

# The Gap and Food Security of Poultry Meat in the Kingdom of Saudi Arabia

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## ABSTRACT

Within the framework of the National Transformation Program and the economic diversification policy for the agricultural sector, the Kingdom of Saudi Arabia aimed to increase the self-sufficiency rate in poultry meat to 60% by 2020. This goal was set to bridge the gap between local production and the rising consumption of animal products. The current research focused on assessing the food gap and food security status of poultry meat in the Kingdom between 2008 and 2022. The study utilized qualitative and quantitative analysis methods for its economic analysis. The findings revealed a significant annual increase in the self-sufficiency rate of poultry meat in the Kingdom, averaging around 1.50%. This represented approximately 3.18% of the annual average self-sufficiency rate during the study period. The results aligned with economic principles by emphasizing the importance of boosting domestic production by 6.0% annually to outpace consumption growth, which stood at 2.65%. Import volumes remained stable, hovering around 724.4 thousand tons throughout the research period. The apparent gap also saw a yearly increase of about 3.7 thousand tons, equivalent to 0.56% of the annual average gap of 689.6 thousand tons. Despite indicating a surplus in the objective gap, this surplus could be attributed to the higher average Saudi per capita consumption of poultry meat at 43 kg/capita/year compared to the global average of 17.3 kg. The relatively stable instability coefficients for the food gap from poultry meat suggested a consistency in its contributing variables. Consequently, the Kingdom maintained a high level of food security for poultry meat, as evidenced by an average food security factor of 0.07 from 2008 to 2022. This underscored the relative food security of poultry meat in Saudi Arabia. The study identified local production volume and average per capita consumption as the most influential factors, explaining approximately 96% of the variations in poultry meat self-sufficiency rates. The study suggests the necessity of optimizing local poultry meat consumption and enhancing investments to further develop the poultry sector, aiming to attain self-reliance and food security in alignment with the National Transformation Program and the Kingdom's Vision 2030. The objective is to boost local poultry meat production by 535 thousand tons compared to the 2022 level of 1,130 thousand tons. The Agricultural Development Fund provided additional loans totaling around 250 million riyals to poultry production projects during the initiation of new ventures and expansion of current ones, resulting in a rise of approximately 500 million riyals in supplementary investments to realize

complete self-sufficiency in poultry meat within the Kingdom.

**Keywords:** Food gap & security, Poultry meat, Consumption, Self-sufficiency, Strategic stock.

## INTRODUCTION

The Saudi agricultural sector faces many challenges, including limited arable land resources, limited availability of water, and unsuitable climatic conditions. The volume of local production of poultry meat in the Kingdom, amounted to about 39.5 thousand tons, representing about 6.0% of the average volume of local production of poultry meat during the study period (2008-2022). This has led to a gap between the needs of individuals and what is produced locally from the most food commodities, because of the increasing demand from the food commodities in rates higher than the production rates from those commodities, which is attributed to the factors of population increase and high-income levels for the participants of society (Elsebaei and Mansour, 2016). The Kingdom has been interested in enhancing food security by overcoming the major challenges that must be addressed and finding appropriate solutions to achieve sustainable development and contribute to achieving sustainable food security, as the prevalence coefficient of acute food insecurity among the total population in the Kingdom was estimated at zero percentage (FAO, 2021) compared to other countries of the world. Recently, the Kingdom has paid attention to productive families and farmers, and national strategies have focused on giving great importance to agricultural development, food security, water security, and environmental balances. The quantity of Saudi imports from Poultry meat increased from approximately 588.9 thousand tons in 2008 to reach a maximum of 967.6 thousand tons in 2015 and then decreased until it reached 562.7 thousand tons in 2022.

Poultry meat is one of the necessary food sources for human life from which proteins and other nutrients are derived, in addition to being considered one of the basic elements in the Saudi diet. The Kingdom is considered one of the most important countries that import broiler chickens from abroad, due to the inability of local production of broiler chickens to Cover consumption or local demand from it, which requires importing broiler

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chickens from abroad, this is a strain on the balance of payments, despite the governmental support directed to poultry production and the development that has occurred in the agricultural sector over the past years (Saied *et al.*, 2022).

The poultry industry is considered one of the most important productive activities that contribute to the provision of animal protein. It is characterized by several characteristics, the most important of which is the short production cycle and then the rapid turnover of capital. It does not require a large agricultural area. It is also characterized by not requiring large quantities of water, in addition to the relative height of nutritional conversion efficiency compared to various other animal sources (Al-Duwais and Ghanem, 2019). Within the framework of the National Transformation Program and the economic diversification policy of the agricultural sector, the Kingdom of Saudi Arabia aimed at raising the self-sufficiency rate from poultry meat, to close the gap between the local production and the increasing consumption of animal products (Al-Duwais and Ghanem, 2019). The Kingdom's government is striving to provide a strategic stock of poultry meat, which will lead to its continued flow to the markets, thus stabilizing its prices in those markets and reducing production fluctuations, and sufficient to meet local consumption needs for a period of at least six months to confront the emergent economic circumstances, especially in crises that countries are exposed to, such as the Covid-19 pandemic. It has negative effects on the transmission movement of food commodities among different countries (Saied *et al.*, 2022).

#### **Research problem:**

The research problem is represented in the Kingdom's increasing needs from poultry meat compared to local production, which has led to a food gap, and these needs increase from year to year as a result of population growth and the high level of income for individuals of society, and then the reliance on imports and the external market has increased to fill the food gap, including Which negatively affects the agricultural trade balance and food security in the Kingdom (Elsebaei *et al.*, 2020). Therefore, estimating the size of this gap is considered important to help decision-makers take the necessary policies to achieve high the Kingdom's self-sufficiency and food security and to develop the necessary agricultural policies to raise the local poultry production , an increase in poultry production quantity in the Kingdom from 460 thousand tons in 2008 to 1130.1 thousand tons in 2022, with an average of 659.2 thousand tons during the study period (2008-2022), the quantity of Saudi imports from Poultry meat increased from approximately 588.9 thousand tons in 2008 to reach a maximum of 967.6 thousand tons in

2015 and then decreased until it reached 562.7 thousand tons in 2022, increase in local consumption of poultry meat, reaching about 932.7 thousand tons in 2008, increasing to about 1664.5 thousand tons in 2022. This is due to the increase in the population at a rate of 0.75 million people annually, improved income levels, as well as the increasing numbers of pilgrims and Umrah performers from year to year.

