



AN ECONOMIC STUDY OF THE ANIMAL PROTEIN PRODUCTS FROM DIFFERENT ANIMAL ACTIVITIES

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ABSTRACT

Animal protein products, such as red and white meat, eggs, fish and dairy, are complete proteins, meaning they provide all of the essential amino acids our body. The study aims mainly at estimation of the economic efficiency indicators of the animal protein products obtained from different sources (i.e., dairy, calf fattening, goats, rabbits, broiler, fish and eggs). The most important results of the study were summarized during the study period (2020-2022) as follows: (1) the average of the daily milk yield per milking cow is estimated at 25 kg/day, (2) The average of the total annual numbers of the births per farms is estimated at 4320 births per farm (3) The average total returns for the dairy farms, rabbit farms, the goats farms, the broiler farms, the fish farms and the layer farms are estimated at 1.659 million LE, 656.5 thousand, 861.9 thousands, 8.669 million, 2.219 million and 11.284 million LE, respectively. (4) The net profit of the animal protein unit produced from the products of goats, dairy, rabbit and fattened calves are the higher per each kg. In contrast the net profit of the animal protein unit produced from the products of broiler, egg, and fish are lower per each kg.

INTRODUCTION

Animal protein products, such as red and white meat, eggs, fish and dairy, are complete proteins, meaning they provide all of the essential amino acids our body needs and requirements. Animal products provide the highest-quality protein sources. The previous products contain higher quantities and more balanced proportions of amino acids relative to human tissues, compared with the plant food products (e.g., rice, wheat, corn, potato, vegetables, beans, peas, seeds and.. etc.) **Donker and Naik (1979)**. For example, beef contains 63-68% protein on the dry matter basis, but most staple foods of plant origin (except for legumes) have a protein content less than 12% (dry matter basis) and are deficient in most amino acids, including lysine, methionine, cysteine, tryptophan, threonine, and glycine. In addition, animal

protein also has health benefits. Certain animal protein sources are linked to a reduced risk of heart disease, improved cholesterol levels, and increased muscle mass **National Research Council (1994)**.

Problem of the Study

The animal production sector in Egypt depends on buffalo and native cattle to produce mainly the milk production. In addition, the sheep, goats, culling female and male's animals used to produce the meat production. The animal production sector is inefficient for the following reasons: (1) its strong concentration in the small farmers' category who do not own land or agricultural holdings. (2) The previous farmers own 17.3% of the cattle and 6% of the buffaloes. (3) 89% of the cattle and 75% of the buffaloes are found in the holdings of less than five acres. (4) 25%

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of the sheep and goats flocks are owned by landless farmers. (5) 82% of the sheep and 87% of the goats' flocks are found in holdings of less than five acres. Consequently, the supply of animal protein production cannot meet the animal protein consumption.

Objectives of the Study

The study aims mainly at estimation of the economic efficiency indicators of the animal protein products obtained from different sources (i.e., dairy, calf fattening, goats, rabbits, broiler, fish and eggs). In addition, the technical and production coefficients and information for the previously studied sources are determined and identified. As well as the economic efficiency measures for the main livestock, broiler, fish and egg products will be estimated and identified. The economic efficiency indicators of the animal protein products obtained from different sources will be discussed and compared.

Data Sources and Methodology

The field primary data conducted from different livestock activities *i.e.*, dairy and calf fattening), fish, broiler, goats, rabbits and egg farms using the rapid appraisal are used to accomplish the study objectives. The field primary data include: (1) the technical coefficients and information of the studied products and activities and (2) the quantities and the prices of the inputs and outputs for the studied products and activities. The field data have been collected from thirty-five pilot farms (i.e., five farms per activity) by the personal meeting using the enterprise budget and the livestock, goats, rabbits, fish, broiler and egg budgets have been used to: (1) estimate and calculate the economic efficiency measures for the studied activities (e.g., the total production costs per protein unit **Chow (1988)**, the gross margin above the variable costs per protein unit, the net profit per protein unit) **Chow (1988)**. (2) the

economic efficiency indicators of the animal protein products (e.g., the total production costs per unit **Brems Hans (1968)**, the gross margin above the variable costs per unit, the net profit per unit, the producer margin and the producer incentives will be calculated **Alpha (1984) and Gittinger (1948)**

RESULTS AND DISCUSSION

First: The Production and Technical Coefficients of the Studied Protein of Animal Products

The production and technical coefficients for the dairy, fattened calves, goats, rabbits, broiler, fish and eggs activities have been identified as follows:

The production and technical coefficients for dairy farms under the study

The averages of the technical and production coefficients for the studied dairy farms and rabbit are presented in Table 1. The main technical coefficients for the studied dairy farms are: (1) the average of the lactation period for the herd, the average numbers of the milking cows, the average of the dry cows, the average of the total dairy cows, the average of the culling rate of the milking cow and the average of the live weight of the culled cow are 365 days, 120 head, 30 head, 150 head, 20%, and 600 kg of live weight, respectively. (2) the average of the daily milk yield per milking cow, the average of the annual milk yield per cow, the average of the annual milk yield per herd, the average of the number of the calves, the average of the live weight per calf after three month age, the average of the dressing rate per culled dairy cow, the average of the protein ration in milk, and the average ratio of the protein ration in beef meat are 25 kg/day, 6000 kg/year, 1.095 ton/year, 150 kg/calf, 45%, 3.5% and 26%, respectively.

The production and technical coefficients and information for rabbit farms under the study

The main technical coefficients for the studied rabbit farms are: (1) the average of the total numbers of the females, the average of the total numbers of the males, average of the culling rate of females rabbit, average of the annual litters per female, average of the annual births per litter, average of the total annual numbers of the births per farms, average of the marketing live weight per rabbit and average of the feed conversion rate are 120 female, 18 male, 33%, 6 litters, 6 births/litter, 4320 births per farm, 2 kg live weight and 3.1 kg feed/kg live weight, respectively. (2) average of the mortality rate for the female or male rabbit, average of the mortality rate for the births, average of the weaning age of the births, average period between the two births, average of the buildings costs of the farm, average of the dressing rate of rabbit and the average protein rate in rabbit meat are 3%, 8%, 35 day, 55 day, 150000 LE, 55% and 21%, respectively.

