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Determinants of Fresh and Processed Meat Consumption in Saudi Arabia

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ABSTRACT

Fresh meat has great importance in food security components. The research targeted studying Determinants of Fresh and processed Meat Consumption in KSA. The study adopted on descriptive and quantitative statistical analysis methods. It depended on secondary and primary data, as well as of a random sample of Al-Ahsa Governorate Families Where the family spends the highest expenditure compared to all provinces of KSA by about 10% in 2018, as the Spending on food is about 11% of total household income. The study concluded that although both processed and poultry meat are good alternatives to fresh red meat, the reduction of their prices compared to fresh meat do not affect the consumed quantity. The study showed the family income has the largest impact on red meat and processed meat quantities consumed .On other hand it cleared that the fresh red meat price has significantly affects on processed and poultry meat consumption.

KEYWORDS: Food security; Red meat production; Burger ; Luncheon-meat; Meat Foreign trade; Self-sufficiency; elasticity of demand.

1. INTRODUCTION

Red meat is one of the most important sources of animal protein as a key factor in building tissue, which has a high nutritional importance. The content of the protein rated as 19 - 31 grams of protein per 85 grams of red meat, 9 - 26 grams of protein per 85 grams of poultry meat and about 20 - 24 grams of protein per 85 grams of fish meat. The Kingdom of Saudi Arabia is one of the largest importers of foods. It is the 18th largest importer in the world at a value of 23.36 billion US dollars in 2018. The value of meat imports represents about 10.10% of Saudi agriculture imports in 2018[(10)].Doubt less that one of the challenges facing meat industry is producing products with high nutritional value and desirable sensory properties. Especially that meat consumers have a great passion for its taste[(2)]

Processed meat is defined as meat that has been processed to improve its taste and through salting, processing, fermentation and smoking, which changes the taste of fresh meat in addition to simple mechanical processes such as cutting, grinding or mixing[(6)]

Americans considered the most consumers of processed meat. Their consumption has unchanged in the past 18 years, as they eat more beef and less chicken. There is strong evidence linking between processed meat with cancer risk. The American individual consumption was about 187 grams/week during (1999-2016).Women and youth over 15 years are the most consumers of red meat [(13)]

Because of the harmful effect of processed meat on health, the US government raised taxes on processed meat, which led to a rise in the prices of processed meat by 25%, which led to decrease in its consumption by 16%.[(7)]

Trade of meat between countries are largely determined by differences between countries in their resource, their preferences for types of meat, and the structure of the industry.[(5)]

Saudi Arabia realized the importance of the nutritional value of meat, especially red meat, as one of the sources of protein, and worked hard to provide it to all classes of society, as the value of the Kingdom of Saudi Arabia imports about 1.096 million tons in 2017 of meat valued at about $ 2.36 billion. The average red meat Consumption in Saudi Arabia is

about 73.26 gm per day in 2017, which is higher than the WHO recommendations, where, meat consumption should not be more than 70 grams per day.[3] Then the research aimed to study the most important factors that affecting the consumption of red meat either in fresh or processed form in the Kingdom of Saudi Arabia (Case Study of Al-Ahsa Governorate) during the period (2018 - 2019).

2. MATERIALS AND METHODS

2.1. Research Methodology:

Meat and meat products are important component of a person's daily diet in Saudi Arabia. However, per capita consumption of meat must not exceed the recommended level by health organizations to avoid cancer [12].The research aims mainly to study the most important factors affecting the consumption of red meat, whether fresh or processed in Saudi Arabia, especially consumption patterns in Al-Ahsa Governorate during the period (2018-2019). On other hand, the study clears meat consumption and the rate of self-sufficiency of meat kinds, as well as studying the ratio of exports to imports of both fresh red meat and poultry meat in the Kingdom of Saudi Arabia.

