

An Economic Study of the Food Security of The Most Important Food Commodities in Egypt

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Abstract

This research aimed to estimate the most important indicators of food security for the most important food commodities in Egypt. The results of the research showed that the geometric mean of the self-sufficiency ratio for vegetal oils, broad beans, wheat, maize, meat, sugar, fish, milk, poultry, and rice during the period (2010-2020), respectively, were about 16.2%, 22.4%, 48%, 52.7%, 63.7%, 72.7%, 83.4%, 87.3%, 96.4%, 99.4%. The average of Production sufficiency period for consumption for each of them, respectively, were about 2.1, 3.0, 5.9, 6.5, 7.8, 8.9, 10.2, 10.6, 11.7, 12.2 months, while the Import coverage period for consumption for each of them, respectively, were about 11.1, 9.6, 6.6, 5.7, 4.3, 4.8, 2.2, 2.5, 0.54, 0.50 months. The total amount of surplus in consumption for each of them, respectively, were about 1187, 252, 5072, 109, 52, 3944, 268, 5551, 188, 2288 thousand tons, which is sufficient for consumption for a period, respectively, were about 10.7, 4.6, 3.3, 0.1, 0.59, 16.3, 1.6, 10.8, 1.4, 5.5 months. The total volume of strategic stocks for each of them, respectively, were about 71, -2, 1733, 5, -50, -637, -12, 33, 137, 102 thousand tons, which are sufficient for consumption for a period, respectively, were about 18.2, -1.1, 34.5, 0.1, -14.5, -77.9, -2.2, 1.9, 35.6, 7.4 days. The food security coefficient for each of them, respectively, were about 0.050, -0.0003, 0.097, 0.0003, -0.004, -0.213, -0.006, 0.005, 0.098, 0.028.

Keywords: *Self-sufficiency ratio, Production sufficiency period for consumption, Import coverage period for consumption, Surplus and deficit in domestic consumption, The volume of the strategic stock, Food security coefficient.*

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I. Introduction

The Food and Agriculture Organization (F.A.O) defines the food security that all members of the community get all their full needs of healthy food and good quality at any time in order to be able to lead a healthy life through the domestic production and importing the rest of its needs from abroad. Egypt suffers from the inability of its domestic production to cover its consumption needs of a large number of food commodities such as wheat, maize, legumes, vegetal oils, meat, sugar and others, especially in light of the limited agricultural land and the limited available water in it, in addition to the large population increase in Egypt, Therefore, Egypt completes its consumption needs of these commodities by importing them from abroad to achieve food security from them. In light of the global inflationary waves in the prices of various commodities in different countries of the world in the recent period, especially after the Russian-Ukrainian crisis, which is due to the increase in energy prices and transportation costs, and the existence of problems in the supply and supply chains. Therefore, Egypt's ability to achieve its food security for the most important food commodities has become one of the most important challenges facing it and affecting its economic, social and political stability.

Egypt has achieved self-sufficiency in some food commodities such as vegetables, fruits, potatoes, onions, garlic, and eggs, as the geometric mean of the self-sufficiency ratio for each of them during the period (2016-2020), respectively, reached about 107.4%, 117.1%, 113%, 120.8%, 100%. It also came close to achieving self-sufficiency in poultry, rice, milk, and fish, as the geometric mean of the self-sufficiency ratio for each of them during that period, respectively, were about 96.7%, 92.7%, 85.3%, 83.9%. While it was unable to achieve self-sufficiency in vegetal oils, legumes, wheat, maize, meat, and sugar, as the geometric mean of the self-sufficiency ratio for each of them during that period, respectively, were about 15.1%, 26.8%, 43.1%, 48.5%, 58%, 74.4%.

Research problem:

In light of the rapid global economic, social and political changes, it has become necessary to achieve food security from the necessary food for human life, especially from food commodities that Egypt cannot achieve self-sufficiency in them, this is in order to face any unfavorable economic, social or political conditions that may prevent or reduce Egypt's ability to import its needs of these commodities from abroad.

Research objective:

This research aims to estimate the most important indicators of food security for the most important food commodities in Egypt, which are represented in each of the most important cereal crops (wheat, maize, and rice), the most important sources of animal protein (meat, poultry, fish, and milk), broad beans, sugar, and vegetal oils.

Research method:

The research relied on both descriptive and quantitative methods of analysis, such as regression and correlation methods, and the most important indicators of food security, as follows:

- **Self-sufficiency ratio** = (Quantity of domestic production / Quantity of domestic consumption) x 100
- **The production sufficiency period for consumption** = Quantity of domestic production / Daily domestic consumption amount.
- **Import coverage period for consumption** = Quantity of imports / Daily domestic consumption amount.
- **The amount of surplus or deficit in domestic consumption** = (The sum of the periods of Production sufficiency and import coverage for consumption - 365) x Daily domestic consumption amount.
- **The period of surplus or deficit in domestic consumption** = amount of surplus or deficit in domestic consumption / Daily domestic consumption amount.
- **Volume of strategic stocks** = [(The sum of periods of production sufficiency and import coverage for consumption - 365) x Daily domestic consumption amount] - quantity of exports.
- **Food security coefficient** = The amount of annual change in the volume of the strategic stock / Annual domestic consumption amount.
= Total volume of strategic stocks / annual Average of domestic consumption amount.

Data sources:

The research relied on published and unpublished data issued by the Ministry of Agriculture and Land Reclamation, the Food and Agriculture Organization (F.A.O) and the Central Agency for Public Mobilization.

II. Research Results

First: Food security of the most important cereal crops in Egypt:

Wheat, maize, and rice crops are among the most important cereal crops in Egypt.

A- Food security of the wheat crop in Egypt:

Table No. (1) in the supplement indicates that the average for each of the amount of domestic production, the available amount for consumption, the amount of Egyptian imports, and the amount of Egyptian exports of wheat during the period (2010-2020), respectively, amounted to about 8.769, 18.330, 9.994, 0.275 million tons, and the annual average per capita share of wheat amounted to about 137.6 kg. The available quantity for consumption, the quantity of Egyptian imports, the quantity of Egyptian exports, and the annual average per capita share of wheat took a general increasing trend during the study period, with annual rates of increase representing, respectively, about 3.4%, 5.8%, 18.5%, 1.84% of the annual average for each of them during the study period, while it was found that the general time trend of the quantity of domestic production of wheat was not significant. Table No. (1) indicates the most important indicators of food security of the wheat crop in Egypt, as follows:

- **Self-sufficiency ratio of wheat:** The geometric mean of the wheat self-sufficiency ratio during the period (2010-2020) was estimated at about 48%. The wheat self-sufficiency ratio ranged from a maximum of about 56.2% in 2012, then it decreased to reach its minimum in 2019 at about 41.1%.
- **Production sufficiency period and import coverage period for consumption of wheat:** The average of Production sufficiency period for consumption of wheat during the period (2010-2020) was estimated at about 176.3 days (5.9 months), while the average of import coverage period for consumption was about 197.1 days (6.6 months). Table No. (2) indicates that the Production sufficiency period for consumption of wheat has taken a general decreasing trend during the period (2010-2020), with an annual decrease period amounted to about 4.5 days, which represents about 2.5% of its annual average during the study period, while the import coverage period for consumption of wheat has taken a general increasing trend, with an annual increase period estimated at 4.7 days, which represents about 2.4% of its average during the study period.
- **Surplus or deficit in domestic consumption of wheat:** The results indicate that a surplus was achieved in the domestic consumption of wheat in all years during the period (2010-2020), except for the year 2012, when there was a deficit in consumption amounting to about 313 thousand tons, the period of this deficit reached about 7.3 days, while the total amount of surplus in domestic consumption of wheat during the study period amounted to about 5.072 million tons, which is sufficient for consumption for a period of about 99.5 days (3.3 months). The annual average of surplus quantity in domestic consumption of the wheat crop during the study period was about 461.1 thousand tons, which is sufficient for consumption for a period of about 9 days.