The production and technical coefficients for fattening calves farms under the study

The main technical coefficients for the studied fattening calves farms are: (1) the average of the total numbers of the fattened calves per farms, the average of starting live weight per calf, average of the marketing live weight per sold calf, average of the total live weight growth per fattened calf, average of the fattening period, average purchasing price per calf and average selling price per fattened calf are 150 calves, 225 kg live weight, 450 kg live weight, 225 kg live weight, 180 days, 140 LE/kg live weight and 120 LE/kg live weight, respectively. (2) average value of the building, average value of the land, average of the concentrated feed intake, average fodder feed intake, average hay feed intake, average of the equipment costs,

average span life of the farm, average dressing rate per fattened calf, and the average protein rate in beef meat are 350 000 LE/farm, 500000 LE, 5 kg/day/head, 5kg/ day/head, 3kg/day/head, 80000 LE, 30 year, 45% and 26%, respectively.

The production and technical coefficients for goats farms under the study

The main technical coefficients for the studied goats farms are: (1) the average of the total numbers of the female goats per farm, the average of the male goats per farm, average of the total goats per farm, average number of the litters per female per year, average number of births per litter per female, average marketing live weight per births, average live weight for culled goat and average culling rate per female goat are 60 heads, 6 heads, 66 heads, 2 litters, 1.5 births, 25 kg live weight, 45 kg live weight and 33%, respectively. (2) average quantity of 14% protein feed intake, average quantity of green fodder intake, average quantity of strew intake, average lactation period, average daily milk yield, average quantity of manure per goat per year, average dressing rate per culled goat, and the average protein rate in goat meat are 0.75 kg/day, 5 kg/day/head, 0.75 kg/day/head, 180 day, 0.5 kg/female goat, 4 cubic meter, 50% and 27.1%, respectively.

The production and technical coefficients for broiler farms under the study

The main technical coefficients for the studied broiler farms are the average numbers of the broiler per farm, the average feed conversion rate, average mortality rate per farm, average number of lots per year, average starting feed ratio, average growing feed ratio, average finishing feed ratio, average marketing live weight per broiler, average dressing rate per broiler and the average protein rate in broiler meat are 20000 one day old chick, 1.6 kg/kg, 5%, 5.5 lot/year, 0.2%, 0.3%, 0.5%, 1.65 kg live weight, 75% and 19%, respectively.

Table 1. The averages technical and production coefficients for the sample of rabbit and dairy farms under the study

Rabbit			Dairy		
Item	Unit	Value	Item	Unit	Value
No. of the female rabbits	No.	120	lactation period	Day	365
No. of the male rabbits	No.	18	milking cows	Cow	120
culling rate	(%)	33%	dry cows	Cow	30
average litters per year	No.	6	total cows	Cow	150
average births per litter	No.	6	culling rate	%	20%
total of births per year	No.	4320	live weight for culled cow	kg	600
average marketing live weight	kg of live weight	2	average milk yield	kg/cow	25
feed converge rate	kg of live weight	3.1	milk quantity per herd	kg/year	1095000
mortality rate per rabbit	(%)	3%	milk quantity per cow	kg/year	6000
mortality rate per births	(%)	8%	No. calves	Calf	150
average weaning age	Day	35	calf live weight	Kg	180
average period between two births	Day	55	dressing rate/culled cow	(%)	45
costs of buildings	LE	150000	protein ratio in milk	(%)	3.5
dressing rate	(%)	55.00%	protein ratio in meat	(%)	26
protein ratio in meat	(%)	21.0%			

Source: compiled and calculated from the selected studied sample.

Table 2. The technical and production coefficients for the sample calves and goats' farms under the study

Fattened			Goats		
Item	Unit	Value	Item	Unit	Value
No. fattened calves	No.	150	No. of female goats	Head	60
starting live weight	kg of live weight	225	No. of male goats	Head	6
marketing live weight	kg of live weight	450	total goats	Head	66
total live weight growth	kg of live weight	225	No. of litters per year	Litter	2
fattening period	Day	180	average births per litter	No.	1.5
daily growth rate	kg/day	1.25	average marketing live weight per births	kg of live weight	25
purchase price	kg of live weight	140	average live weight for culled goat	kg of live weight	45
selling price	kg of live weight	120	culling rate	%	33%
value of building	LE	350000	quantity of 14% protein feed intake	kg/day	0.75
value of land	LE	500000	quantity of green fodder intake	kg/day	5
average concentrated feed intake	kg/day/head	5	quantity of strew intake	kg/day	0.75
average fodder feed intake	kg/day/head	5	lactation period	Day	180
average hay feed intake	kg/day/head	3	daily milk yield	kg/day	0.5
equipment	LE	80000	quantity of manure per goat	cubic meter	4
span life	Year	30	dressing rate/culled goat	(%)	50
dressing rate/calf	(%)	45	protein ratio in meat	(%)	27.1
protein ratio in meat	(%)	26			

Source: compiled and calculated from the selected studied sample

Table 3. The technical and production coefficients for the sample broiler, fish and egg farms under the study

Broiler			Fish			Layers		
Item	Unit	Value	Item	Unit	Value	Item	Unit	Value
No. of broiler	No.	20000	No. of ponds	No.	4	No. of layer houses	No.	3
feed conversion rate	Kg	1.6	pond scale	m ³	250	the house scale	Layer	18000
mortality rate	(%)	5%	No. of fry/pond	000 fries	25	feed intake per layer	gram/day	110
No. of lots	No.	5.5	mortality rate	(%)	1.5	egg rate per layer	egg/year	280
starting feed ratio	(%)	0.2	No. of marketed fish	Thousand	98.5	mortality rate	(%)	12%
growing feed ratio	(%)	0.3	marketing live weight per fish	Kg	0.5	marketing live weight per spent-layer	kg of live weight	2.5
finishing feed ratio	(%)	0.5	total marketed live weight	Ton	49.25	costs per house	LE	250000
average marketing live weight	Kg	1.65	feed conversion rate	kg/kg	1.7	dressing rate	(%)	75
dressing rate	(%)	75.00	condensation rate	kg/m ³	49.25	protein ratio in meat	(%)	29.7
protein ratio in broiler meat	(%)	19.0	protein ratio in fish meat	%	26.0%	protein ratio in egg	(%)	7.5

Source: Compiled and calculated from the selected studied sample.