The research based on secondary data obtained from FAO, the Saudi Arabian Ministry of Water and Agriculture Organization and the General Organization for Statistics, in addition to the available statistics in the field of research. The research also relied on primary data that collected during the period (01-10-2018 to 01-05-2019) for some Saudi families in Al-Ahsa Governorate. According to Herbert Arkan equation,[1] (**Herbert Arken equation**:

$$n = \frac{p(1-p)}{(SE \div t) + [p(1-p) \div N]}$$

Where: N community size, SE error ratio is equal to 0.05, t the standard score corresponding to the mean level of 0.95 and equal to 1.96, p the availability of the property and the neutral = 0.50.) the size of the sample was determined in light of the fact that the population of the Governorate in 2018 amounted to about 1049863 people and that the average size of the family in the Al-Ahsa Governorate was about 6.3 people (The General Authority for Statistics, 2018). The number of families in Al-Ahsa Governorate estimated at 165.38 thousand families of Saudi and non-Saudi families, so the sample size estimated at about386 families. As a result, about 400 forms collected. However, due to the non-response of a number of families and the incomplete data required in some forms, the research relied on arandom sample of 384 households. The study based on quantitative and descriptive economic analysis. The study also used the simple multi and the stepwise regression methods. In addition, it used ordinary least squares method (OLS) to identify the most important factors affecting the consumption patterns of various types of meat using EXCEL and STATA.[10]

3. RESULTS AND DISCUSSION

3.1. Production and consumption:

Results of testing time-series static and stability of model variables using the Extended Dickey Fuller Test (ADF)

Before start the existence test of the long-term equilibrium relationship between the study variables, it is necessary analyze the time series first to ensure its stability over time and determine the degree of its integration. The study conduct the Extended Dickey-Fuller test (ADF), which based on testing the null hypothesis to exam the property of temporal stability of time series.

Table (1) indicated that, all the study variables are stable at the first difference, and so The study reject the null hypothesis (H0) and accept the alternative hypothesis (H1), which indicates that there is no unit root for the time series of the study variables at the first and second difference, so each The study variables are integrated first degree.

The results in table (2) indicated the significant effect of factors, that reflect time on Production meat,Consumption meat, Production Poultry,Consumption Poultry, meat Self-sufficiency ratio, imported meat,imported poultry and exported poultry.While the statistical non-significance to Poultry Self-sufficiency ratio of meat andexported meat.

Table 1. Results of the stability of time series using (ADF). Source: Prepared by the researcher based on (E Views 9)

The result	At the level with no vector and secant		At the level with the vector and secant		at the level with the secant		Variables
Unstable	probability	Value	probability	Value	probability	Value	
Unstable	0.73	0.21	0.49	-2.13	0.92	-0.2	Y_1
Unstable	0.92	1.09	0.99	0.1	0.33	-1.86	Y_2
Unstable	0.96	1.55	0.83	-1.37	0.97	0.38	Y_3
Unstable	0.94	1.3	0.51	-2.09	0.98	0.5	Y_4
Unstable	0.87	0.77	0.57	-1.96	0.93	-0.1	Y_5
Unstable	0.66	0	0.97	-0.46	0.47	-1.57	Y_6
Unstable	0.8	0.45	0.96	-0.55	0.11	-2.58	Y_7
Unstable	0.76	0.33	0.51	-2.09	0.97	0.33	Y_8
Unstable	0.22	-1.12	0.76	-1.57	0.38	-1.76	Y_9
Unstable	0.77	0.34	0.73	-1.64	0.81	-0.71	Y_{10}
Unstable	0.19	-1.21	0.6	-1.91	0.31	-1.92	Y_{11}
Unstable	0.27	-0.98	0.75	-1.59	0.38	-1.76	Y_{12}
	-1.96		-3.69		-3.04		Critical value at 5% level.

Table 2. Results of estimating the equations of the general trend of the evolution of the study variables during the period (2000:2019). Source: Prepared by the researcher based on OLS using the EXCEL program

Variable	slope	T value statistic	Adjusted R squared	F statistic
Production meat	2.57	18.8	0.92*	249.1
Consumption meat	6.39	8.6	0.79*	73.2
Production Poultry	18.3	6.8	0.70*	46.3
Consumption Poultry	56.3	17.7	0.94*	313.2
meat Self-sufficiency ratio	0.57	4.15	0.46*	17.3
Poultry Self-sufficiency ratio	0.39	0.39	0.06	2.24
Imported meat	4.73	4.4	0.49*	19.2
imported poultry	41.1	21.7	0.96*	472.6
exported meat	0.52	1.4	0.05	1.93
exported poultry	1.59	4.2	0.47*	17.9
The percent exports to the imports of Fresh meat	0.18	0.84	0.02	0.72
The percent exports to the imports of Poultry meat	0.08	1.19	0.02	1.4

*Denotes statistical significance of 5%.

