

# Effects of the COVID-19 Pandemic on Red Meat Production in Turkey in 2020

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## Abstract

This study aims to evaluate the amount of meat consumption during the COVID-19 pandemic and its aftermath on a monthly and seasonal basis for the years 2019 and 2020 in our country. The normality of the data distribution was analyzed using histogram graphs, Q-Q plots, and the Kolmogorov-Smirnov test. The significance of the difference between two independent groups in terms of carcass quantities was evaluated using the Mann-Whitney U test, while the significance of the difference between more than two groups was assessed using the Kruskal-Wallis test. Bonferroni tests were used for multiple group comparisons. Data are presented as Median (1st and 3rd Quartile). A significance level of  $P < 0.05$  was set. COVID-19 is a major pandemic that has spread worldwide and affected the lives of many people. From the beginning of the pandemic, many individuals and sectors have been impacted. Furthermore, it has been observed that the COVID-19 pandemic has not only affected the economy of people and countries but also significantly impacted many businesses operating in the food and health sectors. The COVID-19 pandemic has created a broad impact encompassing health, economy, psychology, socio-cultural, and political areas. In this process, it has become a critical necessity to develop short- and medium-term economic and technical solutions for problems in the agriculture and livestock sectors and to plan long-term agricultural and livestock policies. Additionally, to ensure the continuity of agricultural and livestock activities in Türkiye under challenging conditions such as pandemics, natural disasters, and wars, there is a need to review existing agricultural policies and create urgent action plans.

## Introduction

Covid 19, which started to be seen in the city of Wuhan in Hubei province of the People's Republic of China in mid-December 2019, showing a series of symptoms and is thought to be caused by the virüs. It has been reported as cases spreading rapidly and strongly among people worldwide (Carrasco et al., 2021; Kriaucioniene et al., 2020).

COVID-19 spread rapidly around the world, creating a global crisis, which was declared a pandemic by the World Health Organization (WHO) as of March 2020 (Yüce and Muz, 2021). The COVID-19 pandemic, which has been affecting the world for nearly two years,

has had a wide range of impacts both across countries and among individuals around the world. Assessing COVID-19 solely from a health perspective is insufficient, as the pandemic has evolved into a multifaceted crisis, profoundly affecting global unemployment and poverty, while also exerting a detrimental impact on the economy, leading to financial distress (Güler and Günaylı, 2021). While people spent their lives in quarantine due to COVID-19, the increase in the amount of ready-to-eat food consumption and high stress have negatively affected people's physical and mental health (Landaeta-Díaz et al., 2021). Türkiye became acquainted with the COVID-19 pandemic on 11 March 2020, and on March 15,

2020, the Minister of Health reported that an 89-year-old patient travel from China died. This was the first reported case of death in Türkiye. The Minister of Health announced on April 1, 2020 that coronavirus cases have spread all over the country (Güreşçi, 2020)

Throughout human history, food has remained the fundamental necessity for sustaining life. As this fundamental truth persists today, the ongoing COVID-19 pandemic crisis, spanning approximately four years, has starkly highlighted the paramount importance of food. (Arzik et al., 2022; FAO, 2009; Gul et al., 2023). Following the WHO's announcement on March 11, 2020 that it declared the COVID-19 outbreak as a pandemic, and panic-induced fluctuations in the purchase of food and various essentials have been observed worldwide. These behavioral responses are believed to stem from perceptions and fears of scarcity and hunger (Sim et al., 2020).

During the COVID-19 pandemic, the importance of protein as a nutrient has been highlighted, alongside micronutrients such as vitamins D and C, zinc, and selenium. (Karaağaç, 2020). Adequate and balanced nutrition is very important for optimal immunity as it supports a strong immune system as well as prevents infection (Iddir et al., 2020). Malnutrition and poor-quality nutrition can lead to long-term adverse health effects (Tapan, 2021). A healthy diet is of great importance to be protected from infectious diseases and for the treatment of the disease to have a positive outcome (Çelikkaya, 2021). Furthermore, the importance of red meat has increased significantly during the pandemic due to its rich mineral and vitamin content, which not only supports a robust immune system against many diseases but also enhances overall health (Arzik et al., 2022; Özkorkut and Saka, 2022).