The production and technical coefficients for fish farms under the study

The main technical coefficients for the studied fish farms are the average numbers of the ponds per farm, the average pond scale, average number of fish fry per pond, average mortality rate, average number of marketed fish per farm, average marketing live weight per fish, average total marketed live weight per farm, average feed conversion rate, average condensation rate and the average protein rate in fish meat are 4 ponds, 250 cubic meter of water, 25 thousand of fish fry per pond, 1.5%, 98.5 thousand fish, 0.5 kg, 49.25 ton, 1.7 kg/kg, 49.25 kg of fish per one cubic meter of water and 26%, respectively.

The production and technical coefficients for the studied layers farms

The main technical coefficients for the studied egg farms are the average numbers of layer houses per farm, the average house scale, average feed intake per layer, average mortality rate, average egg rate per layer,

average marketing live weight per spent-layer, average total costs per house, average dressing rate for spent-layer, average protein rate in hen meat and the average protein rate in egg are 3 houses, 18000 layers, 110 gram/day/layer, 12%, 280 egg/layer/ year, 2.5 kg live weight, 250000 LE/house, 75%, 29.7 and 7.5%, respectively.

Returns and Costs Structure for the Studied Animal Products

The total returns and costs structure and items for the dairy, fattened calves, goats, rabbits, broiler, fish and eggs activities have been identified and discussed in Tables 4, 5, 6, 7, 8, 9 and 10.

The total returns and costs structure for the studied dairy farms

The total returns and costs items for the studied dairy farms are presented in Table 4. The results in the table indicate: (1) The average total return for the dairy farms is estimated at 1.659 million LE where the milk, calves culling and manure sales is

Table 4. Returns and costs for the sample of dairy farms under the study

Items	Unit	Quantity	price	Value	(%)
returns:					
milk sales	Kg	1095000	12.00	13140000	79.2
calves' sales	kg live weight	27000	85	2295000	13.8
culling sales	kg live weight	18000	60	1080000	6.5
manure sales	cubic meter	543.56	150	81534	0.5
total returns				16596534	100.0
variable costs:					
concentrated feed:					
high yield cows	ton	292	11225	3277700	28.7
middle yield cows	ton	43.8	11225	491655	4.3
dry cows	ton	32.85	11225	368741	3.2
Calves	ton	36.45	11225	409151	3.6
Strew	ton	506.25	2200	1113750	9.8
green fodder	ton	1262.9	2500	3157250	27.6
culling costs	No.	30	35000	1050000	9.2
Labor	Man/month	60	3500	210000	1.8
electricity	k.wat/year	6000	0.65	3900	0.0
veterinary service costs	Month	12	3500	42000	0.4
management	Month	12	6000	72000	0.6
drugs & vaccinations	LE/head	150	950	142500	1.2
total variable costs	LE/head			10338648	90.5
fixed costs:					
depreciation of dairy herd	Head	150	35000	1050000	9.2
depreciation of dairy houses	LE/year	1	362400	7248	0.1
depreciation of building	LE/year	1	827718	16554	0.1
depreciation of milking machines	LE/year	5	15000	7500	0.1
maintenance	LE/year			2380	0.0
total fixed costs	LE/farm			1083683	9.5
total costs	LE/farm			11422330	100.0

Source: Compiled and calculated from the selected studied sample.

estimated at 79.2%, 13.8%, 6.5% and 0.5% of the total returns, respectively. (2) The average total costs for the dairy farms are estimated at 1.142 million LE where the variable and the fixed costs are estimated at 90.5% and 9.5% of the total costs, respectively. (3) The costs of concentrated feed for the high yield cows and the green fodder for the dairy herd are the dominant variable costs (i.e., 28.7% and 27.6% of the total costs, respectively).

Returns and costs structure for the sample of rabbit farms under the study

The total returns and costs items for the studied rabbit farms are presented in Table 5. The result in the table indicates: (1) The average total returns for the rabbit farms is estimated at 656.5 thousand LE where the male and female births, female births for breeding culling and manure returns is estimated at 41.5%, 20.7%, 36.2%, 0.8 and 0.8% of the total returns, respectively. (2) the average total costs for the rabbit farms is estimated at 515.9 thousand LE where the variable and the fixed costs are estimated at 90.9% and 9.1% of the total costs, respectively. (3) The costs of feed intake for the births, feed intake for the births and the female rabbit culling are the dominant variable costs (i.e., 33.7%, 15.7% and 15.4% of the total costs, respectively).

Returns and costs structure for the sample of fattening calves farms under the study

The total returns and costs items for the studied fattened calves' farms are presented in Table 6. The results in the table show: (1) The average total returns for the fattened calves farms is estimated at 8.126 million LE where the fattened calves, manure and sacks sales are estimated at 99.7%, 0.2% and 0.1% of the total returns, respectively. (2) The average total costs for the fattened calves' farms are estimated at 7.412 million LE where the variable and the fixed costs

are estimated at 99.6% and 0.4% of the total costs, respectively. (3) The costs of calves' purchases and concentrated feed for the fattened calves' farms are the dominant variable costs (i.e., 56.9% and 31% of the total costs, respectively).

Returns and costs structure for the sample of goats farms under the study

The total returns and costs items for the studied goat's farms are presented in Table 7. The result in the table indicates: (1) The average total returns for the goats' farms is estimated at 861.9 thousand LE where the births return, milk sales, culling sales and manure returns is estimated at 62.7%, 9.4%, 12.6% and 15.3% of the total returns, respectively. (2) The average total costs for the goats' farms are estimated at 746 thousand LE where the variable and the fixed costs are estimated at 99.1% and 0.9% of the total costs, respectively. (3) The costs of concentrated feed, the green fodder and replacement (culling) for the goats' herd are the dominant variable costs (i.e., 23.4%, 40.4% and 14.6% of the total costs, respectively).