#### **Research objectives:**

The research generally aims at estimating the size of the food gap in poultry meat in the Kingdom of Saudi Arabia during the period (2008-2022) and estimating its food security coefficient. This research aim can be met by completing each of these sub-research goals:

1. Studying the development and growth rates of local production, imports, exports, consumption, average of per capita share, and self-sufficiency rates the size of the apparent and objective food gap and dependence on imports from poultry meat in the Kingdom during the period (2008-2022).
2. Analyzing the technical efficiency of self-sufficiency from poultry meat in the Kingdom of Saudi Arabia.
3. Calculating the indicators of instability and dependence on imports for the food gap variables and Estimating the volume of loans and investments needed to achieve different levels of self-sufficiency in poultry meat in the Kingdom of Saudi Arabia.

#### **Data sources:**

The study primarily utilizes secondary data from various reputable sources, such as the Food and Agriculture Organization of the United Nations (FAO), the Ministry of Environment, Water, and Agriculture's annual statistical book, Export and Import Statistics publications from the General Authority for Statistics, as well as publications from the Ministry of Economy and Planning. Additionally, data from the Arab Organization for Agricultural Development (AOAD) (2022), the League of Arab States, an International Information Network, and other relevant studies and research are also incorporated to achieve the research objectives.

#### **Research methodology:**

The research relies, in achieving its objectives, on econometric analysis to analyze and study the economic variables of the food gap for broiler chickens, where averages, percentages, growth rates, instability coefficients, simple and multiple regressions are used in both linear and non-linear forms (Johnston, 1972 and Greene, 2003). To estimate the significant relationships and standard estimation of the factors affecting the rate of self-sufficiency in poultry meat, the research also relies specifically on the use of the following equations and models:

Food gap: = domestic production - actual consumption.

As for the objective food gap, it was calculated on the basis of the (average limit) annual level of global consumption per capita (Elsebaei, 2017).

Expected Self-Sufficiency Ratio = (Domestic production/available for consumption) x100

Actual Self-Sufficiency Ratio = (Domestic Production - Exports / Available for Consumption) x 100 and expresses the actual share of domestic production in domestic consumption.

Technical Efficiency= Actual self-sufficiency/ Expected self-sufficiency (Al-Dhai and Musharraf, 2014).

Food Security Coefficient: It can be estimated by using the following economic equations:

- Daily domestic consumption = total annual consumption/365 days.
- Era of enough domestic output for consumption = annual domestic production/daily domestic consumption.
- Import coverage period for consumption = annual amount of imports/daily domestic consumption.
- Sum of the two periods = Era of enough domestic output for consumption + Period for imports to cover consumption.
- Size of the strategic stock = Amount of surplus in domestic consumption - the amount of deficit in domestic consumption. Or it is the sum of the surplus and deficit in domestic consumption/average annual domestic consumption (Ghanem, 1996).

Food security Coefficient = Size of the strategic stock / average of the annual domestic consumption. It can also be estimated by the ratio of change in the strategic stock to the annual domestic consumption, and its value ranges between zero and the correct one, as it closes to zero, this refers to low food security coefficient and vice versa (Ghana and Qamra, 2010).

Instability Coefficient for the study variables: Instability Coefficient. This indicator measures the annual fluctuation in a variable for a particular commodity, and the instability coefficient is calculated according to the following equation:

Where;

Sti: is the coefficient of instability of a given commodity variable per year (i)

Yi: are the actual values of the variable for the commodity in year (i)

Ŷi: are the estimated values of the variable for the good in year (i)

As the value of the instability coefficient closes to (100), the more this indicates the occurrence of large fluctuations in this variable for the commodity, which is reflected in a decrease in its food security factor, and vice versa.

The equations used to estimate the volume of loans and investments required to attain self-sufficiency in poultry meat are outlined as follows:

The total additional investments necessary for achieving self-sufficiency = the average proportion of a ton of poultry meat from loans allocated to poultry projects x the magnitude of the increment in local production essential for reaching self-sufficiency (Al-Duwais and Ghanem, 2019).

To achieve the objectives of the study, the data underwent statistical analysis using SPSS ver.16 and Minitab ver.14.

## RESULTS AND DISCUSSION

### First: The current situation of self-sufficiency from poultry meat in the Kingdom:

#### 1. Development of the local production quantity of poultry meat:

The government of the Kingdom of Saudi Arabia pays special attention to the livestock sector by working to facilitate and overcome all obstacles that hinder its development and is keen to deal positively with continuous support and encouragement in this vital and important sector that works to provide food security. The poultry sector in the Kingdom is considered one of the largest and fastest growing sectors due to the large consumption of animal foods, especially poultry meat. Table (1) shows an increase in poultry production quantity in the Kingdom from 460 thousand tons in 2008 to 1130.1 thousand tons in 2022, with an average of 659.2 thousand tons during that period.

Table (2) shows the volume of local production of poultry meat in the Kingdom increased at a statistically significant annual rate at a significance level of 0.01, amounted to about 39.5 thousand tons, representing about 6.0% of the average volume of local production of poultry meat during the study period (2008-2022). This is attributed to the increase in support directed by the Ministry of Environment, Water, and Agriculture for this industry, as well as the increased volume of loans directed by the Agricultural Development Fund, which will increase the scale of poultry wealth initiatives in the Kingdom, and the general trend in the Kingdom to develop and increase this wealth based on the use of technical development and progress in the field of scientific research to reach the best development methods for developing poultry wealth.