The change in the economic balance during the COVID-19 pandemic, the disruption of the supply chains led to increase in diesel and feed prices and decrease in animal product consumption. Moreover, the closure of food service establishments (restaurants, etc.) caused fluctuations in the demand for animal products and consumption habits (Demirhan and Şahin, 2022) reduction. Due to reduced tourism activity, closure of restaurants and communal kitchens, limited student mobility, and shutdown of dormitories and dining halls, the consumption of animal products in these sectors has significantly declined or even come to a halt. Consequently, businesses operating in the ready-to-eat food sector have experienced a notable decrease in revenues (Arzik et al., 2023; Yenişehirlioğlu, 2020).

The objective of this study is to comprehensively assess the impact of the sudden onset pandemic on the livestock sector. This was accomplished through the analysis of data gathered from slaughterhouses and records of imported red meat, spanning the entirety of 2019 and 2020. More

specifically, the study aimed to compare the overall consumption of red meat (encompassing cattle, sheep, goat, and buffalo) in Türkiye between the pre-pandemic period (2019) and the pandemic period (2020).

## Material and Methods

The study data were obtained from the Ministry of Agriculture and Forestry with official permission. A comparative analysis was conducted between the imported carcass and boneless meat data from the General Directorate of Food and Control of the Ministry of Agriculture and Forestry and the corresponding data released by TURKSTAT for 2019 and 2020. The study compared the total amount of red meat (cattle, sheep, goat, and buffalo) consumed in Türkiye during the pre-pandemic period (2019) and the pandemic period (2020).

The amount of red meat imported into the country was minimal and therefore not included in the analyses. Additionally, due to the unregistered slaughters during the Feast of Sacrifice, which affected both years, the exact quantity of red meat could not be estimated and was consequently excluded from our analyses. The data only encompasses the amount of red meat slaughtered under the Ministry of Agriculture and Forestry-approved slaughterhouses in Türkiye monthly for the 12 months of 2019 and 2020.

## Statistical Analysis

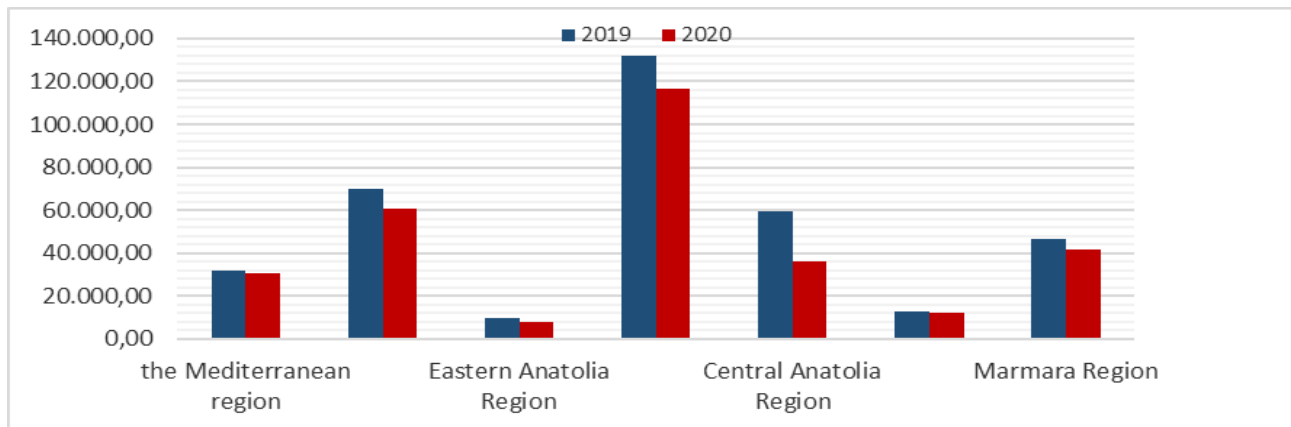
The conformity of the data to normal distribution was evaluated by histogram graph, Q-Q plot and Kolmogorov-Smirnov test. The Mann Whitney U test was used to check the significance of the difference between two independent groups in terms of carcass quantities and the Kruskal Wallis test was used to check the significance of the difference between more than two groups in terms of carcass quantities. Bonferroni test was used for multiple group comparisons. Data are given as Median (1st Quarter - 3rd Quarter). The significance level was determined as  $P < 0.05$ . R 4.0.4 ([www.cran.r-project.org](http://www.cran.r-project.org)) software was used to analyze the data.