Returns and costs structure for the sample of broiler farms under the study

The total returns and costs items for the studied broiler farms are presented in Table 8. The result in the table shows: (1) The average total returns for the broiler farms is estimated at 8.669 million LE where the broiler, manure and sacks returns are estimated at 99.4%, 0.1%, and 0.2% of the total returns, respectively. (2) The average total costs for the broiler farms is estimated at 7.274 million LE where the variable and the fixed costs are estimated at 98.5% and 1.5% of the total costs, respectively. (3) The costs of concentrated feed, one day old chicks and drugs for the broiler farms are the dominant variable costs (i.e., 65.3%, 15.1% and 7.6% of the total costs, respectively).

Table 5. Returns and costs items for the sample of rabbit farms under the study

Item	Unit	Quantity	Price (LE)	Value (LE)	(%)
returns					
male births returns	Kg	4190	65	272376	41.5
female births returns	Kg	2095	65	136188	20.7
female births returns for breeding	No.	1080	220	237600	36.2
manure returns	Ton	9.59	550	5276	0.8
culling returns	Kg	92	55	5060	0.8
Total returns per farm	LE			656500	100
Costs					
variable costs:					
female culling	No.	360	220	79200	15.4
male culling	No.	108.0	140	15120	2.9
feed intake for rabbit	Ton	11.59	7000	81096	15.7
feed intake for births	Ton	26.78	6500	174096	33.7
drugs for rabbit	LE	120.0	40	4800	0.9
drugs for births	LE	4320	7	30240	5.9
electricity & water	Month	12	1050	12600	2.4
labor	Man day	12	3500	42000	8.1
miscellaneous	LE	12	2500	30000	5.8
total variable costs	LE			469152	90.9
fixed costs					0.0
female rabbits	LE	120.0	220	8800	1.7
male rabbits	LE	18.0	65	390	0.1
Buildings	LE	1	150000	5000	1.0
females batteries costs	No.	120	170	4080	0.8
males batteries costs	No.	17	120	411	0.1
births batteries costs	No.	1080	130	28080	5.4
total fixed costs	LE			46761	9.1
total costs	LE			515913	100.0
total returns	Unit	quantity	price (LE)	value (LE)	(%)
male births returns	Kg	4190	65	272376	41.5
female births returns	Kg	2095	65	136188	20.7
female births returns for breeding	No.	1080	220	237600	36.2
manure returns	Ton	9.59	550	5276	0.8
culling returns	Kg	92	55	5060	0.8

Source: compiled and calculated from the selected studied sample.

Table 6. Returns and costs Item for the sample of fattened calves' farms under the study

Return	Unit	Quantity	Price	Value	(%)
calves sales	kg live weight	67500	120.0	8100000	99.7
manure sales	cubic meter	87.8	200	17550.75	0.2
sacks sales	Sacks	2700	3	8100	0.1
total returns	LE			8125651	100.0
variable costs					
claves purchases	Head	33750	125	4218750	56.9
14% protein feed	Kg	135000	17	2295000	31.0
Straw	Kg	135000	2.2	297000	4.0
Hay	Kg	81000	4	324000	4.4
vitamins and minerals	Package	15	2000	30000	0.4
total costs of feed	LE	351015		2946000	39.7
electricity	Month	6	500	3000	0.0
water	Month	6	250	1500	0.0
labor	man/month	30	4000	120000	1.6
management	Month	12	6000	72000	1.0
vaccinations & drugs	Head	150	150	22500	0.3
total variable costs	LE			7380750	99.6
fixed costs					0.0
depreciation of building	LE			11667	0.2
depreciation of land	LE			16667	0.2
depreciation of equipment	LE			2666.7	0.0
total of fixed costs	LE			31000	0.4
total costs	LE/farm			7411750	100.0

Source: Compiled and calculated from the selected studied sample.

Table (7). the returns and costs Item for the sample of goats' farms under the study

Item	Units	Quantity	Price (LE)	Value (LE)	(%)
Returns					
births returns	no.	4500	120	540000	62.7
milk sales	Kg	5400	15	81000	9.4
culling sales	Kg	990	110	108900	12.6
manure	m3	264	500	132000	15.3
total returns	LE			861900	100.0
Variable costs					
concentrated feed	Kg	12045	14.50	174653	23.4
green fodder	Ton	120.5	2500	301125	40.4
strew and roughage	Ton	18.07	2100	37942	5.1
drugs and vit. Services	Head	66	500	33000	4.4
replacement	Head	990	110	108900	14.6
labour	Man day	24	3500	84000	11.3
total variable costs	LE			739619	99.1
fixed costs					0.0
female goats depreciation	Head	66	110	2420	0.3
house depreciation	LE	1	50000	2500	0.3
equipment depreciation	LE	1	15000	1500	0.2
total fixed costs	LE			6420	0.9
total costs	LE			746039	100.0

Source: Compiled and calculated from the selected studied sample.

Table 8.The returns and costs Item for the sample of broiler farms under the study

Item	Unit	Quantity	Price (LE)	Value (LE)	(%)
main return					
broiler	kg live weight	172425	50	8621250	99.4
by-product returns					
manure	m3	72.6	500	36300	0.4
sacks	no.	5808	2	11616	0.1
total returns	LE			8669166	100.0
variable costs					
one day old chicks	Chick	110000	10	1100000	15.1
feed					
starting	Ton	58	17000	987360	13.6
growing	Ton	87.12	16500	1437480	19.8
finishing	Ton	145.20	16000	2323200	31.9
total feed	Ton	290.40		4748040	65.3
drugs	Chick	110000	5	550000	7.6
vit. Services	Month	12	6000	72000	1.0
labor	Man day/month	24	4500	108000	1.5
management	Month	12	8000	96000	1.3
electricity & water	Chick	110000	2	220000	3.0
straw	Ton	60	3500	210000	2.9
miscellaneous	Month	12	5000	60000	0.8
total variable costs	LE			7164040	98.5
fixed costs	LE				
depreciation for building & equipment	LE			50000	0.7
maintenance	LE			10000	0.1
Interest	LE			50000	0.7
total fixed costs	LE			110000	1.5
total costs	LE			7274040	100.0

Source: Compiled and calculated from the selected studied sample.