Figure (1) shows the increase in the quantity produced of fresh red meat from about22 thousand ton as a minimum in 2000 to reach a maximum of 60 thousand tons as a maximum in 2017, as a minimum in 2001 to reach a maximum of 201 thousand tons in 2015, with a growth rate about 5.3%.

Source: (4)

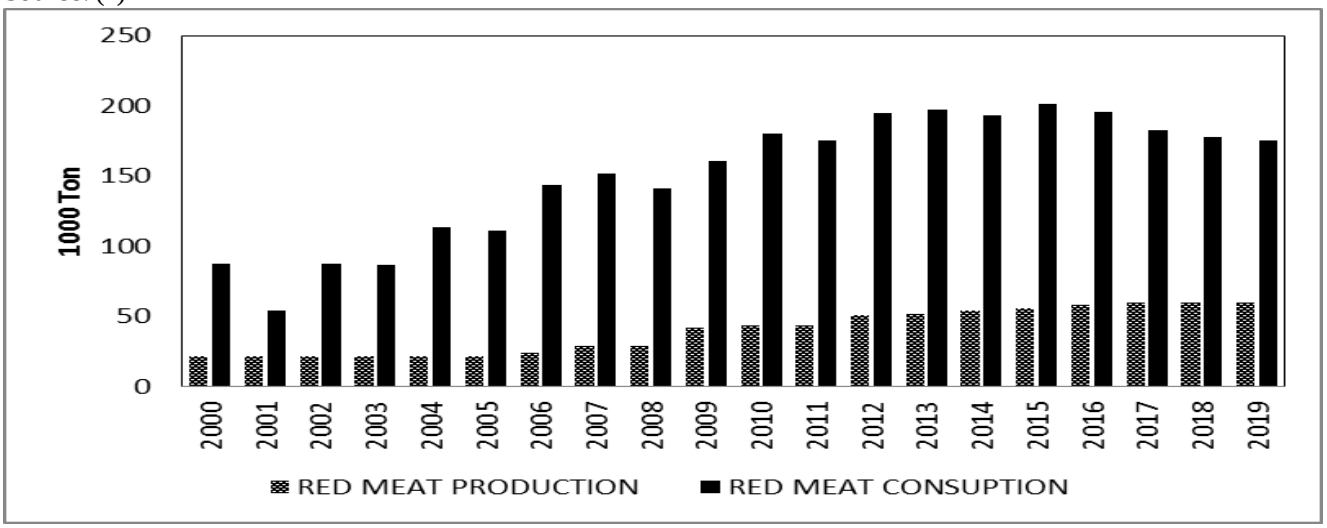

Figure 1. Fresh Red meat production and consumption in KSA during the period (2000-2019).

While Figure (2) shows the quantity of poultry meat production, it was about 370 thousand ton as a minimum in 2000 to reach 782 thousand tons as a maximum in 2019, annual growth rate of about 3.2%. As well as the amount consumed from about 592 thousand ton as a minimum in 2000 to reach a maximum of 1656 thousand tons in 2019, with a growth rate of about 5.2%.

Source: (4)