**Table 1. The evolution of chicken meat production, imports, exports, consumption, and the predicted self-sufficiency rate in the Kingdom of Saudi Arabia from (2008-2022)**

Year	Local production	Domestic consumption (Available for consumption)	Foreign trade		Population (million people)	Per capita kg/year
			Exports	imports		
2008	460.0	932.7	21	493.7	25.8	36.2
2009	494.0	1056.6	21	584.6	26.7	39.6
2010	575.7	1239.2	24.8	688.4	27.6	45.0
2011	469.7	1231.2	27.1	788.7	28.4	43.4
2012	519.7	1301.8	22.1	804.2	29.2	44.6
2013	569.7	1415.1	34.3	879.8	30.0	47.2
2014	525.6	1321.1	34.8	830.2	30.8	42.9
2015	550.6	1470.3	47.9	967.6	31.5	46.6
2016	600.6	1497.9	48.4	945.7	32.2	46.4
2017	650.6	1349.1	50.3	748.8	32.9	40.9
2018	710.6	1320.0	37.1	646.5	33.6	39.3
2019	800.5	1416.2	39.6	655.3	34.3	41.3
2020	900.3	1498.8	36.8	635.4	34.9	42.9
2021	930.2	1517.8	47.0	634.6	35.8	42.4
2022	1130.1	1664.5	28.2	562.7	36.6	45.5
Average	659.2	1348.8	34.8	724.4	-	43.0

Source: 1. General Authority for Statistics, Export, and Import Statistics (2008–2022).

2. Food and Agriculture Organization of the United Nations (FAO STAT).

3. Ministry of Environment, Water, and Agriculture, Annual Statistical Book, various issues.

## 2. Development of the imports quantity of poultry meat:

The Kingdom is still importing broiler chickens to cover the deficit in local production in the local market. Despite the increase in local production of poultry meat in the recent period, more is needed to meet the increasing local demand. By reviewing the data in Table (1), it is clear that the quantity of Saudi imports from Poultry meat increased from approximately 588.9 thousand tons in 2008 to reach a maximum of 967.6 thousand tons in 2015 and then decreased until it reached 562.7 thousand tons in 2022. Table (2) shows that the amount of poultry meat imports in the Kingdom took a decreasing trend at an annual rate that is not statistically significant, which makes It indicates that the Kingdom's imports of poultry meat stabilized around its arithmetic average of about 724.4 thousand tons during the aforementioned study period, which is attributed to the increasing rates of local production of broiler chickens compared to the rates of increasing demand for it.

## 3. Development of the export's quantity of poultry meat:

By displaying the data in Table (1), it is clear that the quantity of Saudi exports from poultry meat increased from about 2.1 thousand tons in 2008 to reach a maximum of about 50.3 thousand tons in 2017, then

decreased to about 28.2 thousand tons in 2022. These exports are attributed to re-exports that take place in some cases. Table (2) shows that the quantity of poultry meat exports in the Kingdom took an increasing trend at a statistically significant annual rate at the level of 0.01, amounting to about 1.43 thousand tons, representing about 4.11% of the annual average of Saudi exports quantity from poultry meat which estimated at about 34.8 thousand tons during the study period.

## 4. Development of local consumption of poultry meat:

Data of Table (1) indicate to an increase in local consumption of poultry meat, reaching about 932.7 thousand tons in 2008, increasing to about 1664.5 thousand tons in 2022. The results of the time trend in Table (2) depicts the Kingdom's usage of poultry meat has taken a general increasing trend at A statistically significant the level of 0.01 amounted to about 35.65 thousand tons, representing about 2.65% of the average of actual consumption from poultry meat during the study period (2008-2022), amounting to about 1,346.8 thousand tons. This is due to the increase in the population at a rate of 0.75 million people annually, improved income levels, as well as the increasing numbers of pilgrims and Umrah performers from year to year.

**Table 2. Results of statistical estimation of the time trend in the development of production, consumption, and average per capita share, imports, and exports of poultry meat in the Kingdom during the period 2008-2022. (Quantity: in thousand tons, per capita: kg per capita/year)**

The Dependent variable	The estimated model is in linear form	T <sub>(b)</sub>	F	Annual growth % rate*	R <sup>2</sup>	R
Local production	$Y_t = 343.1 + 39.5 X_t$	7.2**	52.00**	6.00	0.78	0.88
quantity of imports	$Y_t = 742.6 - 2.27 X_t$	0.26 <sup>n.s</sup>	0.07 <sup>n.s</sup>	0.31	0.005	0.072
quantity of exports	$Y_t = 23.3 + 10.43 X_t$	2.84**	8.10**	4.11	0.34	0.60
Domestic consumption	$Y_t = 1061.6 + 35.65 X_t$	6.38**	4075**	2.65	0.74	0.86
Per capita population	$Y_t = 41.9 + 0.13 X_t$	0.73 <sup>n.s</sup>	0.53 <sup>n.s</sup>	0.3	0.03	0.19
	$Y_t = 25.31 + 0.75 X_t$	83.0**	6893.0**	2.39	0.99	0.99

Where: (\*\*) indicates the significance of the regression coefficient or the significance of the model as a whole at the 0.01 level,

(\*) indicates the significance of the regression coefficient or the significance of the model as a whole at the 0.05 level.

n.s not significant      t: Estimated significance level      f: Significance level of the model.

Source: Data that is in Table (1).

\*Annual growth rate (%) = The amount of annual change / Average \*100.

### 5. Development of the average per capita share from poultry meat:

Data of Table (1) indicate that the average per capita share from poultry meat has increased from about 36.2 kg in 2008 to about 45.5 kg in 2022. Table (2) shows that the average per capita share of poultry meat in the Kingdom has taken a general increasing trend at an annual rate that is not statistically significant. At any of the levels of statistical significance which indicates that the average per capita share of poultry meat stabilized around its arithmetic mean of about 43.0 kilograms during the study period. It is indicated that this average is close to three times of the global average per capita share, which is estimated at about 17.3 kilograms as an average for the period (2020-2022).