- **Strategic stock volume of wheat:** The total volume of the strategic stocks of wheat which Egypt retains from the surplus in domestic consumption achieved during the study period in order to face emergency conditions after covering the deficit that occurred in 2012 and covering the Egyptian exports from it during the total period (2010-2020) estimated at about 1.733 million tons, which is sufficient for consumption for a period of about 34.5 days (1.2 months), and the annual average of strategic stocks volume during the study period was about 157.5 thousand tons, which is sufficient for consumption for a period of about 3.1 days.
- **Food security coefficient of wheat:** The food security coefficient of wheat during the total period (2010-2020) was estimated at about 0.097, which indicates that the total volume of the strategic stock of wheat in Egypt is sufficient to cover about 9.7% of the annual average of consumption needs during the study period. The annual average of the food security coefficient of wheat in Egypt during the study period was about 0.009, which is an indicator of the low of food security for this strategic crop, which requires making the necessary efforts to increase the volume of the strategic stock of it to cover about 50% at least of the consumption needs of it, this is done by increasing the production and productivity of this crop, working to rationalize its consumption and diversifying the import sources of wheat.

Table (1): Evolution of the most important indicators of food security of the wheat crop in Egypt during the period (2010-2020)

Years	Self-Sufficiency Ratio	Average daily domestic consumption in thousand tons	Production sufficiency period for consumption per day	Import coverage period for consumption per day	Surplus in domestic consumption		deficit in domestic consumption		The volume of the strategic stock in thousand tons	Food security coefficient
					Amount of surplus in thousand tons	Surplus period per day	Amount of deficit in thousand tons	deficiency period per day		
2010	47.9	41.036	174.7	193.4	129.0	3.1	-	-	0	0.000
2011	49.6	46.241	181.0	212.2	1304.0	28.2	-	-	1181	0.070
2012	56.2	42.896	205.0	152.7	-	-	313.0	7.3	-427	-0.027
2013	55.0	47.151	200.6	167.1	128.0	2.7	-	-	39	0.002
2014	54.5	46.644	199.0	174.2	381.0	8.2	-	-	266	0.016
2015	52.2	50.441	190.5	178.4	198.0	3.9	-	-	-63	-0.003
2016	48.1	53.178	175.7	203.5	755.0	14.2	-	-	570	0.029
2017	42.1	54.847	153.5	219.9	463.0	8.4	-	-	62	0.003
2018	42.4	54.011	154.6	229.4	1025.0	19.0	-	-	447	0.023
2019	41.1	57.115	149.9	218.7	205.0	3.6	-	-	-315	-0.015
2020	42.4	58.855	154.7	218.6	484.0	8.2	-	-	-27	-0.001
Total					5072	99.5	313	7.3	1733	0.097
Average	48.0	50.220	176.3	197.1	461.1	9.0	28.5	0.7	157.5	0.009

Source: Compiled and calculated from the Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **Food Balance Bulletin in the Arab Republic of Egypt**, various issues.

Table (2): Equations for the general time trend of the development of the most important indicators of food security of the wheat crop in Egypt during the period (2010-2020)

	Dependent Variable	The equation	The average	R ²	F	Amount of change	Annual rate of change %
1	Production sufficiency period for consumption per day	$\hat{Y}_i = 203.19 - 4.483 X_i$ (20.57)** (-3.078)**	176.3	0.513	9.474**	-4.483	-2.54
2	Import coverage period for consumption per day	$\hat{Y}_i = 168.90 + 4.700 X_i$ (12.25)** (2.312)*	197.1	0.373	5.347*	4.700	2.38

Whereas:

- \hat{Y}_i : indicates the estimated value of the dependent variable in year i.
- X_i : time variable i: 1, 2, 3, ,11.
- The values between () are the computed "t" values.
- * : indicates significance at 0.05 ** : indicates significance at 0.01.

Source: Calculated from Table No (1).

B- Food security of the maize crop in Egypt:

Table No. (1) in the supplement indicates that the average for each of the amount of domestic production, the available amount for consumption, the amount of Egyptian imports, and the amount of Egyptian exports of maize during the period (2010-2020), respectively, amounted to about 7.807, 14.912, 7.115, 0.010 million tons and the annual average per capita share was about 49.6 kg. The available quantity for consumption and the quantity of Egyptian imports took a general increasing trend during the study period, with annual rates of increase representing, respectively, about 3.43% and 6.14% of the annual average for each of them, while the annual average per capita share of maize took a general decreasing trend at an annual decreasing rate representing about 9.3% of its average during the study period, while it was found that the general time trend for

the quantity of domestic production and the quantity of Egyptian exports of maize were not significant. Table No. (3) indicates the most important indicators of food security of the maize crop in Egypt, as follows:

- **Self-sufficiency ratio of maize:** The geometric mean of the maize self-sufficiency ratio during the period (2010-2020) was estimated at about 52.7%. The maize self-sufficiency ratio ranged from a maximum of about 64.6% in 2014, then it decreased to reach its minimum in 2020 at about 44.8%.
- **Production sufficiency period and import coverage period for consumption of maize:** The average of Production sufficiency period for consumption of maize during the period (2010-2020) was estimated at about 193.6 days (6.5 months), while the average of import coverage period for consumption was about 171.7 days (5.7 months). Table No. (4) indicates that the Production sufficiency period for consumption of maize has taken a general decreasing trend during the period (2010-2020), with an annual decrease period amounted to about 4.6 days, which represents about 2.35% of its annual average during the study period, while the import coverage period for consumption of maize has taken a general increasing trend, with an annual increase period estimated at 4.5 days, which represents about 2.64% of its average during the study period.
- **Surplus or deficit in domestic consumption of maize:** The results indicate that a surplus was achieved in the domestic consumption of maize in all years during the period (2010-2020). The total amount of this surplus achieved during the total study period was about 109 thousand tons, which is sufficient for consumption for a period of about 2.9 days. The annual average of this surplus during the study period amounted to about 9.9 thousand tons, which is sufficient for consumption for a period of about 0.2 days.
- **Strategic stock volume of maize:** The total volume of the strategic stock of maize which Egypt retains from the surplus in domestic consumption achieved during the period (2010-2020) after covering the amount of Egyptian exports of it was estimated by about 5 thousand tons, which is sufficient for consumption for a period of about 0.1 days. The annual average of the volume of the strategic stock of it during the study period was about 455 tons.

Table (3): Evolution of the most important indicators of food security of the maize crop in Egypt during the period (2010-2020)

Years	Self-Sufficiency Ratio	Average daily domestic consumption in thousand tons	Production sufficiency period for consumption per day	Import coverage period for consumption per day	Surplus in domestic consumption		The volume of the strategic stock in thousand tons	Food security coefficient
					Amount of surplus in thousand tons	Surplus period per day		
2010	60.7	34.693	221.5	144.2	27.0	0.8	0	0.0000
2011	51.0	38.559	186.3	178.9	6.0	0.2	0	0.0000
2012	51.4	36.660	187.6	177.9	18.0	0.5	0	0.0000
2013	58.1	38.151	212.2	152.9	2.0	0.1	0	0.0000
2014	64.6	33.734	235.9	129.3	5.0	0.1	0	0.0000
2015	54.2	40.759	197.7	167.3	3.0	0.1	0	0.0000
2016	56.1	38.107	204.8	160.4	6.0	0.2	0	0.0000
2017	47.0	45.553	171.6	193.5	6.0	0.1	0	0.0000
2018	50.3	46.542	183.6	181.6	9.0	0.2	0	0.0000
2019	45.1	50.197	164.6	200.7	15.0	0.3	5	0.0003
2020	44.8	46.444	163.5	201.8	12.0	0.3	0	0.0000
Total					109.0	2.9	5.0	0.0003
Average	52.7	40.855	193.6	171.7	9.9	0.3	0.455	0.00003

Source: Compiled and calculated from the Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **Food Balance Bulletin in the Arab Republic of Egypt**, various issues.

