



## Economic Analysis in a Small-Scale Farm Producing Rabbit for Meat Purposes in Argentina

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### ABSTRACT

Rabbits in Argentina are mostly produced by rural farmers who maintain small-scale operations for meat and complements other farm activities. The main meats consumed in Argentine are beef (46.1 kg/per capita/year), poultry (45.2 kg/per capita/year), pork (14.6 kg/per capita/year) and sheep (1.06 kg/per capita/year); respect to rabbit meat, not exceed 2 g/per capita/year. The objective of this study was to analyze the economic efficiency and feed cost of rabbit production for meat in a small-scale farm of Argentina. The global FCR was of 5.7, and an average of 15.9 kg/animal were required to produce live weight of slaughtered one rabbit of 2.85 kg. The average of rabbit price/feed price and the relation of rabbit meat price/feed price was of ratio was of 15.2 and 10.8 respectively. The global FCR worsens when the productivity values are lower than 2.5 animals/doe/month. The profit obtained for each commercialized rabbit was very low (USD 0.06/animal). Within the strategies to develop the productive chain of rabbit meat in Argentina, it should aim to stimulate the consumption habit promoting the high nutritional quality of the meat, improve the superior price ratio with respect to other meats such as chicken and pork.

## Arjantin'de Et Üretimi Amaçlı Tavşan Yetiştiriciliği Yapan Küçük Ölçekli Bir Çiftliğin Ekonomik Analizi

### MAKALE BİLGİSİ

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### ÖZ

Arjantin'de tavşan eti, çoğunlukla diğer çiftlik faaliyetlerini tamamlamak üzere küçük ölçekli tavşan yetiştiriciliği yapan kırsal çiftçiler tarafından üretilmektedir. Arjantin'de tüketilen başlıca etler; sığır (46.1 kg/kişi/yıl), kümes hayvanları (45.2 kg/kişi/yıl), domuz (14.6 kg/kişi/yıl) ve koyun (1.06 kg/kişi/yıl) eti olup tavşan eti için kişi başı yıllık tüketim 2 gr'ı geçmez. Bu çalışmanın amacı, Arjantin'de küçük ölçekli bir çiftlikte et üretimi için yapılan tavşan yetiştiriciliğinin ekonomik verimliliğini ve yem maliyetini analiz etmektir. Küresel bazda yem dönüştürme oranı (YDO) 5.7 olup, 2.85 kg canlı ağırlıkta kesilmiş bir tavşan üretmek için ortalama hayvan başına 15.9 kg yem gerekir. Tavşan fiyatı/yem fiyatı ortalaması ve tavşan eti fiyatı/yem fiyatı ilişkisi sırasıyla 15.2 ve 10.8 oranında olmuştur. Küresel YDO,

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retkenlik deęerleri 2.5 hayvan/gey/ay'dan dřk olduęunda ktleřir. Ticarileřtirilmiř her tavřan iin elde edilen kar ok dřkt (0,06 USD/hayvan). Arjantin'de tavřan etinin retken zincirini geliřtirme stratejileri iinde, etin yksek besin kalitesini teřvik ederek tketim alıřkanlıęını teřvik etmeyi, tavuk ve domuz eti gibi dięer etlere gre fiyat oranını iyileřtirmeyi amalamaktadır.

## Introduction

Rabbits (*Oryctolagus cuniculus*), in Argentina are mostly produced by rural farmers who maintain small-scale operations for meat and complements other farm activities. This specie was formerly raised in rural areas in pens or precarious cages, mainly for meat. In 1950 the first rabbit farms (Angora breed) began, raising the animals in cement hutches for the production of fur. Years later, the New Zealand White and Californian breeds were incorporated, which were characterized by having greater prolificacy; in this way, the first rearing systems were installed in wire cages under confinement. Although, from 1991 to 2001, rabbit farming in Argentina was destined to produce meat for the local market, from 2002 it began to export meat to the European Union, reaching the peak of animals slaughtered during the year 2005. Subsequently, when China returned to the international market, a drop in the price of rabbits was generated, and due to the high feed cost and the lack of development of the local market, farms left the activity. Currently there are few farms dedicated to the production of rabbit meat in Argentina, and are generally independent and not usually integrated.

Rabbits are slaughtered at the age of 70 to 90 days, depending of the genetics of the farm and the body weights required by the market (generally, between 2 and 2.6 kg). Age and weight at slaughter are important variables due to their effect on meat quality (Dalle Zotte, 2014); In general, as slaughter age and weight increase, slaughter performance worsens, tenderness decreases and fat content increases (Parigi et al., 1992).