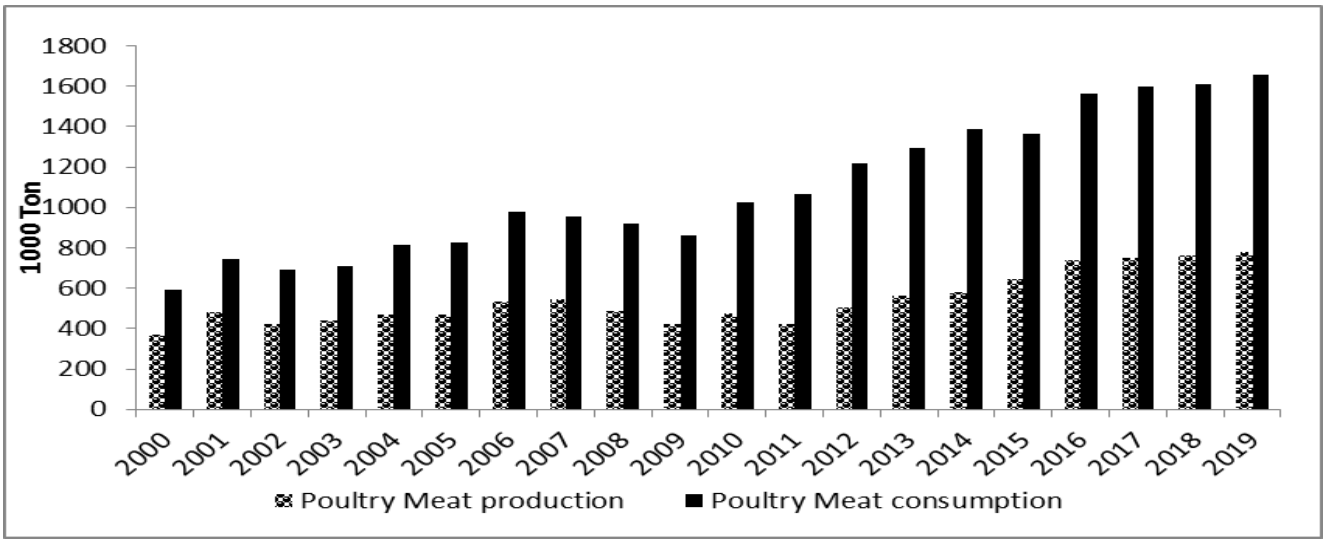

Figure 2. Poultry meat production and consumption in KSA during the period (2000-2019).

3.2. Self-sufficiency:

Figure (3) also shows the fluctuation of the self-sufficiency ratio of both red meat and poultry meat during the period (2000-2019), where the maximum self-sufficiency ratio of red meat and poultry meat amounted to 34.3% and 64.9% as a maximum in 2019 and 2001, respectively.

Source: (4)