Table (4): Equations for the general time trend of the development of the most important indicators of food security of the maize crop in Egypt during the period (2010-2020)

	Dependent Variable	The equation	The average	R ²	F	Amount of change	Annual rate of change %
1	Production sufficiency period for consumption per day	$Y_i = 220.91 - 4.555 X_i$ (18.14)** (-2.536)*	193.6	0.417	6.433*	-4.555	-2.35
2	Import coverage period for consumption per day	$Y_i = 144.49 + 4.533 X_i$ (11.84)** (2.519)*	171.6	0.414	6.346*	4.533	2.64

Whereas:

- Y_i : indicates the estimated value of the dependent variable in year i.
- X_i : time variable i: 1, 2, 3,11.
- The values between () are the computed "t" values.
- * : indicates significance at 0.05 ** : indicates significance at 0.01.

Source: Calculated from Table No (3).

- **Food security coefficient of maize:** The results indicate the lack of food security of the maize crop during the period (2010-2020), where the value of the food security coefficient for it during the total study period was about 0.0003, which indicates that the total volume of the strategic stock of maize is sufficient to cover about 0.03% only of the average of consumption needs during the study period. The annual average of its food security coefficient during the study period was about 0.00003, which requires working to increase the strategic stock of this crop in order to achieve the concept of food security.

C- Food security of the rice crop in Egypt:

Table No. (1) in the supplement indicates that the average for each of the amount of domestic production, the available amount for consumption, the amount of Egyptian imports, and the amount of Egyptian exports of rice during the period (2010-2020) amounted to about 5.058, 5.049, 0.189, 0.189 million tons, respectively, and the annual average per capita share estimated at 36.1 kg. It was found that the general time trend was not significant for each of the amount of domestic production, the available amount for consumption, and the amount of Egyptian imports of rice during the study period, while the amount of Egyptian exports and the annual average per capita share of rice took a general declining trend at an annual decreasing rate representing, respectively, about 28.7 %, 3.34% of the annual average for each of them during the study period. Table No. (5) indicates the most important indicators of food security of the rice crop in Egypt, as follows:

- **Self-sufficiency ratio of rice:** The geometric mean of the rice self-sufficiency ratio during the period (2010-2020) was estimated at about 99.4%, which means that Egypt achieves self-sufficiency in rice. The self-sufficiency ratio of rice ranged from a maximum of about 116.2% in 2010 (the base year), then it decreased to reach its minimum in 2019 at about 76.9%, because the amount of rice production reached its lowest level in this year.

Table (5): Evolution of the most important indicators of food security of the rice crop in Egypt during the period (2010-2020)

Years	Self-Sufficiency Ratio	Average daily domestic consumption in thousand tons	Production sufficiency period for consumption per day	Import coverage period for consumption per day	Surplus in domestic consumption		deficit in domestic consumption		The volume of the strategic stock in thousand tons	Food security coefficient
					Amount of surplus in thousand tons	Surplus period per day	Amount of deficit in thousand tons	Deficiency period per day		
2010	116.2	13.014	424.2	1.9	795	61.1	-	-	0	0
2011	98.3	12.074	358.6	11.3	60	5	-	-	0	0
2012	103.4	15.041	377.3	2.3	220	14.6	-	-	-5	-0.001
2013	109.3	14.811	399.1	1.6	529	35.7	-	-	0	0
2014	101.9	15.392	371.9	0.9	120	7.8	-	-	0	0
2015	103.9	14.414	379.3	3.2	252	17.5	-	-	0	0
2016	100.2	13.17	365.8	6	90	6.8	-	-	-10	-0.002
2017	90.9	15.997	331.9	26.6	-	-	-105.0	-6.6	-105	-0.018
2018	95.9	14.167	350.2	14.8	0	0	-	-	0	0
2019	76.9	11.137	280.5	87.6	35	3.1	-	-	35	0.009
2020	101.7	12.948	371	8.4	187	14.4	-	-	187	0.04
Total					2288.0	166.0	-105.0	-6.6	102.0	0.028
Average	99.4	13.833	364.5	15.0	208.0	15.1	-9.5	-0.6	9.273	0.003

Source: Compiled and calculated from the Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **Food Balance Bulletin in the Arab Republic of Egypt**, various issues.

Table (6): Equations for the general time trend of the development of the most important indicators of food security of the rice crop in Egypt during the period (2010-2020)

	Dependent Variable	The equation	The average	R ²	F	Amount of change	Annual rate of change %
1	Production sufficiency period for consumption per day	$\hat{Y}_i = 408.18 - 7.275 X_i$ (21.47)** (-2.595)*	364.5	0.428	6.734*	-7.275	-2.0
2	Amount of surplus in consumption in thousand tons	$\hat{Y}_i = 476.53 - 46.35 X_i$ (3.381)** (-2.230)*	198.5	0.356	4.973*	-46.35	-23.4

Whereas:

\hat{Y}_i : indicates the estimated value of the dependent variable in year i.
 X_i : time variable i: 1, 2, 3,11.
 The values between () are the computed "t" values.
 * : indicates significance at 0.05 ** : indicates significance at 0.01.

Source: Calculated from Table No (5).

- **Production sufficiency period and import coverage period for consumption of rice:** The average of Production sufficiency period for consumption of rice during the period (2010-2020) was estimated at about 364.5 days (12.2 months), while the average of import coverage period for consumption was about 15 days. Table No. (6) indicates that the Production sufficiency period for consumption of rice has taken a general decreasing trend during the period (2010-2020), with an annual decrease period amounted to about 7.3 days, which represents about 2% of its annual average during the study period.
- **Surplus or deficit in domestic consumption of rice:** The results indicate that a surplus was achieved in the domestic consumption of rice in all years during the period (2010-2020) except for the year 2017, in which there was a deficit in consumption amounting to about 105 thousand tons, the period of this deficit reached about 6.6 days, while the total amount of surplus in domestic consumption of the rice crop during the total study period amounted to about 2.288 million tons, which is sufficient for consumption for a period of about 166 days (5.5 months). The annual average of the amount of surplus in domestic consumption of the rice crop during the study period was about 208 thousand tons, which is sufficient for consumption for a period of about 15.1 days. Table No. (6) indicates that the amount of surplus in rice consumption took a general decreasing trend during the period (2010-2020) by an annual decrease amount of about 46.35 thousand tons, which represents about 23.4% of its average during the study period.
- **Strategic stock volume of rice:** The total volume of the strategic stock of rice that Egypt keeps to face emergency conditions after covering the deficit in consumption that occurred in 2017 and covering the amount of Egyptian exports from it during the study period was estimated at about 102 thousand tons, which is sufficient for consumption for a period of about 7.4 days. The annual average of the strategic stock volume of rice was about 9.3 thousand tons, which is sufficient for consumption for a period of about 0.7 days.
- **Food security coefficient of rice:** The food security coefficient of the rice crop in Egypt during the total period (2010-2020) was estimated at about 0.028, which means that the total volume of the strategic stock of rice in Egypt during the study period does not cover more than 2.8% of the annual average of consumption needs of rice during that period. The annual average of the food security coefficient of the rice crop in Egypt during the study period was about 0.003, which indicates the low of food security of this strategic crop, which requires making the necessary efforts to increase the volume of the strategic stock of rice.

Second: Food security for the most important sources of animal protein in Egypt

Meat, poultry, fish, and milk are among the most important sources of animal protein in Egypt.

