounted to 886.86 million tons. Cow milk constitutes a large part of the total milk produced (80.96%), followed by buffalo milk (15.16%) and goat milk (2.33%). According to FAO data, 134.42 million tons of buffalo milk, 3.14 million tons of camel milk, 718.03 million tons of cow milk, 20.62 million tons of goat milk, and 10.61 million tons of sheep milk were produced in

Compared to 2010, the production of buffalo, goat, cow, camel and sheep milk production increased 45.33%, 28.75%, 20.49%, 15.14%, and 11.75% respectively (Table 1). The recovery and restocking period of 2010 to 2020 clearly indicates the rapid growth potential of cow herds relative to goat, sheep, buffalo, and camel; whereas the 2010 to 2020 period represents more normal long-term herd growth rates (Table 2).

Table 1. World milk production between 2010 and 2020 (tons).

Year	Milk whole fresh buffalo	Milk whole fresh camel	Milk whole fresh cow	Milk whole fresh goat	Milk whole fresh sheep	Total quantity
2010	92496372	2735822	595914598	16022588	9502049	716671429
2011	96114627	2678655	610118596	16556201	9464811	734932890
2012	99041124	2687714	629936935	18352509	9823579	759841861
2013	108448781	2825944	638443326	18438052	9881280	778037383
2014	114053395	2587351	659273388	18542383	9991480	804447997
2015	116025086	2763634	665306500	18771105	10057331	812923656
2016	120160488	2745259	669710681	19421038	10205743	822243209
2017	126117810	2970244	683209298	20136103	10485847	842919302
2018	132444138	2871985	700216426	20453075	10364548	866350172
2019	134791772	3087052	708264265	20066359	10617961	876827409
2020	134425197	3149997	718038443	20629610	10618551	886861798
Change (%) (2010-2020)	45.33	15.14	20.49	28.75	11.75	23.75



Table 2. Number of dairy animals in the world (Head).

Year	Buffalo	Camel	Cow	Goat	Sheep	Total
2010	194034343	25048490	1369822223	874457191	1046140329	3315468233
2011	195181279	25463726	1374454720	901517441	1065359028	3366794915
2012	196409774	30468768	1427257421	951405119	1132940091	3542071399
2013	196776730	31311625	1431886790	969908079	1157187874	3590294368
2014	198288978	32124803	1439387463	984372329	1151093273	3606977868
2015	199650185	32981414	1451963866	1004730745	1182177688	3671853713
2016	200904517	33866555	1470385681	1029023580	1197723570	3730999386
2017	201282401	34971120	1477057966	1045350517	1206686523	3764066126
2018	202813970	35871027	1493931621	1066922560	1213972478	3810697686
2019	202454780	38156315	1511107043	1108972959	1240310138	3898546455
2020	203532944	38654378	1525939479	1128106236	1263136644	3955836737
Change(%) (2010-20)	4.90	54.32	11.40	29.01	20.74	19.31

Major dairy producing countries are India, the USA, Pakistan, Brazil, China, Russia, Germany, France, New Zealand, and Türkiye (Table 3). Examining world milk production in 2020, it is seen that India has achieved 21.74% of total production with 183.95 million tons.

Pakistan follows with 101.27 million tons, and the United States with 60.77 million tons. Fifteen countries now contribute to 70% of the overall global milk supply. Iraq has reached 0.05% of total milk production with 404,246 tons.



Table 3. Top 15 largest milk producing countries in the world in 2020 (tons).

Country	Quantity	Percent (%)
India	183955490	21.74
United States of America	101276991	11.42
Pakistan	60770000	6.85
China	38769118	4.37
Brazil	36806788	4.15
Germany	33188890	3.74
Russian Federation	32219165	3.63
France	26152110	2.95
New Zealand	21871305	2.47
Türkiye	21839351	2.46
Great Britain	15558000	1.75
Netherlands	14932000	1.68
Poland	14830870	1.67
Italy	13509520	1.52
Mexico	12783734	1.44
Other	258398466	29.14
Total	886861798	100.00

Source: FAOSTAT, 2022.