### 6. Development of the expected self-sufficiency rate from poultry meat in the Kingdom:

Table (3) indicates to an increase in the percentage of expected self-sufficiency in poultry meat from about 49.3% in 2008 to about 67.9% in 2022, meaning an increase by 22.6%, which indicates an increase in the percentage of self-sufficiency in poultry meat in the Kingdom during the study period, which reflects the extent to which there is an increase in local production despite the increase in the average Saudi per capita during the study period to three times the global average per capita. This may be attributed to the increase in the numbers of pilgrims and Umrah performers and the impact of their consumption of poultry meat during their stay in the Kingdom on the increase in the average per capita share.

Table (4) illustrates that the self-sufficiency rate of poultry meat in the Kingdom exhibited a rising trend at a statistically significant annual rate with a significance level of 0.01, reaching approximately 1.50%. This

accounts for around 3.15% of the annual average self-sufficiency rate throughout the study period, which was estimated to be about 47.6%. This trend aligns with economic principles by indicating an increase in the volume of Saudi poultry meat production by 6.0% annually, surpassing the growth rate of local consumption, which was estimated at 2.65% during the study period.

### 7. Development of the actual self-sufficiency rate of poultry meat in the Kingdom:

Table (3) indicates to an increase in the percentage of actual self-sufficiency in poultry meat from about 47.1% in 2008 to about 66.2% in 2022, meaning an increase by 19.1%, which indicates an increase in the percentage of self-sufficiency in poultry meat between the two periods in the Kingdom which reflects the extent to which there is an increase in local production. This is corroborated by the findings of the temporal analysis, evident in Table (4), where the self-sufficiency percentage of poultry meat in the Kingdom exhibits a rising trajectory with a statistically notable yearly growth rate at a significance threshold of 0.01, approximately reaching 1.50%. This accounts for around 3.15% of the yearly mean of the self-sufficiency rate throughout the research duration, estimated to be 44.9%.

### 8. Analysis of technical efficiency for self-sufficiency from poultry meat:

Table (3) indicates to an increase in the technical efficiency for self-sufficiency from poultry meat from about 95.4% in 2008 to about 97.5% in 2022, meaning an increase of 2.1%, which indicates the stability of the technical efficiency for self-sufficiency from poultry meat between the two periods,

**Table 3. Progression of the anticipated and achieved self-sufficiency rate, the technical efficiency of poultry meat self-sufficiency within the Kingdom of Saudi Arabia from 2008 - 2022**

Year	Actual self-sufficiency %	Expected self-sufficiency %	Technical efficiency of self-sufficiency %
2008	47.1	49.3	95.4
2009	44.7	46.8	95.5
2010	44.5	46.5	95.7
2011	35.9	38.1	94.2
2012	38.2	39.9	95.7
2013	37.8	40.3	94.0
2014	37.2	39.8	93.4
2015	34.2	37.5	91.3
2016	36.9	40.1	91.9
2017	44.5	48.2	92.3
2018	51.0	53.8	94.8
2019	53.7	56.5	95.1
2020	57.6	60.1	95.9
2021	58.2	61.3	94.9
2022	66.2	67.9	97.5
Average	44.9	47.6	94.5

Source: Data that is in Table (1).

%Expected self-sufficiency = Production / Apparent consumption.

%Actual self-sufficiency = Production /Consumption \*100.

**Table 4. Outcomes of statistical analysis regarding the temporal evolution of the anticipated and realized self-sufficiency ratio, as well as the technical efficiency of poultry meat self-sufficiency in the Kingdom of Saudi Arabia spanning from 2008 - 2022**

Dependent variable	The estimated model in the linear form	T <sub>(b)</sub>	R <sup>2</sup>	R	F	Annual growth rate*% <sup>o</sup>
Expected self-sufficiency	Y <sub>t</sub> = 36.4 + 1.50 X <sub>t</sub>	3.50 <sup>**</sup>	0.44	0.66	12.02 <sup>**</sup>	3.15
Actual self-sufficiency	Y <sub>t</sub> = 34.3 + 1.44 X <sub>t</sub>	3.21 <sup>**</sup>	0.40	0.63	10.33 <sup>**</sup>	3.21
Technical efficiency of self-ufficiency	Y <sub>t</sub> = 94.3 + 0.03 X <sub>t</sub>	0.26 <sup>n.s</sup>	0.01	0.1	0.07 <sup>n.s</sup>	0.03

Where: (\*\*) indicates the significance of the regression coefficient or the significance of the model as a whole at the 0.01 level, (-) indicates that the regression coefficient or the model as a whole is not significant at any of the usual levels of significance. n.s not significant

t: Estimated significance level f: Significance level of the model

Source: Data that is in Table (3).

\*Annual growth rate (%) = The amount of annual change / Average \*100.

and this was confirmed by the results of the time trend, as it is clear from Table (4) that the technical efficiency for self-sufficiency from poultry meat in the Kingdom took an increasing trend at an annual rate that is not statistically significant at any of the levels of statistical significance, which means its stability at the annual average of the technical efficiency for self-sufficiency during the study period, estimated at about 94.5 %.

## Second: Analysis of the food gap from poultry meat in the Kingdom:

### 1. Food gap from poultry meat:

Food gap is calculated as the disparity among local production and consumption, and it is possible to distinguish between two types of food gap, the first: the apparent food gap, which means the difference between actual production and consumption, and the second: the objective food gap, which means the difference between production and appropriate or objective needs, and the research depends on its estimation. The objective food gap in calculating consumption is based

on the average global per capita consumption, which is estimated at approximately 17.3 kg/capita/year on average during the period (2020-2022).