The rabbit is still linked to a traditional form of distribution based primarily on whole or half carcasses without head; however, in supermarkets you can see vacuum-packed tray cuts (hindquarter, front quarter, grill and loin). In Argentina, the domestic consumption of rabbit meat reached its peak in 2005 (44 g/per capita/year), coinciding with the time when the highest number of slaughtered rabbits in the country was destined for the international market; currently it does not exceed 2 g/per capita/year. The main meats consumed in Argentine are beef (46.1 kg/per capita/year), poultry (45.2 kg/per capita/year), pork (14.6 kg/per capita/year) and sheep (1.06 kg/per capita/year) (Ministerio de Agroindustria, 2018). Rabbit production and slaughter are concentrated in Buenos Aires (82%), La Rioja (15%), Crdoba (2%) and Santa Fe province (1%), and the destination of the production is the domestic market.

The objective of this study was to analyze the economic efficiency and feed cost of rabbit production for meat in a small-scale farm of Argentina.

## **Material and Method**

### ***Rabbit farm***

This study was carried out at Secondary School of Agricultural Education, Azul, Buenos Aires province, Argentina. Rabbit farm for meat purposes (Figure 1) selling rabbits locally per unit (\$/rabbit: \$ is Argentine Peso, ARS).

### ***Housing rabbits***

Rabbit farming developed in a shed where the rabbit's houses consist of rows of suspended wire mesh cages with shallow litter pits in the floor. Breeding females and males were kept in individual cages, while replacement females and fattening animals were weaned. Regarding the population densities, they were 16 rabbits/m<sup>2</sup> (40-50 kg of live weight/m<sup>2</sup>).

### ***Rabbit breeds and reproduction***

Californian, New Zealand White, New Zealand Black, Butterfly, and Fauve de Bourgogne were used as breeds. The applied reproduction rhythm was semi-intensive of 42 days (mating at 11 days' post-partum). The kits weaned were transferred to the fattening area until reaching slaughter weight (about 2.6 kg).

### ***Feeding***

A single commercial balanced diet was used and was restricted to breeding males, replacement rabbits and non-lactating breeding rabbits; in lactating rabbits and fattening animals, feeding was ad libitum.

### ***Solid waste management***

The droppings together with litter remains, hair, balanced food and fodder, fall from the cages directly to the cement floor and are removed daily manually with brushes, shovels and wheelbarrows). The material to be composted is deposited linearly in piles 1-meter-high and 1.5 meters wide with a length of approximately 10 meters. The piles are turned periodically (every 10-15 days), allowing ventilation and homogenization of humidity and temperature. After a period of approximately 90 days (depending on environmental conditions) the material reaches maturity and is considered stabilized and ready to be screened and used as an amendment, corrector and fertilizer.

### ***Statistical analyses***

During the period January 2019 and December 2021, the productive (rabbit produced/doe/year, live weight of rabbits weaned, lactation and fattening mortality, fertility rate) and economic (live weight of slaughtered rabbits, global feed conversion rate: FCR, feed cost, feed consumed/rabbit produced, unit price of rabbit produced) parameters were analyzed. All costs incurred, both variable costs and fixed costs were attributed to the doe/year, per fattened rabbit, per kilogram of produced live and of carcass weight produced. According to the distribution of costs, the feed, the veterinary medicine, the repair-maintenance of buildings and cages, the fuel and transportation were considered as variable costs; while the depreciation of buildings and cages and labor were considered fixed costs. Incomes (rabbits for meat, preserves, pet or breeders, and compost) and expenses (variable costs and fixed costs) were expressed in

USD due to constant devaluation of Argentine peso. The rabbit price/feed price ratio (quantity of feed (kg) can be purchased with 1 rabbit for sale) and the rabbit meat price/feed price ratio (quantity of feed (kg) can be purchased with 1 kg of rabbit meat for sale) were analyzed. All analyzes were performed in the statistical software R (1R Core Team 2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. [https://www.R-project.org/.](https://www.R-project.org/))

## Results

Rabbit farm worked on average with 21 reproductive does/month, with a productivity of 2.84 rabbit produced/doe/month (34.1 rabbits/doe/year). Details of the productive parameters of rabbit's farm are presented in table 1. A total of 33606 kg of feed was required to produce 2149 animals: slaughtered rabbits for meat (2062) and live rabbits for pet or breeders (87); of the total of slaughtered rabbits, 1968 were marketed for meat (2952 kg of carcass), 7 preserves as pickles and 87 not marketed (165 kg). Average of 15.9 kg/animal were required to produce one live weight of slaughtered rabbit of 2.85 kg (range: 2.3-3.5). The global FCR was of 5.7 (range: 3.3-19.1), and 5876 kg of live weight were produced in the farm. The carcass weight (headless animal, with kidneys and liver) was of 1.5 kg/animal (53% yield) respect to live weight of slaughtered rabbits. Also 137 kg of compost generated in farm were marketed (Figure 1).