3.2 Milk Production, Consumption and Trade in Iraq

Livestock production in Iraq mainly consists of cattle, sheep and goats. Buffalo and camel breeding is done on a limited scale. According to FAO data, the total number of dairy animals in Iraq decreased by 2.02 million heads in 2020 compared to 2010. Sheep comprised 64% of the total number of livestock, followed by cows and goats (Table 4). The number of buffalo, cows, goats, and sheep decreased by 20.86%, 23.18%, 10.97%, and 15.37% respectively. These figures demonstrate that the number of dairy cows is not significant for milk production. This situation could be attributed to unsuccessful dairy investment policies.

Table 4. Total number of milking animals in Iraq (Head).

Year	Buffalo	Camel	Cow	Goat	Sheep	Total
2010	295000	60000	2629000	1519000	7945000	12448000
2011	302000	62000	2707000	1565000	8183000	12819000
2012	312000	65000	2720000	1612000	8200000	12909000
2013	180662	57489	2780000	1195675	6515825	10729651
2014	187401	68000	2900000	1216898	6545146	10917445
2015	194391	67048	1823184	1238498	6574599	9897720
2016	201642	72408	1860887	1260481	6604185	9999603
2017	209163	78196	1899370	1282856	6633904	10103489
2018	216965	84447	1938649	1305627	6663757	10209445
2019	225058	91198	1978740	1328802	6693744	10317542
2020	233453	98488	2019660	1352388	6723866	10427855
Change (%) (2010-2020)	-20.86	64.15	-23.18	-10.97	-15.37	-16.23

Source: FAOSTAT, 2022.



Table 5. Milk production quantity (thousand tons) by animal species and average yield (kg/head) per dairy animal in Iraq

Year	Buffalo		Camel		Cow		Goat		Sheep	
	Quantity	Yield	Quantity	Yield	Quantity	Yield	Quantity	Yield	Quantity	Yield
2010	60454	7881	165	471	226000	6384	19497	248	66158	177
2011	27206	3478	176	500	233000	6401	18769	220	55783	145
2012	63220	7867	180	500	234900	6401	20000	234	67568	175
2013	41386	8030	170	459	238000	6485	18000	212	58402	186
2014	30716	5782	215	202	235000	6369	17007	263	56527	179
2015	31593	5769	235	223	263323	6926	17203	262	56775	179
2016	33348	5908	255	537	267727	6921	17402	260	57050	179
2017	33348	5731	274	537	272205	6916	20887	307	57297	179
2018	35103	5853	294	432	276758	6911	21224	307	57545	179
2019	35981	6718	333	600	281387	6906	21609	308	57821	179
2020	37737	7027	353	607	286093	6901	21994	309	58069	179
Change (%) (2010-2020)	-37.58	-10.84	113.94	28.87	26.59	8.10	12.81	24.60	-12.23	1.13

Source: FAOSTAT, 2022.

Table 5 refers to the quantity of milk produced and the average yield per animal in Iraq between 2010 and 2020. In 2010, buffalo milk production was 60,454 tons and decreased to 37,737 tons in 2020. Camel milk production was 353 tons in 2020, cow milk production was 286,093 tons, goat milk production was 21,994 tons, and sheep milk production was 58,069 tons.

Although the number of milk cows has decreased by 23.18% in the last 10 years, cow milk production has increased by around 26.59%. Approximately 85% of milk cows in Iraq are local breeds with very low milk yield, and the rest consist of hybrid breeds. The main local cattle breeds are Sharabie and Junobie (FAO, 2022a).

Table 6. Consumption of cow milk in Iraq between 2015 and 2020.