A- Food security of meat in Egypt:

Table No. (1) in the supplement indicates that the average for each of the amount of domestic production, the available amount for consumption, the amount of Egyptian imports, and the amount of Egyptian exports of meat during the period (2010-2020) amounted to about 721, 1127, 402.5, 1 thousand tons, respectively, and the annual average per capita share estimated at about 9.4 kg. The amount of domestic production took a general declining trend during the study period, at a decreasing rate representing about 3.63% of its annual average during the study period, while the amount of Egyptian imports of meat took a general increasing trend, at an increasing rate representing about 6.04% of its average during the study period. The study showed that the general time trend was not significant for each of the available quantity for consumption, the quantity of Egyptian exports, and the annual average per capita share of meat during the study period. Table No. (7) indicates the most important food security indicators of meat in Egypt as follows:

- **Self-sufficiency ratio of meat:** The geometric mean of the meat self-sufficiency ratio during the period (2010-2020) was estimated at about 63.7%. The meat self-sufficiency ratio ranged from a maximum of about 76.2% in 2011, then it decreased to reach its minimum in 2018 at about 50.6%, because of the decrease in the amounts of its production during the study period.
- **Production sufficiency period and import coverage period for consumption of meat:** The average of Production sufficiency period for consumption of meat during the period (2010-2020) was estimated at about 234.6 days (7.8 months), while the average of import coverage period for consumption was about 129.4 days (4.3 months). Table No. (8) indicates that the Production sufficiency period for consumption of meat has taken a general decreasing trend during the period (2010-2020), with an annual decrease period amounted to about 8.8 days, which represents about 3.8% of its annual average during the study period, while the import coverage period for consumption of meat has taken a general increasing trend, with an annual increase period estimated at 8.5 days, which represents about 6.6% of its average during the study period.
- **Surplus or deficit in domestic consumption of meat:** The total surplus in meat consumption during the period (2010-2020) was estimated at about 52 thousand tons, which is sufficient for consumption for a period of about 17.6 days. The annual average of the surplus in meat consumption during the study period was about 4.7 thousand tons, which is sufficient for consumption for a period of about 1.6 days. This surplus occurred only in two years, 2012 and 2018, while the total deficit in meat consumption during the study period was about 91 thousand tons, the period of this deficit was about 28.7 days. The annual average of the amount of deficit in meat consumption during the study period was about 8.3 thousand tons, the period of this deficit was about 2.6 days.

- **Strategic stock volume of meat:** The results indicate that there were no strategic stocks of meat in Egypt during the total period (2010-2020), this is due to the increase in the total amount of deficit in meat consumption compared to the amount of surplus in meat consumption achieved during the study period. The total deficit in the strategic stock of meat during the total period (2010-2020) amounted to about 50 thousand tons, the period of this deficit was about 14.5 days. The annual average of deficit in the strategic stock of meat during the study period was about 4.5 thousand tons, the period of this annual deficit was about 1.3 days.
- **Food security coefficient of meat:** The food security coefficient of meat during the total period (2010-2020) was estimated at about (-0.04), and the annual average of the food security coefficient of it during the study period was about (-0.004), which is a negative value, less than zero, which is a serious indication of the lack of food security of meat, which requires working to provide a strategic stock of meat in order to achieve the concept of food security from it.

Table (7): Evolution of the most important indicators of food security of meat in Egypt during the period (2010-2020)

Years	Self-Sufficiency Ratio	Average daily domestic consumption in thousand tons	Production sufficiency period for consumption per day	Import coverage period for consumption per day	Surplus in domestic consumption		deficit in domestic consumption		The volume of the strategic stock in thousand tons	Food security coefficient
					Amount of surplus in thousand tons	Surplus period per day	Amount of deficit in thousand tons	deficiency period per day		
2010	75.2	2.882	274.4	90.6	0.0	0.0	0.0	0.0	0.0	0.000
2011	76.2	2.830	278.1	84.8	-	-	6.0	2.1	-6.0	-0.006
2012	74.9	2.882	273.4	107.2	45.0	15.6	-	-	45.0	0.043
2013	69.8	3.063	254.7	110.3	0.0	0.0	0.0	0.0	0.0	0.000
2014	62.9	3.351	229.5	115.8	-	-	66.0	19.7	-67.0	-0.055
2015	56.3	3.858	205.6	159.4	0.0	0.0	0.0	0.0	-3.0	-0.002
2016	67.8	3.197	247.4	116.7	-	-	3.0	0.9	-6.0	-0.005
2017	63.8	3.164	232.9	132.1	0.0	0.0	0.0	0.0	-1.0	-0.001
2018	50.6	3.460	184.7	182.4	7.0	2.0	-	-	6.0	0.005
2019	54.2	2.748	198.0	163.4	-	-	10.0	3.6	-11.0	-0.011
2020	55.4	2.532	202.3	160.4	-	-	6.0	2.4	-7.0	-0.008
Total					52.0	17.6	91.0	28.7	-50.0	-0.04
Average	63.7	3.088	234.6	129.4	4.7	1.6	8.3	2.6	-4.5	-0.004

Source: Compiled and calculated from the Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **Food Balance Bulletin in the Arab Republic of Egypt**, various issues.

Table (8): Equations for the general time trend of the development of the most important indicators of food security of meat in Egypt during the period (2010-2020)

	Dependent Variable	The equation	The average	R ²	F	Amount of change	Annual rate of change %
1	Production sufficiency period for consumption per day	$Y_i = 287.69 - 8.843 X_i$ (25.73)** (-5.363)**	234.6	0.762	28.77**	-8.843	-3.77
2	Import coverage period for consumption per day	$Y_i = 78.455 + 8.486 X_i$ (7.125)** (5.227)**	129.4	0.752	27.32**	8.486	6.56

Whereas:

Y_i : indicates the estimated value of the dependent variable in year i.

X_i : time variable i: 1, 2, 3,11.

The values between () are the computed "t" values.

* : indicates significance at 0.05

** : indicates significance at 0.01.

Source: Calculated from Table No (7).

B- Food security of poultry in Egypt:

Table No. (1) in the supplement indicates that the average for each of the amount of domestic production, the available amount for consumption, the amount of Egyptian imports, and the amount of Egyptian exports of poultry during the period (2010-2020) amounted to about 1.359, 1.404, 0.061, 0.003 million tons, respectively, and the annual average per capita share was estimated at about 10.7 kg. The amount of domestic production, the available quantity for consumption and the average per capita share of poultry took a general increasing trend at an annual rates representing, respectively, about 7.7%, 7.3%, 4.5% of the annual average for each of them, while the general time

trend of the quantity of Egyptian exports and Egyptian imports of poultry during the study period were not significant. Table No. (9) indicates the most important indicators of food security of poultry in Egypt, as follows:

- **Self-sufficiency ratio of poultry:** The geometric mean of poultry self-sufficiency ratio during the period (2010-2020) was estimated at about 96.4%, which means that Egypt has come close to achieving self-sufficiency in poultry. The self-sufficiency ratio of poultry ranged between a minimum of about 93.1% in 2017, and a maximum of about 103.8% in 2020.
- **Production sufficiency period and import coverage period for consumption of poultry:** The average of Production sufficiency period for consumption of poultry during the period (2010-2020) was estimated at about 352.1 days (11.7 months), while the average of import coverage period for consumption was about 16.2 days.
- **Surplus or deficit in domestic consumption of poultry:** The results indicate that there was a surplus in the domestic consumption of poultry in all years during the period (2010-2020), except for the years 2013 and 2016, in which there was a deficit in consumption amounting to about 16 thousand tons, the period of this deficit amounted to about 4.4 days, while the total amount of surplus in domestic consumption of poultry during the study period was about 188 thousand tons, which is sufficient for consumption for a period of about 41.3 days (1.4 months). The annual average of surplus in domestic consumption of poultry during the study period was about 17.1 thousand tons, which is sufficient for consumption for a period of about 3.8 days.
- **Strategic stock volume of poultry:** The total volume of the strategic stock of poultry during the period (2010-2020) after covering the deficit in consumption that occurs in some years and Egyptian exports of it, was estimated at about 137 thousand tons, which is sufficient for consumption for a period of about 35.6 days (1.2 months). The annual average volume of the strategic stock of poultry during that period was about 12.5 thousand tons, which is sufficient for consumption for a period of about 3.2 days.
- **Food security coefficient of poultry:** The food security coefficient of poultry in Egypt during the total period (2010-2020) was estimated at about 0.098, which means that the total volume of the strategic stock of poultry achieved during the study period is sufficient to cover about 9.8% of the annual average of its consumption. The annual average of the food security coefficient during that period was about 0.009, which is an indication of the low of food security of poultry, which requires an increase in the strategic stock of poultry by making the necessary efforts to increase its productivity, production, and work to rationalize its consumption.