The production cost of the farm was of USD 8.09/rabbit; the and 56% of costs were variable and the 44% fixed. The 48% of the total costs were related to feed costs (USD 3.94/rabbit produced). Table 2 presents the estimated expenses and incomes of the farm for 2019-2021 period. The resulted costs per doe/year, per slaughter rabbits, per kg of live weight and per kg of carcass weight produced were USD 276, 8.09, 2.96 and 5.58 respectively (Table 3). Respect to profits per doe/year, per fattened rabbit, per kg of live weight and kg of carcass weight produced were USD -132.8, -3.89, -1.42 and -2.78 respectively, that is, a profitability of 6% was reached (Table 3). The averages of parameters related with feed price during the study period in the farm are presented in table 4.

In the period of study, the commercial feed price was an average of USD 0.26/kg (Figure 2), however, in Argentina the feed price (\$/kg) increase a 192% from 2019 to 2021 (annual average: 64%). The average of rabbit price/feed price ratio was of 15.2 (Figure 2), and the relation of rabbit meat price/feed price was of 10.8; however, these ratios varied annually (Table 4).



Figure 1. Rabbit farm for meat purposes a) Housing rabbits b and c) Slaughtered rabbits for selling

Şekil 1. Et amaçlı tavşan çiftliği a) Tavşan barınağı. B and c) Kesilen ticari tavşanlar

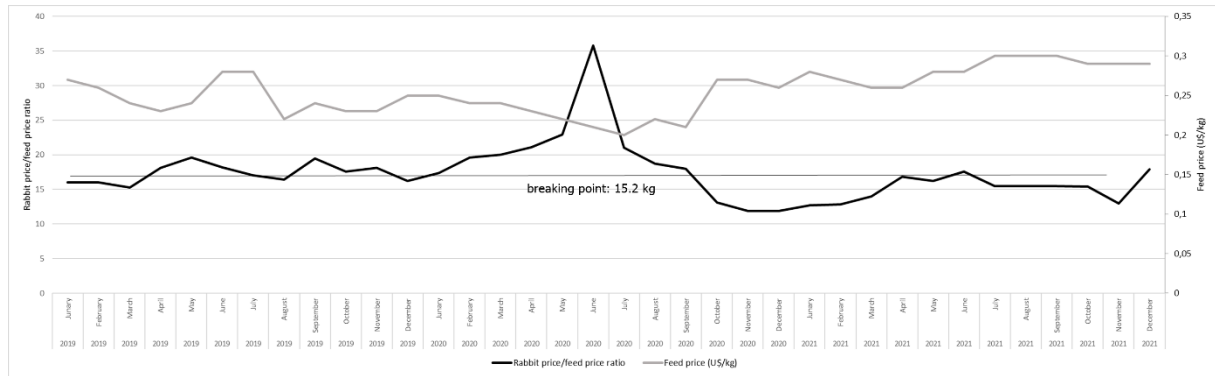


Figure 2. Commercial feed price in Buenos Aires province, Argentina, and the relation of rabbit price/feed price in the farm

Şekil 2. Arjantin, Buenos Aires eyaletinde ticari yem fiyatı ve çiftlik tavşan fiyatı/yem fiyatı ilişkisi