Year	Production (Tons)	Imports (Tons)	Consumption (Tons)	Self-sufficiency (%)
2015	263323	67779	331102	79.53
2016	267727	76124	343851	77.86
2017	272205	65000	337205	80.72
2018	276758	51380	328138	84.34
2019	281387	55000	336399	83.65
2020	286093	34856	320973	89.15

Source: FAOSTAT, 2022

The milk yield per cow increased from 6,384 kg in 2010 to 6,926 kg in 2015 and decreased to 6,901 kg in 2020. When the yields per animal of buffalo, camel, goat, and sheep were examined, they were found to be lower.

Iraq is uniquely positioned to harness the potential of its younger generation to promote prosperity, despite the multiple challenges it faces (Mahmud, 2021). The demand for dairy products is expected to grow, with support plans by large international organizations. The average per capita consumption of dairy products is expected to rise from 52 liters to more than 60 liters (FAO, 2022b).



Dairy production has ceased, and the vast majority of dairy products consumed in Iraq are imported. Imports include fresh and powdered milk, cheese, and yogurt. Türkiye, Iran, and Saudi Arabia, as well as several European countries have also reportedly made investments in dairy infrastructure, including the largest dairy processing factory in the country. Cross-border smuggling also distorts the market, and the lack of enforcement undermines the effectiveness of governmental import controls. In addition, neighboring countries strategically support the export of their products to the Iraqi market as a way of gaining foreign currency.

Consumption of milk and dairy products has been increasing in recent years in all countries. In Iraq, the decrease in demand has led to a decrease in imports of whole fresh cows. In terms of volume, Iraq's imports of whole fresh cows changed from 67,779 tons in 2015 to 34,856 tons in 2020 (Table 7). However, Iraqi imports of dairy products traditionally consist of butter and cow milk. Buttermilk

Cheese, processed cheese, whole cow milk cream, fresh milk, natural constituents milk products, skimmed cow milk, skimmed dried milk, whole condensed milk, whole dried milk, whole evaporated milk, whole fresh cow milk, whey, dry yogurt, concentrated or not. Iraq is also among the top ten milk importers in the Middle East. Belgium, Canada, Denmark, Egypt, France, Germany, United Kingdom, Uruguay, India, Indonesia, Ireland, Italy, Jordan, Malaysia, Netherlands, Poland, Spain, Sweden, Switzerland, Iran, Türkiye, Saudi Arabia, Kuwait and, United Arab Emirates are among the countries that export dairy products to Iraq.

The countries from which Iraq imports milk and dairy products have changed over the years due to political problems. For example, while the rate of milk imports from Türkiye varies between 7% and 20%, it is between 0% and 85% for Kuwait (Table 7).

Table 7. Iraq's dairy milk import quantity by country (tons).

Countries	2015	2016	2017	2018	2019	2020
Kuwait	57644	56760	164	40389	0	21802
Türkiye	4607	5943	6080	5368	6136	6845
Saudi Arabia	4427	48	212	477	46	5317
Un. Arab Emirate	901	1437	11748	4835	2144	672
Germany	91	575	673	108	77	32
France	25	96	112	33	4	32
Netherland	15	47	94	43	335	46
Other	69	11218	45917	127	46258	110
Total	67779	76124	65000	51380	55000	34856

Source: FAOSTAT, 2022.



3.3. Applying the ARIMA Model to Forecast Global and Iraqi Milk Production

The ARIMA model was used to forecast global milk production, Iraqi milk production, cow milk production in Iraq and number of cattle in Iraq. The main problem in the ARIMA modeling technique is how to choose the most appropriate values for p , d , and q . To meet the study objectives, different ARIMA models were tried, and the best model for forecasting each variable was as below:

The ARIMA (2,1,0) model was selected as the most suitable for predicting global milk production. Figure 1 shows total production of 944.26 million tons is expected in 2025.

ARIMA (1,0,0) was chosen as the best model for milk production in Iraq. Figure 2 shows that Iraqi milk production in 2025 is forecast to decrease by 7.48%.