Technical coefficient, returns and costs structure for the studied fish farms

The total returns and costs Item for the studied fish farms are presented in Table 9. The results in the table show: (1) The average total returns for the fish farms are estimated at 2.219 million LE where the fish and sacks returns are estimated at 99.8% and 0.2% of the total returns, respectively. (2) The average total costs for the fish farms are estimated at 1.854 million LE where the variable and the fixed costs are estimated at 97.5% and 2.5% of the total costs, respectively. (3) The costs of concentrated feed and labor for the fish

farms are the dominant variable costs (i.e., 82.5% and 8.7% of the total costs, respectively).

Returns and costs structure for the studied layers (egg) farms

The total returns and costs Item for the studied layer farms are presented in Table 10. The results in the table shows: (1) The average total returns for the layer farms is estimated at 11.284 million LE where the egg return, spent-layer return and manure return are estimated at 85.2%, 14.0% and 0.8% of the total returns, respectively. (2) the average total costs for the layer farms is estimated at 9.176 million LE where the variable and the

Table 9. The returns and costs Item for the studied fish farms

Item	Unit	Quantity	Price (LE)	Value (LE)	(%)
fish returns	Ton	49.25	45000	2216250	99.8
sacks returns	Suck	1700	2	3400	0.2
total returns	LE			2219650	100.0
total costs					
Variable costs					
fries	thousands	100	90	9000	0.5
concentrated Feed	Ton	85	18000	1530000	82.5
management	Month	12	8000	96000	5.2
labor	Month	36	4500	162000	8.7
electricity	Month	12	300	3600	0.2
drugs and vit. Services	Month	12	100	1200	0.1
Transportation	LE	1	500	500	0.0
miscellaneous	LE	1	5000	5000	0.3
total variable costs	LE			1807300	97.5
fixed costs					
depreciation of equipment	LE	1	200000	20000	1.1
depreciation of building	LE	1	800000	26666.667	1.4
total fixed costs	LE			46666.667	2.5
total costs	LE			1853966.7	100.0

Source: Compiled and calculated from the selected studied sample

Table 10. The technical coefficients, the returns and costs Item for the studied layers farms

Item	Unit	Quantity	Price (LE)	Value (LE)	(%)
egg returns	Egg	4435200	2.17	9609600	85.2
manure returns	Ton	180.68	500	90338	0.8
spent-layer returns	kg of live weight	39600	40	1584000	14.0
total returns	LE			11283938	100
variable costs					
layer broilers	LE/broiler	18000	80	1440000	15.7
concentrated Feed	LE/ton	722.7	9500	6865650	74.8
labor	Man day/month	36	3500	126000	1.4
drugs	LE/broiler	18000	12	216000	2.4
vit. Services	Month	12	4000	48000	0.5
miscellaneous	LE/broiler	18000	20	360000	3.9
total variable costs	LE			9055650	98.7
fixed cost					
depreciation of batteries	LE	150	3500	105000	1.1
depreciation of equipment	LE	150	250	7500	0.1
depreciation of buildings	LE	1	250000	8333	0.1
total fixed costs	LE			120833	1.3
total costs	LE			9176483	100.0

Source: Compiled and calculated from the selected studied sample.

fixed costs are estimated at 98.7% and 1.3% of the total costs, respectively. (3) The costs of concentrated feed and layer broilers for the layers farms are the dominant variable costs (*i.e.*, 74.8% and 15.7% of the total costs, respectively).

Third: Measures of the Economic Efficiency for the Studied Animal Products

The economic efficiency measures for the dairy, fattened calves, goats, rabbits, broiler, fish and eggs activities have been identified and discussed in Tables 11 and 12.

The economic efficiency measures for the dairy fattened and goats farms

The economic efficiency measures for the studied dairy, fattened calves and goats' farms are presented in Table 11. For the dairy farms, the main results shown in the table are: (1) The total costs per kg of milk and per milking cow are estimated at 10.43LE and 76149 LE, respectively. (2) the gross margin per kg of milk and per milking cow is estimated at 5.77 LE and 42124 LE, respectively. (3) The net profit per kg of milk and per milking cow is estimated at 4.78 LE and 34900 LE, respectively. (4) The producer margin, the producer incentive and net profit per spent LE are estimated at 1.57LE, 40% and 0.46 LE, respectively.

For the fattened calves' farms, the main results shown in the table are: (1) the total costs per calf, per kg of growth and per kg of live weight are estimated at 49411.7 LE, 109.8 LE and 219.6 LE, respectively. (2) The net profit per calf, per kg of live weight and per kg of growth are estimated at 4940 LE, 11 LE and 22 LE, respectively. (3) The producer margin and the producer incentive are estimated at 10.2 LE and 9.1%, respectively.

For the goats' farms, the main results shown in the table are: (1) The total costs

per head, the gross margin per head are estimated at 11303.6 LE and 1852.7 LE, respectively. (2) The net profit per head, per kg of live weight, the producer incentive and margin are estimated at 1755.5 LE, 25.7 LE, 21.5% and 15.5 LE, respectively.

The economic efficiency measures for the rabbit, broiler, fish and layer farms

The economic efficiency measures for the studied dairy, fattened calves and goats' farms are presented in Table 12. For the rabbit farms, the main results shown in the Table are: (1) The total costs per rabbit mother and per one rabbit births are estimated at 1561 LE and 4299.3 LE, respectively. (2) The gross margin per rabbit mother and per one rabbit births are estimated at 1561 LE and 43.4 LE, respectively. (3) The net profit per rabbit mother and per one rabbit births are estimated at 1171.6 LE and 32.5 LE, respectively.