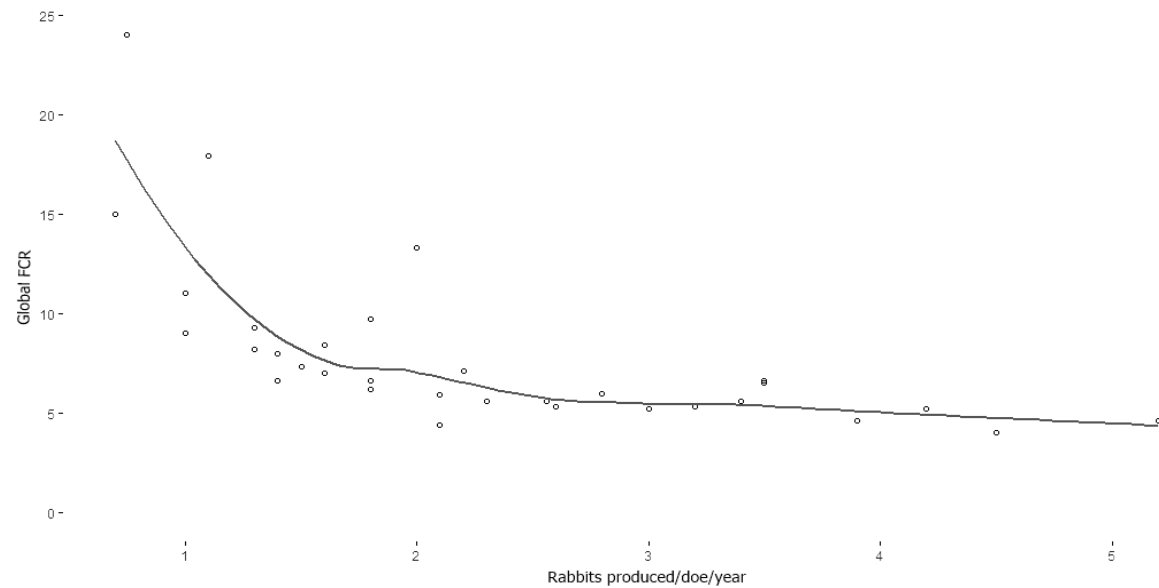


Figure 3. Relation of the global feed conversion ratio and number of rabbit produced/doe/year

Şekil 3. Küresel yem dönüşüm oranı ile üretilen tavşan sayısı/geyik/yıl arasındaki ilişki

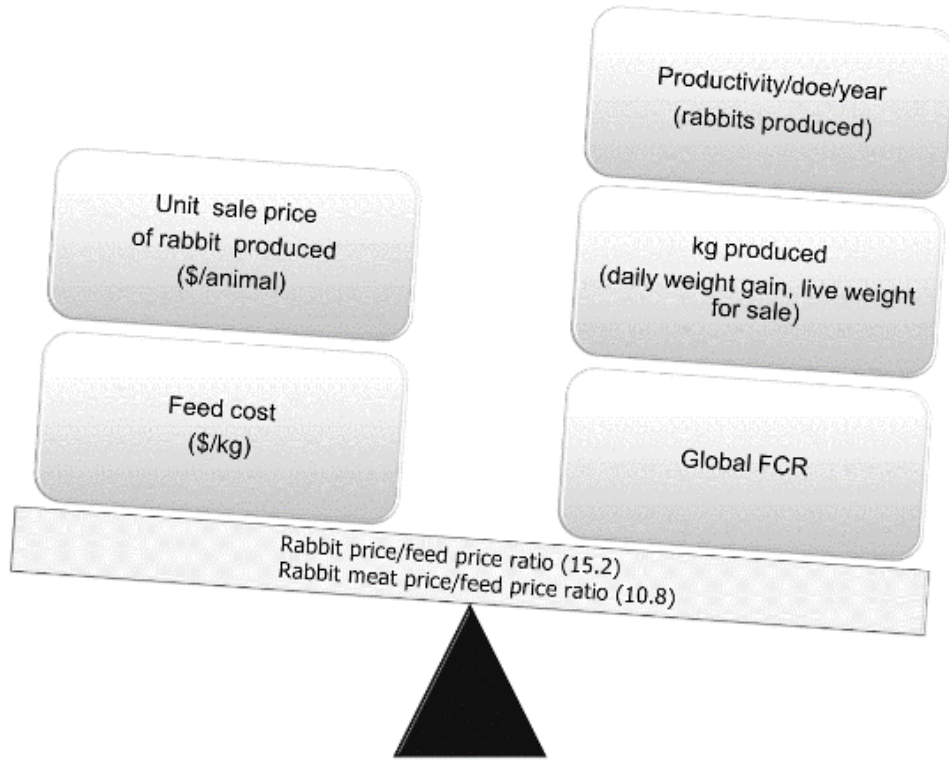


Figure 4. Factors that affect costs and profits in a small-scale rabbit farming for meat in Argentina

Şekil 4. Arjantin'de et için küçük ölçekli bir tavşan çiftliğinde maliyetleri ve karı etkileyen faktörler