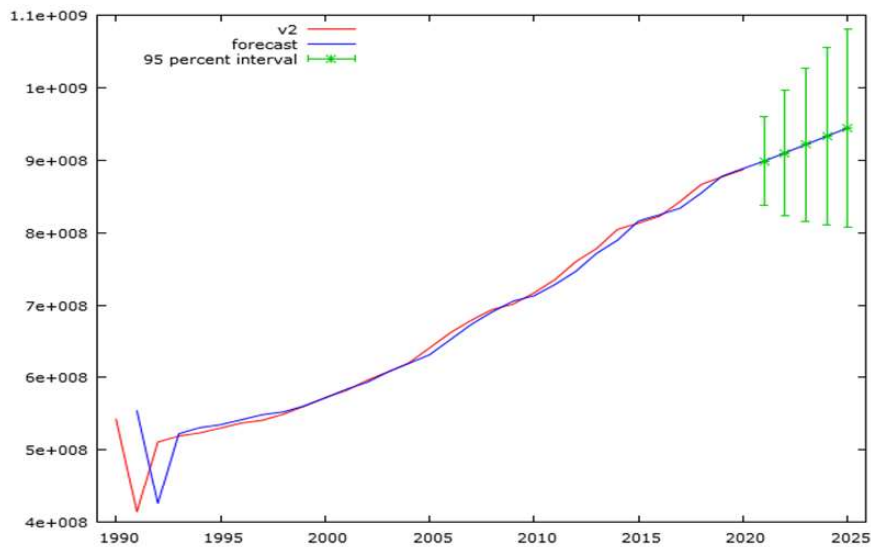


Figure 1. Long-term trends in global total milk production.

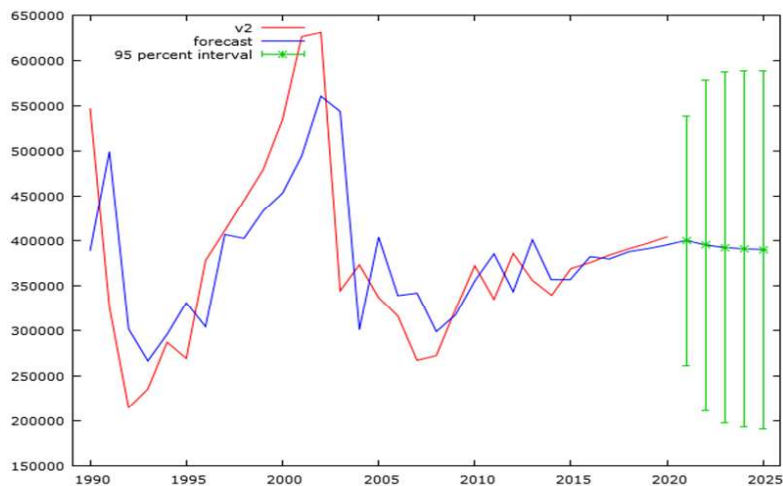


Figure 2. Long-term trends in Iraqi milk production.



The results showed that the most suitable model for cow milk production in Iraq was ARIMA (1,0,0). The average milk production from cows for 2025 is estimated to be 245,655 tons, as can be seen in Figure 3.

In addition, ARIMA (0,0,1) was selected as the most suitable model for the number of cattle in Iraq. Figure 4 shows the number of cattle will decrease by 10.30% to 1,811,613 head.