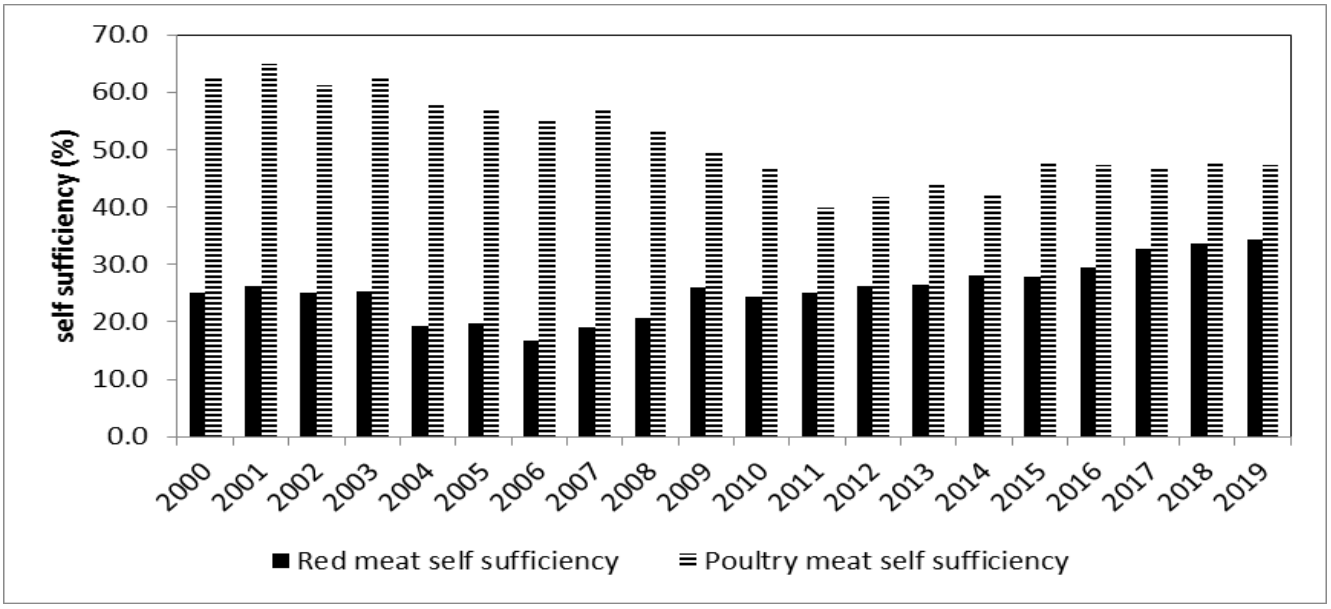

Figure 3. Fresh Red meat and Poultry meat Self-sufficiency ratio in KSA during the period (2000-2019).

3.3. Exports and Imports:

Figure (4) shows the fluctuation of the percent exports to the imports of Fresh Red meat and Poultry meat in KSA during the period (2000-2019).The maximum exports to imports percent of Fresh red meat and poultry meat were about 20.4% and 7.0% in 2012, 2003 respectively.

Source: (4)

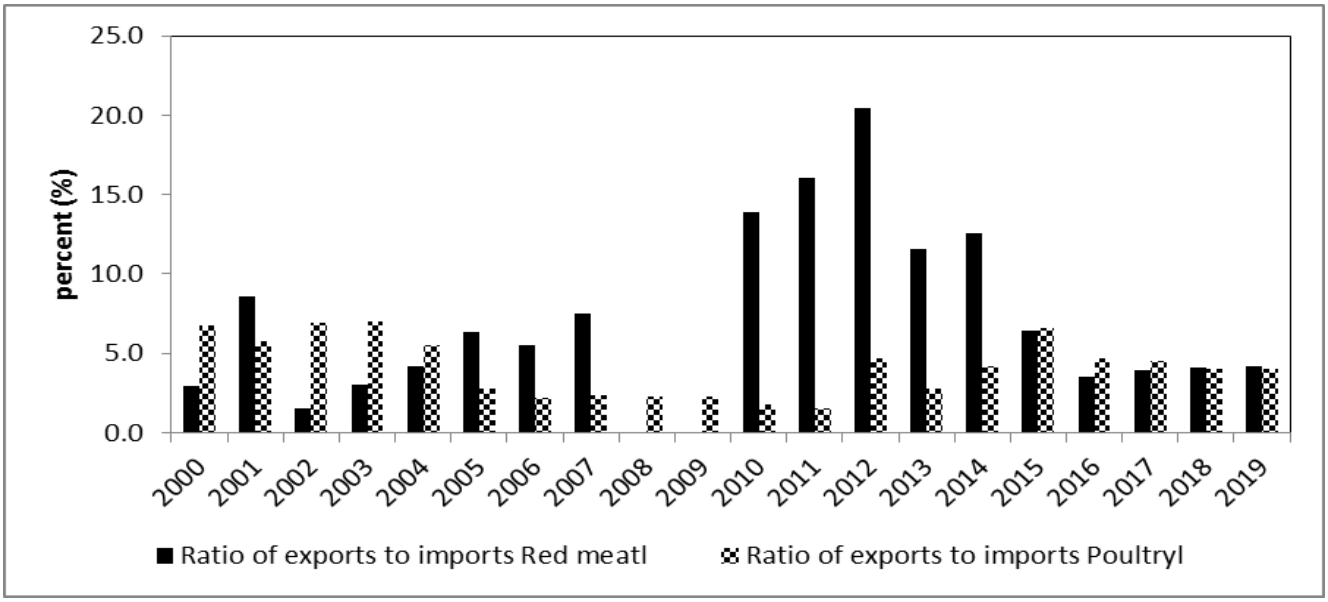

Figure 4. The percent of exports to the imports of Fresh Red meat and Poultry meat in KSA during the period (2000-2019).

Figure (5) cleared the value of processed meat exports and imports of Saudi Arabia during the period (2000-2019) increased with an annual growth rate about 7.3%, 6.7% respectively.