Table (9): Evolution of the most important indicators of food security of poultry in Egypt during the period (2010-2020)

Years	Self-Sufficiency Ratio	Average daily domestic consumption in thousand tons	Production sufficiency period for consumption per day	Import coverage period for consumption per day	Surplus in domestic consumption		deficit in domestic consumption		The volume of the strategic stock in thousand tons	Food security coefficient
					Amount of surplus in thousand tons	Surplus period per day	Amount of deficit in thousand tons	Deficiency period per day		
2010	97.4	2.668	355.6	13.1	10.0	3.7	-	-	5.0	0.005
2011	96.7	2.836	353.0	12.3	1.0	0.4	-	-	-1.0	-0.001
2012	96.7	2.937	353.1	20.4	25.0	8.5	-	-	23.0	0.021
2013	96.0	3.389	350.2	14.2	-	-	2.0	0.6	-3.0	-0.002
2014	97.4	3.622	355.3	10.2	2.0	0.6	-	-	0.0	0.000
2015	93.4	3.795	340.8	26.4	8.0	2.1	-	-	0.0	0.000
2016	93.5	3.685	341.4	19.8	-	-	14.0	3.8	-16.0	-0.012
2017	93.1	3.836	339.7	26.6	5.0	1.3	-	-	-1.0	-0.001
2018	97.0	4.449	354.0	13.5	11.0	2.5	-	-	8.0	0.005
2019	96.3	5.405	351.5	13.7	1.0	0.2	-	-	-1.0	-0.001
2020	103.8	5.693	378.7	8.3	125.0	22.0	-	-	123.0	0.059
Total					188.0	41.3	16.0	4.4	137.0	0.098
Average	96.4	3.847	352.1	16.2	17.1	3.8	1.5	0.4	12.5	0.009

Source: Compiled and calculated from the Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **Food Balance Bulletin in the Arab Republic of Egypt**, various issues.

C- Food security of fish in Egypt:

Table No. (1) in the supplement indicates that the average for each of the amount of domestic production, the available amount for consumption, the amount of Egyptian imports, and the amount of Egyptian exports of fish during the period (2010-2020) amounted to about 1.637, 1.967, 0.354, 0.026 million tons, respectively. The annual average per capita share was estimated at 11.3 kg. The quantity of domestic production, the available quantity for consumption, the quantity of Egyptian imports, and the quantity of Egyptian exports of fish took a general increasing trend during the study period, at annual rates representing, respectively, about 4.95%, 5.1%, 6%, and 10% of the annual average for each of them during The study period, while the general time trend of the average per capita share of it during the study period was not significant. Table No. (10) indicates the most important indicators of food security of fish in Egypt, as follows:

- **Self-sufficiency ratio of fish:** The geometric mean of fish self-sufficiency ratio during the period (2010-2020) was estimated at about 83.4%. Fish self-sufficiency ratio ranged from a minimum of about 72.6% in 2014 to a maximum of about 88.8% in 2011.
- **Production sufficiency period and import coverage period for consumption of fish:** The average of Production sufficiency period for consumption of fish during the period (2010-2020) was estimated at about 304.7 days (10.2 months), while the average of import coverage period for consumption was about 64.8 days (2.2 months).
- **Surplus or deficit in domestic consumption of fish:** The results indicate that a surplus was achieved in the domestic consumption of fish in all years during the period (2010-2020). The total amount of this surplus achieved during the total study period was about 268 thousand tons, which is sufficient for consumption for a period of about 49.4 days (1.6 months). The annual average of this surplus during the study period amounted to about 24.4 thousand tons, which is sufficient for consumption for a period of about 4.5 days.
- **Strategic stock volume of fish:** The results indicate that there was no strategic stock of fish in Egypt during the total period (2010-2020), as the surplus in fish consumption during the study period was not enough to cover Egyptian exports of fish, so that the total deficit in the strategic stock of fish during the study period was about 12 thousand tons, the period of this deficit was about 2.2 days. The annual average of the deficit in the strategic stock of fish during that period was about 1.1 thousand tons.
- **Food security coefficient of fish:** The food security coefficient of fish during the total period (2010-2020) was estimated at about (-0.006), and the annual average of the food security coefficient of it during the study period was about (-0.0006), which is a negative value, less than zero, which is a serious indication of the lack of food security of fish, which requires working to provide a strategic stock of fish in order to achieve the concept of food security from it.

Table (10): Evolution of the most important indicators of food security of fish in Egypt during the period (2010-2020)

Years	Self-Sufficiency Ratio	Average daily domestic consumption in thousand tons	Production sufficiency period for consumption per day	Import coverage period for consumption per day	Surplus in domestic consumption		The volume of the strategic stock in thousand tons	Food security coefficient
					Amount of surplus in thousand tons	Surplus period per day		
2010	84.1	4.249	307.1	60.5	11.0	2.6	0.0	0.000
2011	88.8	4.200	324.3	43.3	11.0	2.6	2.0	0.001
2012	81.3	4.622	296.8	72.5	20.0	4.3	4.0	0.002
2013	87.3	4.564	318.6	51.7	24.0	5.3	4.0	0.002
2014	72.6	5.592	265.0	104.4	25.0	4.5	-3.0	-0.001
2015	84.6	4.918	308.9	60.2	20.0	4.1	0.0	0.000
2016	86.6	5.397	316.1	57.6	47.0	8.7	-1.0	-0.001
2017	84.6	5.901	308.9	62.2	36.0	6.1	1.0	0.000
2018	84.5	6.277	308.3	61.5	30.0	4.8	0.0	0.000
2019	81.1	6.890	295.9	73.3	29.0	4.2	-6.0	-0.002
2020	82.8	6.655	302.2	65.1	15.0	2.3	-13.0	-0.005
Total					268.0	49.4	-12.0	-0.006
Average	83.4	5.388	304.7	64.8	24.4	4.5	-1.1	-0.0006

Source: Compiled and calculated from the Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **Food Balance Bulletin in the Arab Republic of Egypt**, various issues.

D- Food security of milk in Egypt:

Table No. (1) in the supplement indicates that the average for each of the amount of domestic production, the available amount for consumption, the amount of Egyptian imports, and the amount of Egyptian exports of milk during the period (2010-2020) amounted to about 5.481, 6.278, 1.302, 0.502 million tons, respectively. The annual average per capita share was estimated at 69.3 kg. The quantity of production and the annual average per capita share of milk took a general declining trend during the study period at annual rates representing, respectively, about 1% and 3% of the annual average for each of them, while the general time trend of the available amount for consumption, the amount of Egyptian imports, and the amount of Egyptian exports of milk were not significant during the study period. Table No. (11) indicates the most important indicators of food security of milk in Egypt, as follows:

- **Self-sufficiency ratio of milk:** The geometric mean of milk self-sufficiency ratio during the period (2010-2020) was estimated at about 87.3%. Milk self-sufficiency ratio reached its maximum in 2010 (the base year) by about 93.6%, then it decreased and reached its minimum in 2016 by about 76.9%, because the amount of milk production reached its minimum in this year.
- **Production sufficiency period and import coverage period for consumption of milk:** The average of Production sufficiency period for consumption of milk during the period (2010-2020) was estimated at about 319.2 days (10.6 months), while the average of import coverage period for consumption was about 75.3 days (2.5 months).