## Results

The comparison of the amount of red meat carcasses slaughtered by slaughterhouses in Türkiye in 2019 and 2020 according to geographical regions is given in Table 1 and Figure 1. In terms of 2019 and 2020 red meat carcasses, it was determined that there was a significant difference between the Aegean and Central Anatolia regions ( $P = 0.006$ ,  $P < 0.001$ , respectively). In addition, it was determined that there was a significant difference ( $P < 0.001$ ) between the 2019 and 2020 in the total meat production of Türkiye (See Table 1 and Figure 1).

**Table 1:** Comparison of red meat carcass slaughtered by slaughterhouses in Türkiye in 2019 and 2020 by geographical regions (in thousand tons-carcass weight equivalent).

Region	2019 Median (1st Quartile - 3rd Quartile)	2020 Median (1st Quartile - 3rd Quartile)	P Value
Mediterranean	32,1 (10,4 – 99,9)	30,3 (9,8 – 79,1)	0.168
Aegean	69,6 (16,9 – 163,7)	60,8 (12,5- 138,5)	<b>0.006</b>
Eastern Anatolia	9,9 (2,9 – 36,6)	7,9 (2,5 – 30,4)	0.104
Southeastern Anatolia	131,8 (30,3 – 307,8)	116,5 (29,4 – 321,6)	0.476
Central Anatolia	59,2 (13,1 – 256,8)	35,9 (8,3 – 138,9)	<b>&lt;0.001</b>
Black Sea	12,7 (5,1 – 35,1)	12,2 (4,8 – 30,9)	0.486
Marmara	46,6 (13,4 – 125,4)	41,7 (10,9 – 141,2)	0.132
Türkiye in general	30,6 (7,9 – 112,1)	25,3 (6,6 – 90,2)	<b>&lt;0.001</b>



**Figure 1.** The amounts of red meat carcasses slaughtered by slaughterhouses in Türkiye in 2019 and 2020 across geographical regions (in thousand tons-carcass weight equivalent).

The analysis indicates that the amount of red meat slaughtered in all regions was lower in 2020 compared to 2019. Additionally, it was observed that the Black Sea region had a particularly low amount of red meat.

Table 2 presents a monthly comparison of red meat slaughtered in Türkiye in 2019 and 2020. Significant decreases were observed in March, May, and November 2020 compared to the same months in the previous year ( $P < 0.01$ ). Although the amount of red meat slaughtered in 2020 was consistently lower than in 2019 across other months, these differences were not statistically significant ( $P > 0.05$ ).

The analyses show that while the slaughter amounts in Türkiye in 2019 and 2020 vary across some months, the pattern in 2019 is more homogeneous. In 2019, the highest slaughter amount was recorded in May, approaching 45 tons. However, the greatest decrease between the corresponding months of both years occurred in May 2020. These decreases were followed by November and March 2020, respectively. When the