Source: (11)

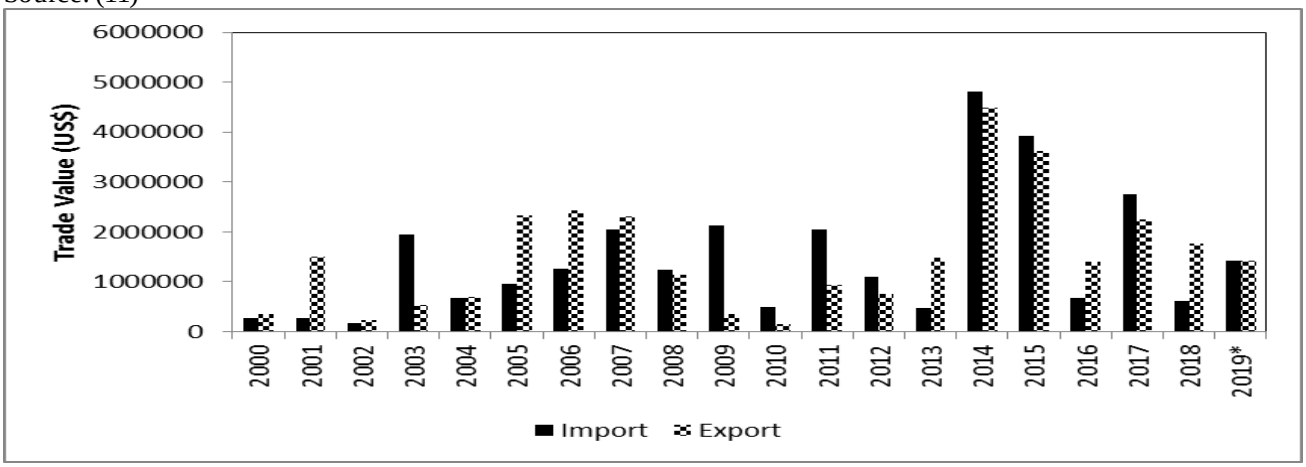

Figure 5. The Trade value of processed meat in KSA during the period (2000-2019).

3.4. Households processed meat consumption in Al-Ahsa research sample:

3.4.1. Opinions of the research sample families on processed meat consumption according to family's income:

Table (3) shows families opinions about the advertising and advertising effect on consumer demand of processed meat as about 72.9% of families sample believe that advertising and advertising do not affect on processed meat demand. On other hand, it found that, about 24.7% of the sample families believe that the high prices of processed meat does not affect on processed meat demand. Table (1) also shows that about 40.3%, 37.7% and 22.0% of families prefer buying processed meat from mini markets, supermarkets and grocery stores respectively.

Table 3. Families sample opinion about the advertising and advertising, raising prices and buying stores effect on consumer demand of processed meat. Source: The research sample.

Items	Advertising & publicity		high prices affecting		sources of purchase		
	Affect	Not Affect	Affect	Not Affect	Grocery	mini market	supermarket
Less than 3000	38.3	61.7	93.6	6.4	14.9	46.8	38.3
3000: Less than 6000	28.1	71.9	71.9	28.1	19.3	40.4	40.4
6000: Less than 10000	37.5	62.5	80.0	20.0	22.5	35.0	42.5
10,000: Less than 18000	11.6	88.4	74.4	25.6	23.3	32.6	44.2
More than 18000	20.0	80.0	56.7	43.3	30.0	46.7	23.3
% Of the total sample	27.1	72.9	75.3	24.7	22.0	40.3	37.7

Table No. (4) Shows that the highest monthly expenditure average per capita for burgers, it is about 145 riyals, while the lowest monthly expenditure per capita is about 6 riyals for luncheon meat. It is noted that the highest monthly burger expenditure for the income category ranges between (3000-less than 6000) riyals per month, as it is about 194 riyals per month, while the lowest monthly burger expenditure for the income category (less than 3000 riyals) with average about 94 riyals per month. on other hand, the highest monthly luncheon-meat expenditure for the income category ranges between (6000-less than 10000) riyals per month, as it is about 19 riyals per month, while the lowest monthly luncheon-meat expenditure for the income categories (less than 3000 riyals) and more than 18000 riyals with average about zero riyals per month.