Table (11): Evolution of the most important indicators of food security of milk in Egypt during the period (2010-2020)

Years	Self-Sufficiency Ratio	Average daily domestic consumption in thousand tons	Production sufficiency period for consumption per day	Import coverage period for consumption per day	Surplus in domestic consumption		The volume of the strategic stock in thousand tons	Food security coefficient
					Amount of surplus in thousand tons	Surplus period per day		
2010	93.6	16.910	341.5	58.0	582.0	34.4	0.0	0.000
2011	91.6	17.362	334.2	61.1	527.0	30.4	-103.0	-0.016
2012	93.6	17.118	341.7	82.3	1009.0	58.9	512.0	0.082
2013	90.8	16.759	331.4	63.1	495.0	29.5	-56.0	-0.009
2014	85.9	17.860	313.6	74.1	406.0	22.7	-79.0	-0.012
2015	79.5	18.079	290.1	93.1	330.0	18.3	-132.0	-0.020
2016	76.9	18.132	280.7	96.4	218.0	12.0	-61.0	-0.009
2017	91.4	16.175	333.5	62.4	501.0	31.0	-40.0	-0.007
2018	87.4	16.222	318.9	75.2	472.0	29.1	-28.0	-0.005
2019	88.1	16.258	321.5	74.7	508.0	31.2	0.0	0.000
2020	83.5	18.337	304.6	87.8	503.0	27.4	20.0	0.003
Total					5551.0	325.0	33.0	0.005
Average	87.3	17.201	319.2	75.3	504.6	29.5	3.0	0.0005

Source: Compiled and calculated from the Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **Food Balance Bulletin in the Arab Republic of Egypt**, various issues.

- **Surplus or deficit in domestic consumption of milk:** The results indicate that a surplus was achieved in the domestic consumption of milk in all years during the period (2010-2020). The total amount of this surplus achieved during the total study period was about 5.551 million tons, which is sufficient for consumption for a period of about 325 days (10.8 months). The annual average of this surplus during the study period amounted to about 504.6 thousand tons, which is sufficient for consumption for a period of about 29.5 days.
- **Strategic stock volume of milk:** The total volume of the strategic stock of milk during the period (2010-2020) after covering the Egyptian exports of it was estimated at about 33 thousand tons, which is sufficient for consumption for a period of about 1.9 days. The annual average volume of the strategic stock of milk during that period was about 3 thousand tons, which is sufficient for consumption for a period of about 0.2 days.
- **Food security coefficient of milk:** The food security coefficient of milk during the total period (2010-2020) was estimated at about 0.005, which means that the total strategic stock of milk achieved during the study period is sufficient to cover 0.5% of the annual average of consumption of it during the study period. The annual average of the coefficient of food security of milk during the study period was about 0.0005, which is an indication of the low of food security of milk in Egypt during that period, which requires making the necessary efforts to increase the strategic stock of milk in order to achieve the concept of food security.

Third: Food security of the broad beans crop in Egypt:

Table No. (1) in the supplement indicates that the average for each of the amount of domestic production, the available amount for consumption, the amount of Egyptian imports, and the amount of Egyptian exports of broad beans during the period (2010-2020) amounted to about 144.8, 669.1, 547.2, 23.1 thousand tons, respectively. The annual average per capita share was about 5.6 kg. The quantity of broad beans production took a general declining trend during the study period, at an annual decreasing rate representing about 5.7% of its annual average, while the available quantity for consumption and the quantity of Egyptian imports of broad beans took a general increasing trend during the study period, the annual rate of increase for each of them, respectively, was about 7.1% and 10.5% of the annual average for each of them, the general time trend of the quantity of Egyptian exports, and the annual average per capita share of broad beans in Egypt were not significant during the study period. Table No. (12) indicates the most important indicators of food security of the broad beans crop in Egypt, as follows:

- **Self-sufficiency ratio of broad beans:** The geometric mean of the broad beans self-sufficiency ratio during the period (2010-2020) was estimated at about 22.4%. The broad beans self-sufficiency ratio reached its maximum in 2012 by about 37.5%, then it decreased and reached its minimum in 2019 by about 10.3%.
- **Production sufficiency period and import coverage period for consumption of broad beans:** The average of Production sufficiency period for consumption of broad beans during the period (2010-2020) was estimated at about 90 days (3 months), while the average of import coverage period for consumption was about 287.7 days (9.6 months). Table No. (13) indicates that the Production sufficiency period for consumption of broad beans has taken a general decreasing trend during the period (2010-2020), with an annual decrease period amounted to about 9.9 days, which represents about 11% of its annual average during the study period, while the import coverage period for consumption of broad beans has taken a general increasing trend, with an annual increase period estimated at about 10.2 days, which represents about 3.54% of its average during the study period.
- **Surplus or deficit in domestic consumption of broad beans:** The results indicate that a surplus was achieved in the domestic consumption of broad beans in all years during the period (2010-2020), the total

amount of surplus in domestic consumption of broad beans during the study period amounted to about 252 thousand tons, which is sufficient for consumption for a period of about 139.3 days (4.6 months). The average quantity of surplus in domestic consumption of the broad beans crop during the study period was about 22.9 thousand tons, which is sufficient for consumption for a period of about 12.7 days.

- **Strategic stock volume of broad beans:** The results indicate that there is no strategic stock of broad beans in Egypt during the total period (2010-2020) because the amount of surplus in consumption which achieved during that period is not sufficient to cover the amount of Egyptian exports of it during the study period. The total deficit in the strategic stock of broad beans amounted to about two thousand tons, and the period of this deficit amounted to about 1.1 days.
- **Food security coefficient of broad beans:** The food security coefficient of broad beans during the total period (2010-2020) was estimated at about (-0.003), and the annual average of the food security coefficient of it during the study period was about (-0.0003), which is a negative value, less than zero, which is a serious indicator of the lack of Food security of broad beans, which requires making the necessary efforts to provide a strategic stock of broad beans to achieve the concept of food security.

Table (12): Evolution of the most important indicators of food security of the broad beans crop in Egypt during the period (2010-2020)

Years	Self-Sufficiency Ratio	Average daily domestic consumption in thousand tons	Production sufficiency period for consumption per day	Import coverage period for consumption per day	Surplus in domestic consumption		The volume of the strategic stock in thousand tons	Food security coefficient
					Amount of surplus in thousand tons	Surplus period per day		
2010	33.7	1.904	122.9	252.1	19.0	10.0	0.0	0.000
2011	36.2	1.323	132.2	236.5	5.0	3.8	0.0	0.000
2012	37.5	1.030	136.9	242.7	15.0	14.6	0.0	0.000
2013	27.8	1.556	101.5	273.1	15.0	9.6	0.0	0.000
2014	32.1	1.145	117.0	266.3	21.0	18.3	0.0	0.000
2015	30.1	1.093	109.8	268.0	14.0	12.8	0.0	0.000
2016	15.6	2.090	56.9	327.7	41.0	19.6	-2.0	-0.003
2017	20.1	2.318	73.3	316.7	58.0	25.0	0.0	0.000
2018	10.5	3.025	38.4	333.3	20.0	6.6	0.0	0.000
2019	10.3	2.699	37.4	336.5	24.0	8.9	0.0	0.000
2020	17.3	1.981	63.1	312.0	20.0	10.1	0.0	0.000
Total					252.0	139.3	-2.0	-0.003
Average	22.4	1.833	90.0	287.7	22.9	12.7	-0.182	-0.0003

Source: Compiled and calculated from the Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **Food Balance Bulletin in the Arab Republic of Egypt**, various issues.