For the broiler farms, the main results shown in the table are: (1) The total costs per broiler and per kg of live weight are estimated at 66.13 LE and 42.19 LE, respectively. (2) The gross margin per broiler and per kg of live weight are estimated at 13.68 LE and 8.73 LE, respectively. (3) The net profit per broiler and per kg of live weight is estimated at 12.68 LE and 8.09 LE, respectively. (4) The producer margin, producer incentive and the net profit per spent LE are estimated at 7.81, 16.2% and 0.19 LE, respectively.

For the fish farms, the main results shown in the table are: (1) The total costs per fry unit and per ton of live weight are estimated at 18539.7 LE and 37644 LE, respectively. (2) The gross margin per ton of fish and per one of fish fry are estimated at 8372.6 LE and 4.1 LE, respectively. (3) the net profit per fry unit, per ton of fish and per spent LE is estimated at 3656.8 LE, 7425 LE and 0.20 LE/ LE, respectively. (4) The producer margin per ton of fish and producer incentive are estimated at 7356% and 16.5%, respectively.

Table 11. The economic efficiency measures of the studied dairy, fattened calves and goats farms under the study

Measure	Unit	Value (LE)
Dairy		
Total cost per kg of milk	LE/kg	10.43
Total cost per milking cow	LE/cow	76149
Gross margin per farm	LE	6318652
Gross margin per kg of milk	LE/kg	5.77
Gross margin per milking cow	LE/cow	42124
Net profit per farm	LE	5234969
Net profit per kg of milk	LE/kg	4.78
Net profit per milking cow	LE/cow	34900
Producer margin	LE	1.57
Producer incentive	(%)	40
Net profit per spent LE	LE	0.46
Fattened calves		
Total costs/calf	LE/calf	49411.7
Total costs/ kg of live weight	LE/kg	109.8
Total costs/ kg of growth	LE/kg	219.6
Total Returns/kg of live weight	LE	120.8
Net profit/farm	LE	741049.0
Net profit/calf	LE/calf	4940.3
Net profit/kg of live weight	LE/kg	11.0
Net profit/kg of growth	LE/kg	22.0
Producer incentive	(%)	9.1
Producer margin	LE/kg	10.2
Goats		
Total costs per head	LE/Head	11303.6
Gross margin per farm	LE	122280.8
Gross margin per head	LE/head	1852.7
Net profit per farm	LE	115860.8
Net profit per head	LE/head	1755.5
Net profit per kg of live weight	LE/kg	25.7
Producer incentive	(%)	21.5
Net profit per spent LE	LE	15.5

Source: Compiled and calculated from the tables from 1-10

Table 12. The economic efficiency measures for the studied rabbit, broiler, fish and layer farms

Measure	Unit	Value (LE)
Rabbit		
Total cost per mother	LE	4299.3
Total cost per births	LE	119.4
Gross margin per farm	LE	187348.1
Gross margin per mother	LE	1561.2
Gross margin per births	LE	43.4
Net profit per farm	LE	140586.6
Net profit per mother	LE	1171.6
Net profit per births	LE	32.5
Broiler		
Total cost per chick	LE/chick	66.13
Total cost per kg of live weight	LE/kg	42.19
Gross margin per chick	LE/chick	13.68
Gross margin per kg of live weight	LE/kg	8.73
Net profit per chick	LE/chick	12.68
Net profit per kg of live weight	LE/kg	8.09
Producer margin	LE/kg	7.81
Producer incentive	(%)	16.2
Net profit per spent LE	LE	0.19
Fish		
Total cost per fry unit	LE/unit	18539.7
Total cost per ton live weight	LE	37644.0
Gross margin per ton of fish	LE	8372.6
Gross margin per ton of fry	LE	4.1
Net profit per fry unit	LE	3656.8
Net profit per ton of fish	LE/unit	7425.0
Net profit per spent LE	LE	0.20
Producer margin	LE	7356.0
Producer incentive	(%)	16.5
Egg (layer)		
Total costs per egg	LE	2.07
Total costs per layer	LE	509.80
Total Return per egg	LE	2.54
Total Return per layer	LE	626.89
Gross margin per farm	LE	2228287.50
Gross margin per egg	LE	0.50
Gross margin per layer	LE	123.79
Net profit per farm	LE	2107454.17
Netprofit per egg	LE	0.48
Net profit per plate	LE	14.25
Net profit per layer	LE	117.08
Producer incentive	(%)	21.9
Net profit/spent LE	LE	0.23
Producer margin	LE	0.10

Source: Compiled and calculated from the tables 1-10

For the layer (i.e., egg) farms, the main results shown in the table are: (1) The total costs per egg and per layer are estimated at 2.07 LE and 509.8 LE, respectively. (2) The gross margin per egg and per layer is estimated at 0.5 LE and 123.8 LE, respectively. (3) The net profit per egg, per egg plate, per layer and per spent LE is estimated at .48 LE, 14.25 LE, 117.08 and 0.23 LE/ LE, respectively. (4) the producer margin per egg and producer incentive is estimated at 0.10 LE and 21.9%, respectively.

Fourth: The Economic Efficiency Measures for the Studied Animal Products

The technical coefficient and the economic efficiency measures for the animal protein products according to the studied dairy, fattened calves, goats, broiler, rabbit, fish and layer (egg) are presented in Tables 13 and 14.

The technical coefficients and the economic efficiency measures for the studied dairy, fattened calves and goats' products

The technical coefficient and the economic efficiency measures for the animal protein products according to the studied dairy, fattened calves and goats' farms are presented in Table 13. For dairy products and farms, the result in the table indicates that: (1) the ratio of animal protein in fresh milk, the average milk yield per cow and dressing ratio of beef meets per cow, the culling rate, live weight per culled cow and live weight per weaned calf are estimated at 3.5%, 6000 kg/cow, 45%, 20%, 600 kg and 180 kg, respectively. Consequently, the net quantity of beef yield per culled cow, the quantity animal protein in milk and in beef meat and in total are estimated at 135 kg / cow, 210 kg/cow, 35.1 kg/cow and 245.1 kg /cow, respectively. (2) Total costs per animal protein, net profit per animal protein and

gross margin per animal protein are 310.7 LE/kg, 142.39 LE/kg and 171.9 LE/kg, respectively.