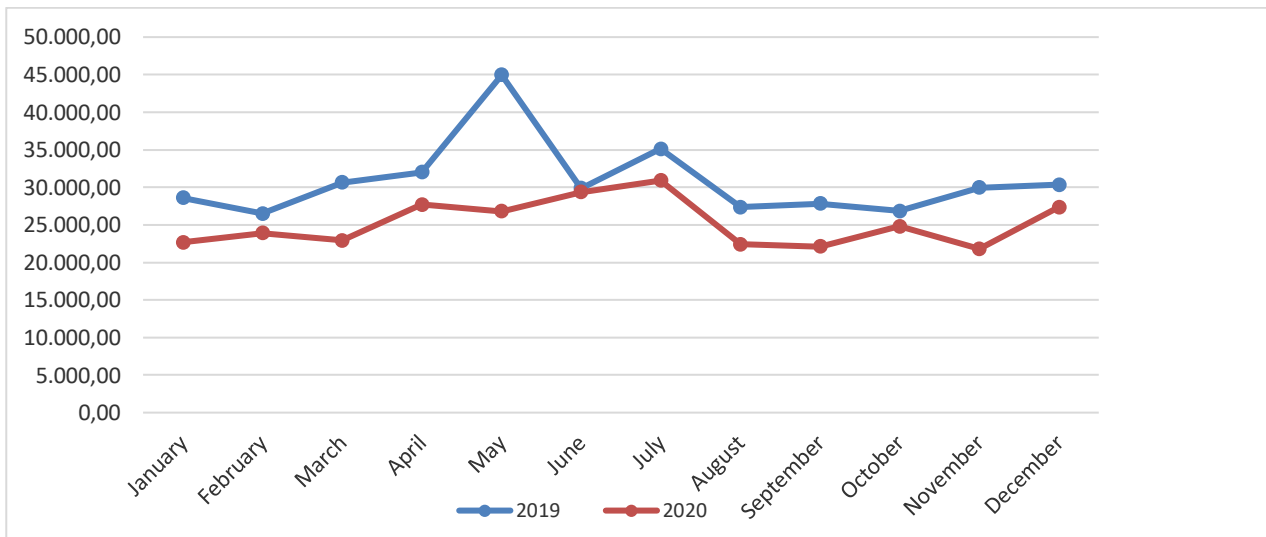
average monthly red meat carcass amounts for 2019 and 2020 were analyzed, the 2019 data was consistently higher than the 2020 data for all months except June (Figure 2).

The comparison of the average amount of red meat carcass production in Türkiye in 2019 and 2020 by season is given in Table 3. When we analyzed the differences in the amount of red meat by year and season, and also analyzed both years among themselves, the differences between some seasons were found to be significant (Table 3). In the analyses, it is seen that more slaughter was made in the spring and summer seasons of 2019 compared to the autumn and winter seasons significantly ( $P < 0.05$ ). Although there was no significant difference between the data of 2019 in summer and fall seasons, a significant decrease ( $P < 0.05$ ) occurred in the transition from summer to fall in 2020. Numerically, the slaughter amounts of all seasons in 2020 were lower than 2019. However, this decrease was significant ( $P < 0.01$ ) only in spring and fall.

**Table 2.** Monthly comparison of average red meat carcasses slaughtered by slaughterhouses in Türkiye in 2019 and 2020 (tons/month).

Aylar	2019	2020	P Değeri
January	28,5 (6,7-110,2) <sup>a</sup>	22,6 (60-84,8) <sup>a</sup>	0.107
February	26,5 (6,2-95,7) <sup>a</sup>	23,9 (5,1-81,9) <sup>a</sup>	0.262
March	30,6 (7,4-104,4) <sup>ab</sup>	22,9 (5,4-88,1) <sup>ad</sup>	<b>0.037</b>
April	32 (9,5-114,6) <sup>ab</sup>	27,7 (7,3-91,1) <sup>ab</sup>	0.061
May	44,9 (14,4-145,5) <sup>b</sup>	26,8 (7,9-94,5) <sup>ab</sup>	<b>&lt;0.001</b>
June	29,8 (8,7-105,1) <sup>ab</sup>	29,3 (8,9-104,7) <sup>bc</sup>	0.894
July	35,1 (10,2-126,8) <sup>ab</sup>	30,9 (9,6-106,6) <sup>b</sup>	0.180
August	27,3 (7,6-99,9) <sup>a</sup>	22,2 (6-85,5) <sup>a</sup>	0.071
September	27,8 (6,7-95,5) <sup>a</sup>	22,1 (5,9-78,7) <sup>ad</sup>	0.191
October	26,8 (6,9-106,8) <sup>a</sup>	24,8 (6,2-86) <sup>ace</sup>	0.254
November	29,9 (7,9-114,7) <sup>ab</sup>	21,8 (5,9-88,5) <sup>ad</sup>	<b>0.029</b>
December	30,3 (6,5-129,5) <sup>ab</sup>	27,3 (6,8-111,7) <sup>bde</sup>	0.765
<b>P Value</b>	<b>0.001</b>	<b>0.014</b>	