By reviewing the data in Table (5), the apparent food gap in poultry meat has increased from about 472.7 thousand tons in 2008 to about 534.4 thousand tons in 2022. Table (6) shows that the apparent food gap in poultry meat in the Kingdom has taken an increasing trend at a non-significant annual rate. Statistically at any of the usual levels of statistical significance, which indicates that the size of the apparent food gap from poultry meat is stable and fluctuates around its arithmetic average of about 689.6 thousand tons during the study period. While

calculating the size of the objective nutritional gap from poultry meat shows the presence of a surplus for all years of the study except for the years 2011 and 2014, and this surplus is increasing from about 13.9 thousand tons in 2008 to about 497.7 thousand tons in 2022, and this is confirmed by the results of the time trend as shown by the results Table (6) shows that the objective gap, which represents a surplus of poultry meat in the Kingdom, has taken a general increasing trend at a statistically significant annual rate at the level of 0.01, amounting to about 26.5 thousand tons, totaling about 22.64% of the average volume of the annual surplus of poultry meat throughout the research era (2008 -2022) amounting to about 116.9 thousand tons.

**Table 5. Development of production, consumption, and food gap of poultry meat in the Kingdom of Saudi Arabia during the period (2008-2022) (Quantity: in thousand tons)**

Years	Local production	Local consumption	Apparent food gap (1)	Annual needs (2)	Objective food gap (3)	Dependence % on imports
2008	460.0	932.7	(472.7)	446.1	13.9	52.9
2009	494.0	1056.6	(562.6)	461.2	32.8	55.3
2010	575.7	1239.2	(663.5)	476.8	98.8	55.5
2011	469.7	1231.2	(761.6)	490.9	(21.2)	64.1
2012	519.7	1301.8	(782.1)	505.1	14.6	61.8
2013	569.7	1415.1	(845.5)	518.9	50.8	62.2
2014	525.6	1321.1	(795.5)	532.3	(6.7)	62.8
2015	550.6	1470.3	(919.6)	545.3	5.3	65.8
2016	600.6	1497.9	(897.3)	557.9	42.7	63.1
2017	650.6	1349.1	(698.4)	570.0	80.6	55.5
2018	710.6	1320.0	(609.4)	581.7	128.9	49.0
2019	800.5	1416.2	(615.7)	593.0	207.5	46.3
2020	900.3	1498.8	(598.5)	603.8	296.6	42.4
2021	930.2	1517.8	(587.6)	619.6	310.6	41.8
2022	1130.1	1664.5	(534.4)	632.4	497.7	33.8
Average	659.2	1348.8	(689.6)	542.3	116.9	53.3

Where: (1) Domestic production- Domestic consumption,

(2) Population multiplied by (17.3 kg/capita per year) average per capita at the world level as an annual average for the period (2020-2022),

(3) Local production - Annual needs, Numbers in parentheses indicate negative values.

Source: Data that is in Table (1).

**Table 6. Results of statistical estimation of the time trend for the development of the apparent and objective food gap and dependence on imports of poultry meat in the Kingdom during the period 2008-2022**

Dependent variable	The estimated model in the linear form	T <sub>(b)</sub>	R <sup>2</sup>	R	F	Annual growth % rate*
Apparent gap	$Y_t = -719.3 + 3.70 X_t$	0.44 <sup>n.s</sup>	0.01	0.1	0.19 <sup>n.s</sup>	0.56
Objective gap	$Y_t = -94.8 + 26.46 X_t$	4.74 <sup>**</sup>	0.60	0.77	22.44 <sup>**</sup>	22.64
Dependence on imports	$Y_t = 65.7 - 1.43 X_t$	3.04 <sup>**</sup>	0.37	0.61	9.20 <sup>**</sup>	2.68

Where: (\*\*\*) indicates the significance of the regression coefficient or the significance of the model as a whole at the level of 0.01, (-) indicates that the regression coefficient or the model is not significant at any of the usual levels of statistical significance. n.s not significant

t: Estimated significance level f: Significance level of the model

Source: Data that is in Table (5).

\*Annual growth rate (%) = The amount of annual change / Average \*100.

## 2. Dependence on imports of poultry meat:

The data in Table (5) indicates to a decrease in the percentage of dependence on imports of poultry meat from about 52.9% in 2008 to reach about 33.8% in 2022, meaning a decrease by 19.1%.

## 3. Instability coefficients for food gap variables of poultry meat:

The values of the instability coefficients for the quantity of local production of poultry meat, demonstrated in Table (7), show their relative stability during the years of the study, as the coefficient ranged between two lower limits of about 0.8 in 2014 and a higher of about 22.4 in 2018, with an annual average of 5.51, and The same position for poultry meat imports, which was found to be relatively stable during the years of the study, as the coefficient ranged between a maximum of approximately 33.3 in 2008 and a minimum of approximately 0.6 in 2011, with an annual average estimated at approximately 11.0, exports of poultry meat were also characterized by relative stability during the years of the study, as the coefficient ranged between A minimum of about 0.6 in 2012 and a maximum of about 89.2 in 2017, with an annual average of about 9.6. The self-sufficiency rate was also characterized by relative stability during the study period, as its instability coefficient ranged between a maximum of 27.6 in 2008 and a minimum of 1.4 in 2013. An annual average estimated at about 9.7 during the study period.

The instability coefficients values for the apparent nutritional gap amount of poultry meat presented in Table (7) demonstrate their consistent nature over the duration of the study. These coefficients varied from a peak of approximately 31.2 in 2008 to a low of about 2.8 in 2010 and 2011 AD, with an average of around 11.2 per year. Conversely, the status of the objective food gap in poultry meat revealed a certain level of instability throughout the study period. The coefficient ranged from a high of about 178.2 in 2009 to a low of around 6.6 in 2010, with an average of approximately 45.7 annually. Similarly, the self-sufficiency rate displayed relative stability over the study period. The instability coefficient for the self-sufficiency rate fluctuated between two extremes, reaching a maximum of 27.5 in 2008 and a minimum of 1.8 in 2018, with an average of about 9.7 during the mentioned study period. Overall, the variables contributing to the poultry meat food gap, such as local production, imports, and exports, remain stable, with the exception of the objective gap variable. This stability indicates a relative food security status for poultry meat in the Kingdom of Saudi Arabia.