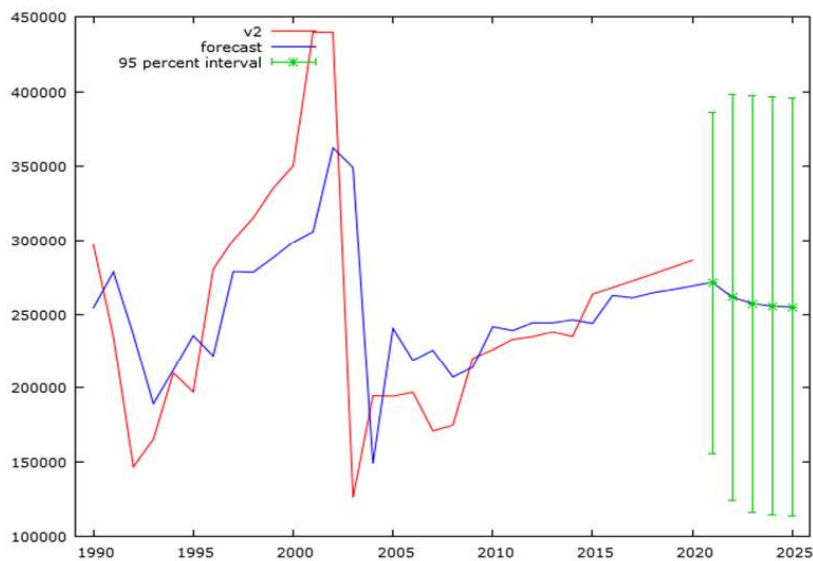


Figure 3. Long-term trends in Iraqi cow milk production.

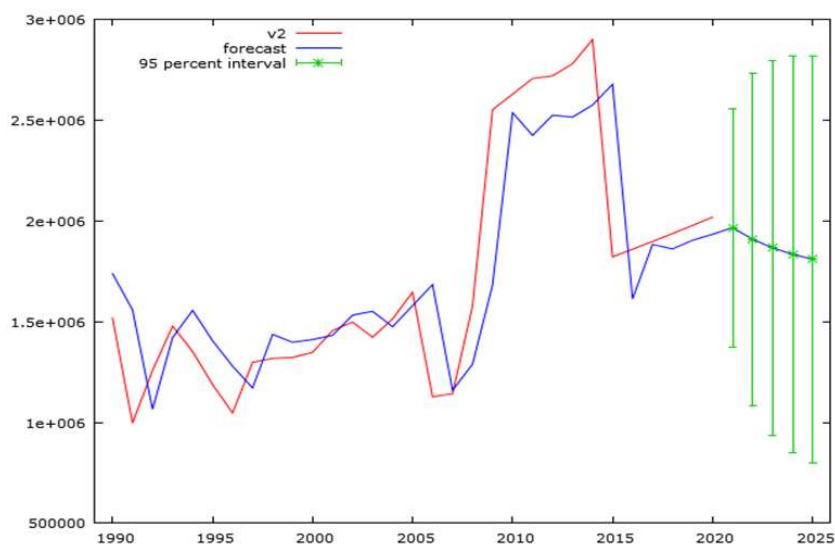


Figure 4. Long-term trends in number of cattle in Iraq.



4. Conclusion and Recommendations

Milk has been one of the most important basic foods for thousands of years, and it will be an integral part of healthy human consumption in the future as well (Vasylieva, 2017). After the economic crisis of 2009, the dairy sector is showing signs of improvement for the future (Berry, 2009). This study also supports this positive trend and predicts further development of the dairy sector in developing countries, mainly in Middle East.

According to the results, global milk production will increase by 6.47% in 2025. Around 44% of this will be produced by India, China, the United States of America, and Pakistan.

Generally, Iraq has faced many challenges that have had a direct impact on all sectors of the country's economy. These include weak institutions, insecurity, corruption, deterioration of basic services and social indicators such as education and health, as well as widespread unemployment (Woertz, 2017). The problems confronting the agricultural sector are inextricably linked to the larger picture. Furthermore, the sector's low efficiency and growth rates can be attributed to a variety of issues and government policies.

In Iraq, it is expected that milk production, which was 404,246 thousand tons in 2020, will decrease by 7.48% in 2025 if the number of dairy animals and the trend of milk yield don't change.

Addressing these factors only on paper will not increase dairy productivity until these factors are reduced through appropriate policies. To improve the economic viability of dairy farming communities, it is critical to create opportunities for international companies to collaborate on projects such as dairy in Iraq.



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