The results in the table indicate that: (1) the dressing ratio for fattened calf, animal protein ratio in beef meat and the average live weight per fattened calf are estimated at 45%, 26% and 450 kg of live weight, respectively. Consequently, the beef meat quantity per fattened calf and the animal protein quantity per fattened calf are 202.5 kg and 52.65 kg/calf, respectively. (2) Accordingly, the total costs for the animal protein, the net profit for the animal protein and gross margin for the animal protein are estimated at 938.5 LE/kg, 93.83 LE/kg and 97.76 LE/ kg, respectively.

For goats' products and farms, the results in the table indicate that: (1) the dressing ratio for goat, animal protein ratio in goat meat, culling ratio in goats' herd and the average live weight per culled goat are estimated at 50%, 27.1%, 33% and 45 kg of live weight, respectively. Consequently, the goat's meat quantity per culled heads, goat's meat quantity per fattened goats and total goats' meat are estimated at 7.43 kg/head, 37.5 kg/head and 44.93 kg, respectively. (2) Accordingly, the total costs for the animal protein, the net profit for the animal protein and gross margin for the animal protein for goat meat are estimated at 928.45 LE/kg, 144.19 LE/kg and 152.18 LE/kg, respectively.

The technical coefficients and the economic efficiency measures for the studied broiler, rabbit, fish and layerproducts

The technical coefficient and the economic efficiency measures for the animal protein products according to the studied broiler, rabbit, fish and layer farms are presented in Table 14. For broiler products and farms, the results in the table indicate that: (1) The dressing ratio for broiler, animal protein ratio in broiler meat,

Table 13. The technical and economic efficiency measures for the animal protein according to the studied dairy, fattened and goats' farms

Economic measures	Unit	Value
Dairy		
Ratio of animal protein in milk	(%)	3.50
Milk yield / cow	Kg	6000.00
Dressing ratio of beef meat	(%)	45
The culling rate	(%)	20
Live weight per culled cow	Kg	600
Live weight per calf	Kg	180
Net beef yield / cow	Kg	135.00
Quantity of protein in milk	kg/cow	210.00
Quantity of protein in meat	kg/cow	35.10
Total protein	kg/cow	245.10
Total costs of animal protein	LE/kg	310.68
Total costs of animal protein	LE/gram	0.31
Net profit of animal protein	LE/kg	142.39
Net profit of animal protein	LE/gram	0.14
Gross margin for animal protein	LE/kg	171.87
Gross margin for animal protein	LE/gram	0.17
Fattened calves		
Dressing ration for calf	(%)	45.00
Animal protein ratio	(%)	26.00
Average live weight per head	Kg	450
Beef meat quantity/calf	Kg	202.50
Animal protein quantity/calf	Kg	52.65
Total costs of animal protein	LE/kg	938.49
Total costs of animal protein	LE/gram	0.94
Net profit of animal protein	LE/kg	93.83
Net profit of animal protein	LE/gram	0.09
Gross margin of animal protein	LE/kg	97.76
Gross margin of animal protein	LE/gram	0.10
Goats		
Dressing ratio in fattened goat	(%)	50.00
Animal protein ratio	(%)	27.10
Culling ratio	(%)	33
Live weight for culled goat	Kg	45
Meat quantity in culled heads	kg/head	7.43
Meat quantity in fattened goats	kg/head	37.50
Total meat quantity	kg	44.93
Animal protein in total meat	Kg	12.17
Total costs of animal protein	LE/kg	928.45
Total costs of animal protein	LE/gram	0.93
Net profit of animal protein	LE/kg	144.19
Net profit of animal protein	LE/gram	0.14
Gross margin of animal protein	LE/kg	152.18
Gross margin of animal protein	LE/gram	0.15

Source: Compiled and calculated from the tables from 1-12.

Table 14. The technical and economic efficiency measures for the animal protein according to the studied broiler, rabbit, fish and layer farms

Economic measures	Unit	Value
Broiler		
Dressing ratio in broiler	(%)	75
Animal protein ratio	(%)	19
Final live weight per broiler	Kg	1.65
Protein quantity per broiler	Kg	0.24
Total Costs of protein	LE/kg	281.24
Total costs of protein	LE/gram	0.28
Net profit of animal protein	LE/kg	53.9
Net profit of animal protein	LE/gram	0.05
Gross margin of animal protein	LE/kg	58.19
Gross margin of animal protein	LE/gram	0.058
Rabbit		
Protein ratio	(%)	21
Dressing ratio	(%)	55
Final live weight of rabbit	kg	2.0
Quantity of rabbit meat for births	Kg	39.6
Quantity of rabbit meat for rabbit mother	Kg	1.1
Total quantity for rabbit meat	Kg	40.7
Total protein quantity	Kg	8.55
Total costs for the protein	LE/kg	503.02
Total costs for the protein	LE/gram	0.50
Net profit of animal protein	LE/kg	137.07
Net profit of animal protein	LE/gram	0.14
Gross margin of animal protein	LE/kg	182.66
Gross margin of animal protein	LE/gram	0.18
Fish		
Dressing ratio	(%)	85
Protein ratio in fish	kg	0.26
Protein quantity in fish	kg	0.221
Total Costs of protein	LE/kg	170.3
Total costs of protein	LE/gram	0.170
Net profit of animal protein	LE/kg	33.6
Net profit of animal protein	LE/gram	0.034
Gross margin of animal protein	LE/kg	37.9
Gross margin of animal protein	LE/gram	0.037
Layer		
Protein ratio in egg	gram/egg	7.50
Protein ratio in layer meat	(%)	29.70
Dressing ratio for layer	(%)	75
Live weight per spent layer	kg	2.5
Quantity of layer meat	Kg	1.88
Protein quantity per egg/layer	kg/layer	2.10
Animal protein quantity per layer	kg/layer	0.56
Total animal protein quantity per egg & layer	kg	2.66
Total costs for egg & layer protein	LE/kg	191.88
Total costs for egg & layer protein	LE/gram	0.19
Net profit for egg & layer protein	LE/kg	44.07
Net profit for egg & layer protein	LE/gram	0.04
Gross margin for egg & layer protein	LE/kg	46.59
Gross margin for egg & layer protein	LE/gram	0.05