## 4. Quantitative estimation for the factors affecting the self-sufficiency rate of poultry meat:

In order to analyze the factors impacting the self-sufficiency rate of poultry meat in the Kingdom, the correlation between the self-sufficiency rate of poultry meat ( $y_i$ ) as the dependent variable and various independent variables ( $X_i, s$ ) such as local production of poultry meat in thousand tons, local consumption of poultry meat in thousand tons, average per capita share from poultry meat (kg per capita/year),

**Table 7. Development of instability coefficients for production, imports, exports, food gap, and self-sufficiency of poultry meat in the Kingdom of Saudi Arabia during the period 2008-2022 (%)**

Years	Production	Imports	Exports	Apparent food gap	Objective food gap	self-sufficiency
2008	20.2	33.3	15.2	31.2	120.3	27.6
2009	17.0	20.8	16.0	11.6	178.2	16.5
2010	1.1	5.0	51.1	2.8	6.6	13.6
2011	2.1	0.6	6.6	2.8	11.4	10.1
2012	3.9	9.3	0.6	9.7	61.0	4.0
2013	1.8	20.7	7.6	21.6	20.6	1.4
2014	0.8	13.3	4.3	17.1	107.4	15.2
2015	2.0	9.5	2.3	9.8	95.5	22.7
2016	18.4	14.8	88.8	13.8	74.1	17.0
2017	12.1	14.9	89.2	12.4	50.1	2.6
2018	22.4	11.5	9.6	11.2	90.7	9.3
2019	10.4	8.4	2.3	8.4	46.6	14.3
2020	2.7	10.9	12.1	10.4	15.4	7.7
2021	5.0	17.1	8.4	18.0	24.5	6.6
2022	20.8	20.6	7.8	19.1	64.8	15.0
Average	5.51	11	9.6	11.2	45.7	9.7

Source: Data that is in Table (1 and 5).



and quantity of poultry meat imports in thousand tons was examined over the period of 2008-2022, utilizing both linear and double logarithmic forms. The statistical analysis results demonstrate the superiority of the linear model, evidenced by the calculated F value, the adjusted coefficient of determination ( $R^2$ ), the significance of regression coefficients in the  $T(\beta)$  model, and the absence of autocorrelation issues. Notably, it was revealed that the most impactful factor influencing the self-sufficiency rate of poultry meat is the local production volume, where a one thousand tons increase in local production leads to a 5.0% rise in self-sufficiency rate during the study period. Conversely, a one-kilogram increase in average per capita share results in a 1.24% decrease in the self-sufficiency rate, aligning with economic principles. The calculated F value further confirms the model's significance at the 0.01 level. With an adjusted coefficient of determination ( $R^2$ ) of approximately 0.96, it is evident that around 96% of the variations in the self-sufficiency rate of poultry meat in the Kingdom can be attributed to the local production quantity and average per capita share during the study period, as presented in Table (8).

### Third: The food security situation for poultry meat in the Kingdom of Saudi Arabia:

#### 1. Daily local consumption of poultry meat:

The data presented in Table (9) reveals that the daily local consumption of poultry meat fluctuates between approximately 2.56 thousand tons in 2008 and about 4.56 thousand tons in 2022 during the period of 2008-2022. Additionally, the analysis of the time trend in Table (10) demonstrates a statistically significant annual increase in the daily local consumption of poultry meat at a rate of 0.01, equivalent to around 0.10 thousand tons per day annually. This increase represents approximately 2.7% of the average daily local consumption of poultry meat, which amounts to about 3.70 thousand tons per day annually during the specified study period.

#### 2. The period of local poultry meat production sufficiency for consumption:

Detailed in Table (9), showing fluctuations between approximately 136.7 days (4.55 months) in 2015 and around 247.8 days (8.26 months) in 2022. The analysis in Table (10) demonstrates a significant annual increase in the period of local poultry meat production sufficiency from 2008 to 2022, with a growth rate of 0.01, equivalent to about 5.43 days per year, representing 3.1% of the average sufficiency period. The local production of poultry meat for consumption over the study period is approximately 176.7 days (5.89 months), signifying an enhancement in the food security status of poultry meat in the Kingdom.

#### 3. Import coverage period for local consumption of poultry meat:

Table (9) illustrates that the duration of import coverage for domestic poultry meat consumption varied between approximately 123.4 days (4.11 months) in 2022 and around 240.2 days (8 months) in 2015 over the period of 2008-2022. The findings from Table (10) demonstrate a significant annual reduction in the import coverage period for local poultry meat consumption from 2008 to 2022 at a rate of 0.01, equating to roughly 5.26 days per year, which is about 2.7% of the average import coverage period for local poultry meat consumption throughout the study period, totaling approximately 197.7 days (6.6 months). This indicates an enhancement in the food security status of poultry meat in the Kingdom throughout the study duration.

#### 4. Factors influencing food security for poultry meat in the Kingdom:

Based on the strategic stock concept, which considers the balance between surplus and deficit over the study period, it has been demonstrated that a strategic stock of poultry meat exists in the Kingdom, due to the presence of almost surplus over a large number of the study years, and thus the percentage of change in the strategic stock reached its highest value in 2015, reaching about 63 thousand tons,

**Table 8. Results of statistical estimation of the factors affecting the rate of self-sufficiency from poultry meat in the Kingdom in linear form during the period 2008-2022.**

Statement	$\alpha$	B <sub>1</sub> Quantity of local production	B <sub>2</sub> Per capita share from consumption	F	R <sup>2</sup>	R	D.W
Value of the Variable	71.2	0.05	-1.24	(160.1)**	0.96	0.98	1.28
Value of t	(9.7)**	(17.20)**	(7.20)**				

Where: (\*\*) indicates the significance of the regression coefficient or the significance of the model as a whole at the level of 0.01, DL = 0.70, Du = 1.25 at k = 2 degrees of freedom, the number of observations N = 15 and a significance level of 0.01.