Table (13): Equations for the general time trend of the development of the most important indicators of food security of the broad beans crop in Egypt during the period (2010-2020)

	Dependent Variable	The equation	The average	R ²	F	Amount of change	Annual rate of change %
1	Production sufficiency period for consumption per day	$\hat{Y}_i = 149.41 - 9.911 X_i$ (12.57)** (-5.657)**	90.0	0.780	32.0**	-9.911	-11.01
2	Import coverage period for consumption per day	$\hat{Y}_i = 226.63 + 10.181 X_i$ (18.99)** (5.787)**	287.7	0.788	33.49**	10.18	3.54

Whereas:

- \hat{Y}_i : indicates the estimated value of the dependent variable in year i.
- X_i : time variable i: 1, 2, 3, ,11.
- The values between () are the computed "t" values.
- * : indicates significance at 0.05 ** : indicates significance at 0.01.

Source: Calculated from Table No (12).

Fourth: Food Security for Sugar in Egypt:

Table No. (1) in the supplement indicates that the average for each of the amount of domestic production, the available amount for consumption, the amount of Egyptian imports, and the amount of Egyptian exports of sugar during the period (2010-2020) amounted to about 2.174, 2.986, 1.161, 0.407 million tons, respectively. The annual average per capita share was estimated at 33.2 kg. The quantity of domestic production and the available quantity for consumption of sugar took a general increasing trend during the study period, at annual rates representing, respectively, about 1.9% and 1.3% of the annual average for each of them, while the average annual per capita share of it took a general decreasing trend during the study period, at an annual rate that represents about 1.4% of its annual average, while the general time trend of the quantity of

Egyptian imports and the quantity of Egyptian exports of sugar were not significant during the study period. Table No. (14) indicates the most important indicators of food security of sugar in Egypt, as follows:

- **Self-sufficiency ratio of sugar:** The geometric mean of sugar self-sufficiency ratio during the period (2010-2020) was estimated at about 72.7%. The self-sufficiency ratio of sugar ranged between a minimum of about 66.2% in 2011 because the amount of sugar production reached its lowest level in this year, and a maximum of about 80.4% in 2016 because the available amount for consumption of sugar reached its lowest level this year.
- **Production sufficiency period and import coverage period for consumption of sugar:** The average of Production sufficiency period for consumption of sugar during the period (2010-2020) was estimated at about 265.9 days (8.9 months), while the average of import coverage period for consumption was about 143.1 days (4.8 months).
- **Surplus or deficit in domestic consumption of sugar:** The results indicate that there was a surplus in the domestic consumption of sugar in all years during the period (2010-2020), except for the year 2020, in which there was a deficit in consumption amounting to about 104 thousand tons, the period of this deficit amounted to about 11.4 days, while the total amount of surplus in domestic consumption of sugar during the study period was about 3.944 million tons, which is sufficient for consumption for a period of about 495.2 days (16.3 months). The annual average of surplus in domestic consumption of sugar during the study period was about 358.5 thousand tons, which is sufficient for consumption for a period of about 45 days (1.5 months).
- **Strategic stock volume of sugar:** The results indicate that there was no strategic stock of sugar in Egypt during the total period (2010-2020), as the surplus in sugar consumption during the study period was not enough to cover Egyptian exports of sugar during the study period and the deficit in domestic consumption which occurred in 2020, so that the total deficit in the strategic stock of sugar during the study period was about 637 thousand tons, the period of this deficit amounted to about 77.9 days (2.6 months). The annual average of the deficit in the strategic stock of sugar during that period was about 57.9 thousand tons, the period of this deficit amounted to about 5.9 days.
- **Food security coefficient of sugar:** The food security coefficient of sugar during the total period (2010-2020) was estimated at about (-0.213), and the annual average of the food security coefficient of it during the study period was about (-0.02), which is a negative value, less than zero, which is a serious indication of the lack of food security of sugar, which requires working to provide a strategic stock of sugar in order to achieve the concept of food security from it.

Table (14): Evolution of the most important indicators of food security of sugar in Egypt during the period (2010-2020)

Years	Self-Sufficiency Ratio	Average daily domestic consumption in thousand tons	Production sufficiency period for consumption per day	Import coverage period for consumption per day	Surplus in domestic consumption		deficit in domestic consumption		The volume of the strategic stock in thousand tons	Food security coefficient
					Amount of surplus in thousand tons	Surplus period per day	Amount of deficit in thousand tons	deficiency period per day		
2010	72.1	7.564	263.2	160.9	447.0	59.1	-	-	0.0	0.000
2011	66.2	7.858	241.6	142.5	150.0	19.1	-	-	-400.0	-0.139
2012	69.1	7.945	252.4	160.2	378.0	47.6	-	-	145.0	0.050
2013	66.6	8.219	243.1	128.8	57.0	6.9	-	-	-259.0	-0.086
2014	75.6	8.329	275.9	129.0	332.0	39.9	-	-	0.0	0.000
2015	79.3	8.195	289.5	112.4	302.0	36.9	-	-	0.0	0.000
2016	80.4	7.490	293.3	161.4	672.0	89.7	-	-	16.0	0.006
2017	77.7	7.926	283.7	211.7	1034.0	130.5	-	-	546.0	0.189
2018	70.8	8.370	258.4	133.3	224.0	26.8	-	-	-212.0	-0.069
2019	75.2	8.959	274.4	129.5	348.0	38.8	-	-	-1.0	0.000
2020	68.4	9.137	249.8	103.9	-	-	104.0	11.4	-472.0	-0.142
Total					3944.0	495.2	104.0	11.4	-637.0	-0.213
Average	72.7	8.181	265.9	143.1	358.5	45.0	9.5	1.0	-48.5	-0.016

Source: Compiled and calculated from the Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **Food Balance Bulletin in the Arab Republic of Egypt**, various issues.

Fifth: Food Security of Vegetal Oils in Egypt:

Sunflower seed oil, maize seed oil, soybean oil, cotton seed oil, and palm oil are the most important vegetal oils in Egypt. Table No. (1) in the supplement indicates that the average for each of the amount of domestic production, the available amount for consumption, the amount of Egyptian imports, and the amount of Egyptian exports of vegetal oils during the period (2010-2020) amounted to about 230.8, 1426, 1303, 101.5 thousand tons, respectively. The annual average per capita share was about 12 kg. The quantity of domestic production, the available quantity for consumption, and the quantity of Egyptian imports of vegetal oils took a general increasing trend during the study period, at annual rates representing, respectively, about 8.15%, 5.95%,

and 5.7% of the annual average for each of them, while the general time trend of the quantity of Egyptian exports, and the annual average per capita share of vegetal oils were not significant during the study period. Table No. (15) indicates the most important indicators of food security of the vegetal oils in Egypt, as follows:

- **Self-sufficiency ratio of vegetal oils:** The geometric mean of the vegetal oils self-sufficiency ratio during the period (2010-2020) was estimated at about 16.2%. The vegetal oils self-sufficiency ratio ranged between a minimum of about 10.3% in 2016, and a maximum of about 25.1% in 2010 because the available amount for consumption of vegetal oils reached its lowest level in this year.
- **Production sufficiency period and import coverage period for consumption of vegetal oils:** The average of Production sufficiency period for consumption of vegetal oils during the period (2010-2020) was estimated at about 61.9 days (2.1 months), while the average of import coverage period for consumption was about 332.4 days (11.1 months).
- **Surplus or deficit in domestic consumption of vegetal oils:** The results indicate that a surplus was achieved in the domestic consumption of vegetal oils in all years during the period (2010-2020), the total amount of surplus in domestic consumption of vegetal oils during the study period amounted to about 1.187 million tons, which is sufficient for consumption for a period of about 322.3 days (10.7 months). The average quantity of surplus in domestic consumption of the vegetal oils during the study period was about 107.9 thousand tons, which is sufficient for consumption for a period of about 29.3 days.
- **Strategic stock volume of vegetal oils:** The total volume of strategic stocks of vegetal oils during the period (2010-2020), after covering Egyptian exports, was estimated at about 71 thousand tons, which is sufficient for consumption for a period of about 18.2 days. The annual average volume of strategic stocks during that period was about 6.5 thousand tons, which is sufficient for consumption for a period of about 1.7 days.
- **Food security coefficient of vegetal oils:** The food security coefficient of vegetal oils during the total period (2010-2020) was estimated at about 0.050, which means that the total strategic stock of vegetal oils achieved during the study period is sufficient to cover 5% of the annual average of consumption of it during the study period. The annual average of the coefficient of food security of vegetal oils during the study period was about 0.005, which is an indication of the low of food security of vegetal oils in Egypt during that period, which requires making the necessary efforts to increase the strategic stock of vegetal oils in order to achieve the concept of food security.