Family's monthly expenditure function on processed meat shows that the average monthly income of the family explains about 8% of the changes on processed meat expenditure for the research sample. The expenditure elasticity was about 0.51, so it clears if the income increases by 10% that leads to an increase on processed meat expenditure by about 5.1%, which indicates that processed meat is a necessary commodity for the Saudi family.

Table 4. Monthly average expenditure per capita on processed meat in riyals for the study sample. Source: The research sample

Items	families Average number	family Average number(persons)	monthly expenditure of processed meat Individual in riyals			
			luncheon-meat	burger	kebab	sausage
Less than 3000	84	2	0	94	44	20
3000: Less than	100	4	3	194	104	19
6000: Less than	70	5	19	164	163	24
10000: Less than	75	5	10	132	120	12
More than 18000	55	3	0	140	168	7
Average		4	6	145	120	16

3.5. The results of the statistical estimation of the consumption of fresh processed red meat and Poultry meat:

This section deals with the factors affecting the consumption of both fresh and processed red meat and poultry meat in both linear and logarithmic forms during the period (2018-2019) and its estimation using the Original least squares method (OLS). The best results were both in statistical and economic terms. The primary data that could be collected through a questionnaire collected during the period (1/10 / 2018-1 / 5/2019) was randomly assigned to a sample randomly from Saudi and non-Saudi families in Al-Ahsa governorate, the questionnaire was subject to scientific evaluation and verification of its validity and stability. The results were as follows: -

3.5.1. The most important factors affecting the consumption of fresh red meat:

This part includes the econometric estimation of factors affecting the amount of fresh red meat consumed, which includes both the price per kilogram of fresh meat, the number of family members, and household income. Table (5) showed that,the increase in the price of one kilogram of fresh red meat by 1 SR lead to a decrease in the consumption amount by 0.014 kg.In addition, the study cleared that,the increase in income by 1 SR led to increases the consumption amount by 0.0006 kg, and every increase in the families number of members by one person increases the consumption of fresh red meat by 0.06 kg. The R^2 value showed that, about 30% of the changes in the fresh meat consumption quantity occur due to changes in both the price, the family number members and family income. The price elasticity of demand was estimated at about -0.27 (less from the correct one), which means that the demand is inelastic for fresh red meat. The income elasticity was about 0.66 (positive and less than the correct one), that means the fresh red meat is a necessary commodity for Al-Ahsa Governorate families.

3.5.2. The most important factors affecting the consumption of processed red meat:

Table (5) indicated that, the most important factors affected the processed meat consumption were the price of fresh red meat, the price of processed meat, and advertising. Based on the results, although the price estimated is not statistical significant but it considers an important factor affecting in consumption depending on economic logic, so if the price of fresh red meat increase by 1 SR lead to an increase in the consumption amount of processed meat by 0.30 kg. On other hand, Fresh meat and processed meat are among the alternative commodities. In addition, every increase in the price of processed meat by 1 SR leads to an increase in the consumption amount of processed meat by 7.32 kg. It also found that, there was no significant effect of advertising on the consumption of processed meat for the families of the study sample. The statistical significance of the model proved, as F value was about 26.47 and R^2 was about 0.45, which explained that 45% of the changes in the consumption quantity of processed meat due to the effect of each of the price per kg of fresh meat and advertising.

3.5.3. The most important factors affecting the consumption of poultry meat:

Equation (3) in Table (5) showed the most important determinants of poultry meat consumption were the fresh red meat price, the impact of the housing site consumption, and the impact of advertising. It was found that every increase by 1 SR in the price per kilogram of fresh red meat lead to an increase in the poultry meat consumption by 1.04 kg. Which was consistent with the economic logic

Table 5. Estimating the most important factors determining the consumption of different meat using (OLS).Source: The research sample.