Source: Data that is in Table (1) using the Minitab program.

**Table 9. An Analysis of Domestic Poultry Meat Consumption, Production Self-Sufficiency, Imports, and Surpluses/Deficits in Saudi Arabia 2008-2022**

(Quantity: in thousand tons)

Years	Daily local consumption in thousand tons	The period of production sufficient for consumption per day	The period of import coverage for consumption per day	The total of the two periods per day	Percentage of inventory change
2008	2.56	180.0	193.2	373.2	-3.00
2009	2.89	170.7	201.9	372.6	0.00
2010	3.40	169.6	202.8	372.3	0.00
2011	3.37	139.2	233.8	373.0	2.00
2012	3.57	145.7	225.5	371.2	6.00
2013	3.88	146.9	226.9	373.9	16.00
2014	3.62	145.2	229.4	374.6	49.00
2015	4.03	136.7	240.2	376.9	63.00
2016	4.10	146.4	230.4	376.8	0.00
2017	3.70	176.0	202.6	378.6	-21.00
2018	3.62	196.5	178.8	375.3	-21.00
2019	3.88	206.3	168.9	375.2	1.00
2020	4.11	219.3	154.7	374.0	0.00
2021	4.16	223.7	152.6	376.3	0.00
2022	4.56	247.8	123.4	371.2	1.00
Average	3.70	176.7	197.7	374.4	6.2
The resultant of percentage change in the strategic stock					93
Food security factor (sum of percentage change in stock/average annual local consumption)					0.07

Source: Data that is in Table (1).

**Table 10. The statistical estimation of the time trend in the development of daily local consumption, the period of production adequacy, the period of import coverage for local consumption per day, and the size of the stock of poultry meat in the Kingdom during the period 2008-2022**

Dependent variable	The estimated model in the linear form	T <sub>(b)</sub>	R <sup>-2</sup>	R	F
Daily local consumption in thousand tons	$Y_t = 2.91 + 0.10 X_t$	6.10**	0.72	0.85	37.11**
The period of production sufficient for consumption per day	$Y_t = 133.2 + 5.43 X_t$	3.47**	0.44	0.66	12.01**
The period of import coverage for consumption per day	$Y_t = 239.7 - 5.26 X_t$	3.21**	0.40	0.61	10.33**

Where: (\*\*) indicates the significance of the regression coefficient or the significance of the model at a significance level of 0.01.  
t: Estimated significance level    f: Significance level of the model

Source: Data that is in Table (9).

while the percentage of change in the strategic stock reached its lowest value in 2017 and 2018, reaching about (-21) thousand tons, while the total percentage of change in the strategic stock reached about 93.0 thousand tons. The food security factor's value was determined by comparing the sum of the percentage change in strategic stock to the average annual domestic consumption, which was approximately 1,348.8 thousand tons on average over the study period. Throughout the period from 2008 to 2022, the average food security coefficient was around 0.07, indicating a

relatively stable food security status for poultry meat in the Kingdom. Enhancing food security levels for poultry meat in the Kingdom can be accomplished through the implementation of various policies and operational initiatives by the relevant government agencies, the most important of which is the expansion of poultry production in light of the manufactured feed strategy, and the rationalization of local consumption of poultry meat in both urban and rural areas due to the increase in the average per capita share. of poultry compared to the global average.

#### Fourth: Estimating the volume of loans and investments necessary to achieve self-sufficiency in poultry meat in the Kingdom:

The data from Table (11) illustrates the progression of loan values approved by the Agricultural Development Fund for poultry ventures between 2020 and 2022. The fluctuations in loan values are evident, with the peak value recorded in 2021 at approximately 676 million riyals, and the lowest value noted in 2020 at around 242 million riyals. The average value over the period stood at 456.0 million riyals. Taking into account local production volume and loan amounts allocated to poultry projects, the average contribution of a ton of poultry meat from these loans during the period was approximately 465 riyals.

Based on the local production needed to meet domestic consumption demands and the average portion of a ton of poultry meat from loans provided to poultry ventures, totaling approximately 465 riyals between 2020 and 2022, an estimate has been made for the volume of loans and investments required to attain self-sufficiency in poultry meat. The figures in Table (12) suggest that, considering the local production necessary for various levels of self-sufficiency, the disparity between the required production and the 2022

equivalent is projected to grow to 1,130 thousand tons from 35.2 thousand tons when achieving a self-sufficiency rate of 70% to 534.5 thousand tons at 100% self-sufficiency. The escalation in the amount of local production needed to achieve self-sufficiency undoubtedly calls for additional loans for the poultry sector in the country, either through the establishment of new projects or the expansion of existing ones. Consequently, it is anticipated that the sum of additional loans will rise from 16.4 million riyals upon reaching a 70% self-sufficiency rate to 248.5 million riyals upon achieving full self-sufficiency.

In accordance with the lending regulations set forth by the Agricultural Development Fund, which entail the Fund covering 50% of the total investment expenses for the upcoming projects, there is a need for supplementary investments to attain self-sufficiency in poultry meat. These additional investments are projected to be twice the amount of the loans required to bridge the gap between the necessary production and its equivalent in 2022, with an anticipated rise thereafter. The scale of these supplementary investments varies from 32.8 million riyals at a self-sufficiency level of 70% to approximately 497.0 million riyals at a self-sufficiency level of 100%.

**Table 11. The average share of a poultry meat ton from the agricultural loans allocated to it during the period (2020-2022).**

Years	The quantity of poultry production in thousand tons	The value of loans granted to poultry projects is in million riyals	Average share of a ton of poultry meat from loans in riyals
2020	900	242	268.9
2021	930	676	726.9
2022	1130	450	398.2
Average	986.7	456.0	464.7

Source: Data was collected and calculated from the Agricultural Development Fund's annual report and various issues (2020-2022).