Table 1. Productive parameters of rabbit's farm with a reproduction rhythm of 42 days

Tablo 1. 42 günlük üreme ritmi ile tavşan çiftliğinin üretken parametreleri

Parameters	Monthly Average Value (range)
Does in production (n°)	21 (12-36)
Fertility rate (%)	71.3 (50-100)
Slaughtered rabbits (n°)	57.3 (0-114)
Productivity/doe (n°)	2.84 (0-6.1)
Live weight of slaughtered rabbits (kg)	163.2
Carcass weight of slaughtered rabbits (kg)	86.6
Feed consumed in farm (kg)	933 (500-1580)
Feed consumed/rabbit produced (kg)	16.6 (9.7-56.8)
FCR	5.7:1 (3.3-19)
Solid waste generated (kg)	800-1000

Table 2. Costs (feed and non-feed) and rabbitry revenue of 2019-2021 period  
 Tablo 2. 2019-2021 dönem maliyetleri (yem ve yem dışı) ve tavşan gelirleri

Expenses	Quantity	Price	Total
Feed	33604 kg	USD 0.26/kg	USD 8464
Labor	3 hours/day	USD 10/day	USD 7200
Repair-maintenance of buildings and cages	-	-	USD 423
Health program	-	-	USD 15
Fuel and transportation	720 liters	USD 1.2/L	USD 864
Depreciation costs of buildings and cages	-	-	USD 425
Total Expenses (not including replacement breeding stock)			USD 17391
<b>Income</b>			
Marketed for meat	1968 animals	USD 4.2/animal	USD 8262
Live rabbits	87 animals	USD 5.7/animal	USD 496
Preserves food	7 animals (13 jars)	USD 6.23/jar	USD 43.6
Compost	137 Kg	USD 1.6/Kg	USD 225.4
Total Incomes			USD 9027

Table 3. Resulted costs and profits per doe/year, per fattened rabbit, per kg of live weight and kg of carcass weight produced in a small-scale rabbit farming for meat in Argentina

Tablo 3. Arjantin'de küçük ölçekli bir tavşan çiftliğinde et amaçlı üretilen besi tavşanı, canlı ağırlık ve karkas ağırlığı başına geyik/yıl ortaya çıkan maliyetler ve karlar

Parameters	Costs (USD)	Profits (USD)
Slaughter rabbits (USD/animal)	8.09	-3.89
Slaughter rabbits (USD/kg of live weight)	2.96	-1.42
Slaughter rabbits (USD/kg of carcass weight)	5.58	-2.87
Reproductive does (USD/ doe/year)	276	-132.8

Table 4. Average of parameters related with feed price during the study period in the farm

Tablo 4. Çiftlikte çalışma süresi boyunca yem fiyatı ile ilgili parametrelerin ortalaması

Parameters	2019	2020	2021
Rabbit price (USD/animal)	4.85	4.1	4.29
Rabbit meat price (USD/kg of carcass)	2.85	2.96	2.89
Feed price (USD/kg)	0.25	0.24	0.28
Relation rabbit price(USD/animal) /feed price(USD/kg)	19.4	17.1	15.2
Relation rabbit meat price (USD/kg)/feed price(USD/kg)	12.8	11.25	10.8

## Discussion and Conclusion

Feed costs represented the main item of the total of variable costs accounted, being approximately 60-70% of the production costs of commercial rabbit's farm (Ministerio de Agroindustria, 2013; Mondin et al., 2021); however, in our case (educative farm) the feeding cost represented 48%. In addition to the price of the balanced diet (\$/kg), there are other variables that affect the economic benefit of rabbit farming (Maertens, 2009), including the sale price of the rabbit produced, the live weight of the rabbits slaughtered, farm productivity and overall feed conversion. The commercial feed price and the rabbit meat price were expressed in USD, however, due to devaluation of peso Argentine (\$) varied annually being of 0.248, 0.235 and 0.283 during 2019, 2020 and 2021 respectively (Figure 2).

The feed consumed by all the animals on the farm is considered for the estimation of the global feed conversion ratio (FCR), indicating the kg of feed necessary to produce 1 kg of rabbit. Feed efficiency allows us to evaluate the productive and economic aspects in rabbit farms; and it is related to the slaughter weight and the number of rabbits produced/doe/year (Scialfa et al., 2021). The doe productivity affected the global FCR; it was observed that the global FCR worsens when the productivity values are lower than 2.5 animals/doe/month; while for values greater than 2.5, the global FCR remains relatively constant. The educative farm has inconvenience that during the weekend and summer season (educational break period and staff vacation), farm is only attended three times a week, mainly affecting the routine of services, weaning and sending to slaughter, explaining the observed global FCR (Figure 3).