a, b, c, d, e: Different letters in the same column indicate the difference between groups.

**Figure 2.** Distribution of Türkiye's average red meat carcass by month in 2019 and 2020 (tons/month).**Table 3.** Comparison of Türkiye's average red meat carcass between seasons in 2019 and 2020 (tons/month).

Season	2019*	2020*	P Value
Spring	35,7 (9,9 - 124,1) <sup>a</sup>	25,7 (6,9 - 90,7) <sup>ab</sup>	<b>&lt;0.001</b>
Summer	30,4 (8,7 - 110,5) <sup>ab</sup>	27,2 (8,1 - 100,2) <sup>b</sup>	0.063
Autumn	28,3 (7,1 - 106,7) <sup>b</sup>	22,6 (6 - 83) <sup>a</sup>	<b>0.008</b>
Winter	28,1 (6,5 - 110,3) <sup>b</sup>	24,8 (6,1 - 88,5) <sup>ab</sup>	0.078
<b>P Value</b>	<b>0.003</b>	<b>0.043</b>	

a,b: Different letters in the same column indicate differences between groups.

## Discussion and Conclusion

In this study, the amount of meat consumption in Türkiye during and after the COVID-19 pandemic was compared by month and season. The COVID-19 pandemic is a major pandemic that has spread all over the world and affected the lives of many people all over the world. Since the beginning of the pandemic, many people and sectors have been affected by this pandemic. At the beginning of the pandemic, people in different countries looted markets due to concerns about access to food and tried to eat healthy food to strengthen their immune systems (Erdem, 2020). The reason why COVID-19 has reduced the purchase of animal products is due to supply chain disruption and panic buying (Akkartal, 2022). In addition to the sudden shift in demand from foodservice to retail due to the global pandemic, the shutdown of slaughterhouses and processing plants has exacerbated the economic hardship for animal farmers and led to the slaughter of animals (e.g. chickens) that were bred for meat production. As a result, meat shortages are now a concrete reality. Meat processing capacities have fallen 40% below 2019 levels during the Covid period (Luckstead et al., 2021; Walters et al., 2020). Beef processors surveyed in the United States and Brazil experienced a drop in production compared to January-March 2020 (21% in April and 19% in May). The production level in June-August 2020 was reported to be close to the highest level observed before the processing plants were shut down.

In Canada, 75% of beef processing plants were disrupted, especially due to the closure of meat plants (Hobbs, 2021). In Ghana, as the country is mainly dependent on livestock imports from the United States, Brazil and the European Union, COVID-19 brought supply problems and damaged the sector, with cattle, sheep and goat numbers falling by 57%, 61% and 64% respectively during the lockdown period (Obese et al., 2021).

Revenue from meat sales has reportedly fallen since the start of the pandemic, largely due to restaurant closures. When dining out, dishes made from meat and meat products are often preferred to vegetarian meals, and this dining out option has temporarily stopped for many. This has resulted in carcasses from animals slaughtered in more expensive slaughterhouses not being sold and storage facilities remaining at peak capacity (Sky News, 2020).