**Table 12: The volume of loans and additional investments necessary to achieve high rates of self-sufficiency in poultry meat in the Kingdom of Saudi Arabia**

(Value: in million riyals, quantity: in thousand tons)

Self-sufficiency rate % (1)	Required production (2)	local consumption (3)	The difference between the necessary production and the production in 2022 (4)	The quantity of additional loans needed (5)	The quantity of additional investments needed (6)
70	1165.2	1664.5	35.2	16.4	32.8
75	1248.4	1664.5	118.4	55.0	110.0
80	1331.6	1664.5	201.6	93.7	187.4
85	1414.8	1664.5	284.8	132.4	264.8
90	1498.1	1664.5	368.1	171.1	342.2
95	1581.3	1664.5	451.3	209.8	419.6
100	1664.5	1664.5	534.5	248.5	497.0

Where: (1) = (2)/ (3)\*100, (2) = (3)\*(1)/100, (4) = (2) - 1130, (5) = (4) \* 0.465, (6) = (5) \* 2

Source: Data that is in Table (1 and 11).

**Recommendations: Considering the findings of the research, the following can be recommended:**

- Enhancing the strategic reserves of poultry meat is essential to attain self-reliance and ensure food security, aligning with the National Transformation Program and the Kingdom's Vision 2030.
- Rationalizing local consumption of poultry meat in the Kingdom, as the average Saudi per capita consumption of it (43.0) exceeds its counterpart in the world (17.3), This initiative aims to enhance self-sufficiency levels and improve food security metrics.
- Increasing local production of poultry meat by 535,000 tons over its counterpart in 2022, which amounted to 1,130,000 tons, by implementing new projects and expanding existing ones. And resurrection.
- The Agricultural Development Fund granted additional loans to poultry production projects worth about 250 million riyals, meaning an increase in the quantity of additional investments by about 500 million riyals to achieve the goal of complete self-sufficiency in poultry meat in the Kingdom.

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## الملخص العربي

### الفجوة والأمن الغذائي من لحوم الدواجن في المملكة العربية السعودية

نواف بن ملحم فراج الحراجين، محمد سيد شحاتة، سلوى محمد أحمد عبد المنعم

١٧،٣ كجم. أشارت معاملات عدم الاستقرار النسبية لفجوة الغذاء من لحوم الدواجن إلى اتساق في المتغيرات المساهمة فيها. ونتيجة لذلك، حافظت المملكة على مستوى عالٍ من الأمن الغذائي لحوم الدواجن، كما يتضح من متوسط عامل الأمن الغذائي البالغ ٠،٠٧ خلال الفترة من ٢٠٠٨ إلى ٢٠٢٢. وهذا يؤكد على الأمن الغذائي النسبي لحوم الدواجن في المملكة العربية السعودية. حددت الدراسة حجم الإنتاج المحلي ومتوسط استهلاك الفرد كأكثر العوامل تأثيراً، حيث تفسر ما يقرب من ٩٦٪ من التغيرات في معدلات الاكتفاء الذاتي لحوم الدواجن. تقترح الدراسة ضرورة تحسين استهلاك لحوم الدواجن المحلية وتعزيز الاستثمارات لمزيد من تطوير قطاع الدواجن، بهدف تحقيق الاكتفاء الذاتي والأمن الغذائي بما يتماشى مع برنامج التحول الوطني ورؤية المملكة ٢٠٣٠. الهدف هو زيادة إنتاج لحوم الدواجن المحلية بمقدار ٥٣٥ ألف طن مقارنة بمستوى عام ٢٠٢٢ البالغ ١،١٣٠ ألف طن. قدم صندوق التنمية الزراعية قروضاً إضافية بقيمة إجمالية تبلغ حوالي ٢٥٠ مليون ريال لمشاريع إنتاج الدواجن خلال بدء مشاريع جديدة وتوسيع المشاريع الحالية، مما أدى إلى ارتفاع قدره ٥٠٠ مليون ريال تقريباً في الاستثمارات التكميلية لتحقيق الاكتفاء الذاتي الكامل في لحوم الدواجن داخل المملكة.

في ضمن إطار برنامج التحول الوطني وسياسة تنويع الاقتصاد في قطاع الزراعة، استهدفت المملكة العربية السعودية رفع معدل الاكتفاء الذاتي في لحوم الدواجن إلى ٦٠٪ بحلول عام ٢٠٢٠. وقد تم تحديد هذا الهدف لسد الفجوة بين الإنتاج المحلي والارتفاع في استهلاك المنتجات الحيوانية. ركز البحث الحالي على تقييم فجوة الغذاء وحالة الأمن الغذائي لحوم الدواجن في المملكة بين عامي ٢٠٠٨ و٢٠٢٢. استخدمت الدراسة أساليب تحليل نوعية وكمية لتحليلها الاقتصادي. كشفت النتائج عن زيادة سنوية كبيرة في معدل الاكتفاء الذاتي بلحوم الدواجن في المملكة، بمتوسط حوالي ١،٥٠٪. وهذا يمثل ما يقرب من ٣،١٨٪ من متوسط معدل الاكتفاء الذاتي السنوي خلال فترة الدراسة. تتوافق النتائج مع المبادئ الاقتصادية من خلال التأكيد على أهمية تعزيز الإنتاج المحلي بنسبة ٦٠٪ سنوياً لتجاوز نمو الاستهلاك الذي بلغ ٢،٦٥٪. استقرت كميات الاستيراد عند حوالي ٧٢٤،٤ ألف طن طوال فترة البحث. كما شهدت الفجوة الظاهرة زيادة سنوية قدرها حوالي ٣،٧ ألف طن، بما يعادل ٠،٥٦٪ من متوسط الفجوة السنوية البالغ ٦٨٩،٦ ألف طن. على الرغم من الإشارة إلى فائض في الفجوة الموضوعية، إلا أن هذا الفائض يمكن أن يعزى إلى ارتفاع متوسط استهلاك الفرد السعودي للفرد من لحوم الدواجن عند ٤٣ كجم/ للفرد/ في السنة مقارنة بالمتوسط العالمي البالغ