R^2	F	The Equation	variable	Equation Number
0.30	13.9	$Y\hat{}_1=0.85 - 0.014X_1+0.0006X_5+ 0.06X_4$ (-1.58) (5.00) (2.72)	Fresh Red meat	1
0.45	26.5	$Y\hat{}_2 = -14.6 + 0.3\ X_1+ 7.3\ X_2 + 1.87D_1$ (1.3) (7.9) (0.19)	processed meat	2
0.15	5.67	$Y\hat{}_3 = 90.23 +1.04\ X_1 - 6.1D_1 - 27.9\ D_2$ (2.87)(-0.36)(-1.8)	poultry meat	3

Where:
Y1: the amount of fresh meat consumed in kg
Y2: the amount of processed meat consumed in kg.
Y3: the amount of Poultry meat consumed in kg
X1: the price of kilograms of fresh red meat in riyals per kilogram.
X2: the price of kilograms of processed meat in riyals per kilogram
X3: the price of kilograms of poultry meat in riyals per kilogram
X4: the number of family members.
X5: family income in riyals.
D1: a qualitativevariable that reflects the effect of advertising on consumption, where it takes value 1 for effect and zero value for non-impact consumption.
D2: a qualitativevariable that reflects the effect of location of housing on consumption, where it takes the value of 1 for the urban location and the value 0 for the other location.
R^2: the value of the coefficient of determination.
F: indicating the calculated F value
The values between brackets refer to the calculated T value.

because they were two alternative commodities. While there was non-significant impact of the advertisement on the poultry meat consumption for the study sample. However, there was no significant impact on the housing location. The significance of the whole model proved and R^2cleared that about 15% of the changes in the white meat consumption amounts were due to the factors mentioned previously, while the rest of the changes were due to other factors not taken into account.

The study concluded that, although both processed and poultry meat is good alternatives to fresh red meat but the decreasing in their prices compared to fresh meat do not affect to the consumption amount consumed. In addition, the income has the largest impact. while the fresh red meat price per kilogram effects on the consumption of processed and poultry meat) which is consistent with the taste of the consumer in the Kingdom of Saudi Arabia, which depends in its food culture on its preference for the consumption of fresh meat than processed). [8]

4. CONCLUSION

According to the previous research results, the study recommends based on the importance of meat consumption, especially as it is a necessary commodity in terms of food in the Kingdom, and this is done through: the study recommends the following:

- Working to encourage investment in animal production outside the Kingdom in promising countries such as Africa, especially in light of the shortage of water resources in the Kingdom.
- The study showed no effect of advertising on the processed meat demand, Therefore, the study recommended encourage more studies in advertising and marketing.
- Encourage more studies about processed meat because of the shortage and lack of economic studies regarding the processed meat economics in Saudi Arabia

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الملخص العربي

محددات استهلاك اللحوم الطازجة والمصنعة في المملكة العربية السعودية

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تعتبرا للحوم الطازجة من أهم مكونات الأمن الغذائي في المملكة العربية السعودية . ولقد استهدف البحث دراسة محددات استهلاك اللحوم الطازجة والمصنعة في المملكة العربية السعودية. اعتمدت الدراسة على طرق التحليل الإحصائي الوصفي والكمي. وذلك بالاعتماد على البيانات الثانوية والأولية ، من خلال عينة عشوائية من أسر محافظة الإحساء حيث أنفقت الأسرة أعلى إنفاق مقارنة بجميع محافظات المملكة العربية السعودية بنحو ١٠٪ في عام ٢٠١٨ ، و بلغ الإنفاق على الغذاء حوالي ١١٪ من إجمالي دخل الأسرة. وخلصت الدراسة إلى أنه بالرغم من أن اللحوم المصنعة ولحوم الدواجن تعتبر بدائل جيدة للحوم الحمراء الطازجة ، إلا أن تخفيض أسعارها مقارنة باللحوم الطازجة لا يؤثر على الكمية المستهلكة. كما أظهرت الدراسة أن دخل الأسرة له التأثير الأكبر على استهلاك اللحوم الحمراء وكذلك كميات اللحوم المصنعة المستهلكة ، ومن ناحية أخرى أوضحت الدراسة أن سعر اللحوم الحمراء الطازجة له تأثير كبير على استهلاك اللحوم المصنعة والدواجن.