Except for June meat consumption in 2019 and 2020, there is a decrease in all months of 2020 compared to 2019. According to the statement made by ETBİR (Association of Red Meat Industrialists and Producers), while the annual per capita red meat consumption was 12 kilograms on average in 2019, this amount decreased to 7-8 kilograms in 2020. In the statement, it was emphasized that low-income people have the opportunity to eat red meat in their workplaces and that there has been a decline in consumption as they mostly

work from home during the pandemic period. In addition, it was stated that the inability of places such as restaurants, hotels and school cafeterias to do business due to the pandemic was also effective in the decline and that 40 percent of the total consumption in the domestic market was realized by individuals and 30 percent by restaurants and tourism enterprises (Cumhuriyet, 2022). They expect that the COVID-19 pandemic will re-emerge previous behavioral patterns and accelerate the transition to low-meat diets that we are starting to see in some high-income countries (Attwood and Hajat, 2020). In our research, when we look at the year 2019, it is seen that significantly more slaughter was done in the spring and summer seasons than in the fall and winter seasons. Although there was no significant difference between the 2019 data in the summer and fall seasons, there was a significant decrease in the transition from summer to autumn in 2020. Numerically, the slaughter amounts of all seasons in 2020 were lower than 2019. However, this decrease was significant ( $P < 0.01$ ) only in spring and fall. Due to uncertainty and drought in Türkiye, crises in the agriculture and livestock sector are predicted to continue in 2021. The rapidly evolving nature of the COVID-19 virus has created many problems for the meat industry. Restrictions on animal exports, logistical constraints and the closure of slaughterhouses, restaurants and food services have negatively impacted all stages of the meat supply chain. Farmers could not find suitable markets to sell their livestock. Meat processing capacity was also reduced due to the closure of processing plants. Factory closures and panic buying have also jeopardized the availability of meat and its products to consumers, causing price fluctuations. In addition to its devastating effects on human health, the COVID-19 pandemic has had unprecedented impacts on animal production and animal health worldwide. Restrictions on mobility and national and international trade have disrupted animal markets and access to consumers. This has caused a major crisis for livestock producers and a major disruption to the global economy. It has also raised concerns about food insecurity and hunger in different parts of the world. These changes have made it vital to develop and implement innovative strategies to mitigate, control and overcome the global impacts of COVID-19 on animal production and animal health. In addition, animal producers, animal health professionals, human health professionals, animal-related industries (such as meat, dairy and poultry), government agencies and non-governmental organizations need to coordinate and work together during this pandemic and ahead of any outbreak. Future pandemics that could affect global health. Therefore, in order to combat such serious situations in the future, some of the recommended measures



related to animals and animal production are included:

Although the subsidies are paid on time, the excessive debts of the farmers create a negative situation in terms of income and expenditure balance. Farmers who received support payments had problems in repaying their existing loan debts with this amount and damaged the continuity of animal husbandry. In addition to short- and medium-term economic and technical solutions, it would be useful to plan a long-term agricultural and livestock policy and review Türkiye's current agricultural policies to ensure continuity in agriculture and livestock production, especially in cases of epidemics, natural disasters and war. Farmers' access to animal feed and additives and the access of animals and animal products to markets and consumers need to be facilitated. Alternative systems for the storage of extra animals and animal products should be provided to help farmers in this outbreak and possible future outbreaks, and modern animal husbandry technologies should be introduced to the agriculture and livestock sector in order to maximize the efficiency of our country's livestock sector and activities. In this context, modern technological animal husbandry methods will contribute to the agriculture and animal husbandry sector by supporting agricultural activities that include smart agricultural application systems that minimize the need for labor force, especially in cases of epidemics and natural disasters, and the creation of interactive networks that enable producers to deliver their products to consumers by expanding this system. In addition, the development of new generation agricultural techniques such as precision agriculture and digital livestock practices involving satellite technology, drones, robotic systems and sensors will prevent crises that may occur in the agriculture and livestock sector during the pandemic.

## Conflicts

There is no conflict of interest between researchers.

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