Source: Compiled and calculated from the tables from 1-12

the average live weight per broiler is estimated at 75%, 19% and 1.65 kg of live weight, respectively. Consequently, the broiler meat quantity per one broiler is 0.24 kg/broiler. (2) Accordingly, the total costs per kg of the broiler animal protein, the net profit for the animal protein and gross margin for the animal protein for broiler meat are estimated at 281.24 LE/kg, 53.9 LE/kg and 58.19 LE/kg, respectively.

For rabbit products and farms, the results in the table indicate that: (1) The dressing ratio for rabbit, animal protein ratio in rabbit meat and the average live weight per rabbit are estimated at 55%, 21%, and 2.0 kg of live weight, respectively. Consequently, the total rabbit meat quantity is 40.7 kg/rabbit mother. (2) Accordingly, the total costs per kg of the rabbit animal protein, the net profit for the animal protein and gross margin for the animal protein for rabbit meat are estimated at 503.02 LE/kg, 137.07 LE/kg and 182.66 LE/kg, respectively.

For fish product and farms, the results in the table indicate that: (1) The dressing ratio fish and animal protein ratio in fish meat are estimated at 85% and 26%, respectively. Consequently, the animal protein quantity per kg of fish is 0.221 kg. (2) Accordingly, the total costs per kg of the fish animal protein, the net profit for the animal protein and gross margin for the animal protein for fish meat are estimated at 170.3 LE/kg, 33.6 LE/kg and 37.9 LE/kg, respectively.

For egg and layer products and farms, the results in the table indicate that: (1) The protein ratio in egg and spent layer meat, and the final live weight per spent layer are 7.5 gram/egg, 29.7% and 2.5 kg of live weight. The dressing ratio for the spent

layer meat is 75%; Consequently, the animal protein quantity per kg of egg per layer is estimated at 2.1 kg of animal protein. The quantity of spent layer meat and animal protein are estimated at 1.88 kg and 0.56 kg (2) Accordingly, the total costs for the animal protein, the net profit for the animal protein and gross margin for the animal protein for the egg and spent layer meat are estimated at 191.88 LE/kg, 44.07 LE/kg and 46.59 LE/kg, respectively.

Sixth: Comparing the Economic Efficiency Measures for the Studied Animal Protein Products

Comparing the economic efficiency measures for the studied animal protein products is shown in Table 15. The main results in the table can be summarized as follows: (1) the animal protein unit produced from the products of fish, egg layer, broiler and dairy are the least total costs per kg. On the other hand the animal protein unit produced from the products of rabbit, goats and fattened calves are the larger total costs per kg. (2) The net profit of the animal protein unit produced from the products of goats, dairy, rabbit and fattened calves are the higher per each kg. In contrast the net profit of the animal protein unit produced from the products of broiler, egg, and fish are lower per each kg. (3) The gross margin of the animal protein unit produced from the products of rabbit, dairy, goats and fattened calves are the higher per each kg. In contrast the gross margin of the animal protein unit produced from the products of broiler, egg, and fish are the lower per each kg.

Table 15. Comparing the economic efficiency measures for the studied animal protein products

Economic measures	Unit	Dairy	Fattened calves	Goats	Rabbit	Broiler	Fish	Egg
Total costs of protein	LE/kg	310.68	938.49	928.45	503.02	281.24	170.33	191.88
net profit of animal protein	LE/kg	142.39	90.40	144.19	137.07	53.94	33.60	44.07
gross margin of animal protein	LE/kg	171.87	94.32	152.18	182.66	58.19	37.89	46.59

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الملخص العربي

دراسة اقتصادية لمنتجات البروتين الحيواني من أنشطة حيوانية مختلفة

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إن منتجات البروتين الحيواني مثل اللحوم الحمراء والبيضاء والبيض والأسماك ومنتجات الألبان، هي بروتينات كاملة، أي أنها توفر جميع الأحماض الأمينية الأساسية لجسمنا. وتهدف الدراسة بشكل رئيسي إلى تقدير مؤشرات الكفاءة الاقتصادية لمنتجات البروتين الحيواني التي يتم الحصول عليها من مصادر مختلفة (مثل الألبان وتسمين العجول والماعز والأرانب والفروج والأسماك والبيض). وتلخصت أهم نتائج الدراسة خلال فترة الدراسة (2020-2022) فيما يلي: (1) متوسط إنتاج الحليب اليومي لكل بقرة حلوب حوالي 25 كجم/يوم، (2) متوسط الولادات السنوية لكل بطن حوالي 4320 ولادة لكل مزرعة. (3) ويقدر متوسط العائد الإجمالي لمزارع الألبان ومزارع الأرانب ومزارع الماعز ومزارع الفروج والمزارع السمكية والمزارع البيضاء بحوالي 1.659 مليون جنيه، 656.5 ألف، 861.9 ألف، 8.669 مليون، 2.219 مليون، 11.284 مليون جنيه على الترتيب. (4) صافي الربح لكل وحدة بروتين حيواني يمكن الحصول عليها من منتجات الماعز والألبان والأرانب والعجول المسمنة هو الأعلى لكل كجم، على العكس وجد أن صافي الربح لكل وحدة بروتين حيواني يمكن الحصول عليها من منتجات الدجاج أو البيض والأسماك أقل لكل كجم.

الكلمات الاسترشادية: مؤشرات الكفاءة الاقتصادية والانتاجية للمنتجات الحيوانية، إجمالي تكاليف الإنتاج، الهامش الإجمالي، صافي الربح، وحدة بروتين.

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