Table (15): Evolution of the most important indicators of food security of vegetal oils in Egypt during the period (2010-2020)

Years	Self-Sufficiency Ratio	Average daily domestic consumption in thousand tons	Production sufficiency period for consumption per day	Import coverage period for consumption per day	Surplus in domestic consumption		The volume of the strategic stock in thousand tons	Food security coefficient
					Amount of surplus in thousand tons	Surplus period per day		
2010	25.1	1.896	91.8	321.7	92.0	48.5	0.0	0.000
2011	15.6	3.523	56.8	334.3	92.0	26.1	0.0	0.000
2012	13.9	3.460	50.9	341.0	93.0	26.9	0.0	0.000
2013	14.1	4.422	51.6	334.5	93.0	21.0	0.0	0.000
2014	14.5	3.762	52.9	345.6	126.0	33.5	0.0	0.000
2015	22.8	1.973	83.1	316.3	68.0	34.5	0.0	0.000
2016	10.3	4.742	37.7	345.0	84.0	17.7	-4.0	-0.002
2017	10.5	4.800	38.3	336.0	45.0	9.4	-46.0	-0.026
2018	13.3	5.334	48.6	333.3	90.0	16.9	-9.0	-0.005
2019	22.2	3.488	80.9	324.9	142.0	40.7	29.0	0.023
2020	24.3	5.567	88.7	323.3	262.0	47.1	101.0	0.050
Total					1187.0	322.3	71.0	0.050
Average	16.2	3.906	61.9	332.4	107.9	53.7	6.5	0.005

Source: Compiled and calculated from the Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **Food Balance Bulletin in the Arab Republic of Egypt**, various issues.

III. Recommendations:

In light of the previous research results, the research recommends that it is necessary to provide a strategic stock of at least 50% of the average consumption needs of strategic food commodities such as vegetal oils, beans, wheat, maize, meat, sugar, fish, milk, poultry, and rice, to face any emergency conditions, through the following:

- 1- It is necessary to work on increasing the production and productivity of these commodities through the expansion of land reclamation, and the projects of poultry, animal and fish production, as well as expanding

modern technological methods in production, and paying attention to scientific research to increase the productivity of these commodities.

- 2- It is necessary to rationalize the consumption of these food commodities and raise awareness of the importance of rationalizing their consumption.
- 3- Modern technological methods must be used in the production, transportation and storage processes to reduce the losses of this commodity during its production, transportation and storage.
- 4- It is necessary to work on providing stocks of some commodities that Egypt suffers from a very low percentage of self-sufficiency, such as vegetal oils, broad beans, wheat and others, by increasing the amount of its imports from abroad.
- 5- It is necessary to work on stopping the exports of some strategic commodities such as rice and cane sugar because they are among the most water-consuming crops in their production processes, as well as limiting wheat exports to provide a strategic stock of it.

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Supplement

Table (1): The development of the most important economic indicators for the most important food commodities in Egypt during the period (2010-2020)

Food commodities	Variables	The average	R ²	F	Amount of change	Rate of change
Wheat	The quantity of Production in million ton	8.769	0.092	0.909	-	-
	The available quantity for consumption in million tons	18.330	0.936	132.01**	0.623	3.4
	The quantity of imports in million tons	9.994	0.740	25.55**	0.581	5.81
	The quantity of exports in thousand tons	275.1	0.783	32.39**	50.764	18.5
	The annual average per capita share in kg	137.6	0.591	13.003**	2.526	1.84
Maize	The quantity of Production in million tons	7.807	0.270	3.326	-	-
	The available quantity for consumption in million tons	14.912	0.721	23.31**	0.511	3.43
	The quantity of imports in million tons	7.115	0.623	14.858**	0.437	6.14
	The quantity of exports in thousand tons	9.5	0.100	0.996	-	-
	The annual average per capita share in kg	49.6	0.951	175.51**	-4.615	-9.30
Rice	The quantity of Production in million tons	5.058	0.228	2.652	-	-
	The available quantity for consumption in million tons	5.049	0.018	0.161	-	-
	The quantity of imports in thousand tons	189.1	0.294	3.749	-	-
	The quantity of exports in thousand tons	189.2	0.490	8.66*	-54.255	-28.7
	The annual average per capita share in kg	36.1	0.497	8.901**	-1.207	-3.34
Meat	The quantity of Production in thousand tons	721.0	0.675	18.667**	-26.164	-3.63
	The available quantity for consumption in thousand tons	1127.1	0.001	0.005	-	-
	The quantity of imports in thousand tons	402.5	0.405	6.130*	24.291	6.04
	The quantity of exports in thousand tons	1.0	0.194	2.165	-	-
	The annual average per capita share in kg	9.4	0.234	2.747	-	-
Poultry	The quantity of Production in million tons	1.359	0.835	45.53**	0.104	7.65
	The available quantity for consumption in million tons	1.404	0.892	74.27**	0.103	7.34
	The quantity of imports in thousand tons	61.0	0.203	2.289	-	-
	The quantity of exports in thousand tons	3.2	0.001	0.007	-	-
	The annual average per capita share in kg	10.7	0.782	32.20**	0.479	4.48
Fish	The quantity of Production in million tons	1.637	0.949	166.4**	0.081	4.95
	The available quantity for consumption in million tons	1.967	0.908	88.83**	0.100	5.08
	The quantity of imports in thousand tons	353.8	0.373	5.353*	21.22	6.0
	The quantity of exports in thousand tons	25.5	0.531	10.176**	2.555	10.02
	The annual average per capita share in kg	11.3	0.290	3.680	-	-
Milk	The quantity of Production in million tons	5.481	0.463	7.745*	-0.055	-1.0
	The available quantity for consumption in million tons	6.278	0.001	0.009	-	-
	The quantity of imports in million tons	1.302	0.147	1.548	-	-
	The quantity of exports in thousand tons	501.6	0.166	1.794	-	-
	The annual average per capita share in kg	69.3	0.821	41.14**	-2.079	-3.0
Broad beans	The quantity of Production in thousand tons	144.8	0.526	9.970**	-8.245	-5.69
	The available quantity for consumption in thousand tons	669.1	0.415	6.394*	47.573	7.11
	The quantity of imports in thousand tons	547.2	0.532	10.23**	57.655	10.54
	The quantity of exports in thousand tons	23.1	0.172	1.872	-	-
	The annual average per capita share in kg	5.6	0.231	2.704	-	-
Sugar	The quantity of Production in million tons	2.174	0.589	12.895**	0.042	1.93
	The available quantity for consumption in million tons	2.986	0.502	9.063**	0.040	1.34
	The quantity of imports in million tons	1.161	0.002	0.015	-	-
	The quantity of exports in thousand tons	407.0	0.0001	0.003	-	-
	The annual average per capita share in kg	33.2	0.495	8.833**	-0.454	-1.37
Vegetal oils	The quantity of Production in thousand tons	230.8	0.431	6.826*	18.81	8.15
	The available quantity for consumption in thousand tons	1425.7	0.399	5.986*	84.85	5.95
	The quantity of imports in thousand tons	1302.8	0.354	4.940*	74.25	5.70
	The quantity of exports in thousand tons	101.5	0.248	2.964	-	-
	The annual average per capita share in kg	12.0	0.016	0.148	-	-

Source: Compiled and calculated from the Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **Food Balance Bulletin in the Arab Republic of Egypt**, various issues.