The rabbit meat price/feed price ratio (10.8) was similar to that observed in Argentina in previous studies, where it has ranged between 8 and 12 (Scialfa, 2020). The price of whole carcass in European Union can be higher than other parts of world. For example, market prices for Germany, Belgium, Portugal and Spain rabbit meat have varied across the years with approximate values of USD 7-11, 10, 5 and 6.25-3.90 €/kg respectively (Selina Wamucii, 2022; Baviera-Puig et al., 2017; MAGRAMA, 2014; European Commission, 2017); however, are higher than those observed in our study (USD 2.89/kg). The approximate rabbit meat wholesale price range for Italy rabbit meat is between USD 2.78-3.74/kg, similar our farm. According to Priyanti & Raharjo (2012), demands and price of rabbit's meat change in some areas of Indonesia (USD 3.1 to 5.5/kg of carcass), being older in tourist provinces.

When analyzing the cost of meat rabbit in the farm (slaughtered rabbit's whit live weight of 2.85 kg) that is commercialized on whole or half carcasses without head (1.5 kg), is observed an important dependence of feed price and a competence with other meats. Price is therefore also a critical factor that determines whether rabbit farmers can increase their production or not. For example, the rabbit price affect the number of rabbits produced per year in rural areas of Zimbabwe, and this means that if rabbit price was to increase by a dollar, the production of rabbits per year would increase by 43 rabbit (Tembachako & Mrema, 2016). At the time of the study the average price/carcass of rabbit marketed was of USD 2.89/kg, a price similar than that of a broiler chicken (USD 3/kg of meat broiler chicken). Similar results are observed by Tembachako & Mrema (2016) in rabbit production of rural areas of Zimbabwe with a price less than that of a broiler chicken (USD 5/rabbit and USD 6-7/broiler chicken).



The feed cost is the main factor that impacts profitability and sustainability of farms in Argentina. The price of the feed (\$/kg) sets the selling of rabbit meat price to the market. In Argentina, variations in commercial feed prices have a strong influence on the market price of rabbit meat. Taking into account the structure of the chain and the efficiency farm, it has barely been possible to cover production costs, a situation similar to that reported in a study of the value chain and price formation of the rabbit meat sector, where prices of the rabbit in origin (1.74 and 1.78 €/kg. of live weight) have hardly allowed to cover the production costs (MAPA 2012). However, a profitability of 6-8%, were reported in other studies (Cartuche et al., 2014; Krupová et al., 2020) in Spain's and Czech Republic rabbit-meat production. Combinations of pellets with other feeds sources (forage and household feeds) allowed to decrease the 53% of feed costs and to get better returns (profit of 41%) to rabbit production farms in Nigeria (Iheukwumere et al., 2018).

In our educational farm, labor was considered a cost for this study so as not to generate a false appearance of profitability. Along with feed, labor were the variables that had the greatest impact on the cost of production, with 48 and 41% respectively, making profitability negative. Even if the farm had marketed by kg of meat (\$/kg of carcass) and not by rabbit (\$/animal), the income per rabbit would have slightly improved (USD 0.34/animal).

The productive indices obtained on the farm should be compared with the indices obtained on farms with similar characteristics of size, market and socioeconomic conditions, and similar management (number of total births per female and year) (Pascual & Gómez 2020). Within the strategies to develop the productive chain of rabbit meat in Argentina, it should aim to stimulate the consumption habit promoting the high nutritional quality of the meat (low fat content and high protein content), improve the superior price ratio with respect to other meats such as chicken and pork.

In our country there is no habit of consuming rabbit meat, it is necessary to implement an adequate strategy to spread the good quality of the meat, given that it must compete in price with others preferred by Argentine consumers. Diversification of rabbit meat products, such as sausages, hamburgers, corned beef, meatballs, and others, has been implemented in other countries (Priyanti & Raharjo 2012). In Spain, around 80% is traded as carcass and only 20% in different ways (Baviera-Puig et al., 2017); the usual rabbit sale formats in Spain are whole carcass (frozen and bagged), half carcass bagged and tray-packaged (whole chopped, half chopped, quarters, shoulders, forequarters, loins or tenderloin and chopped). The sale of rabbit meat in Argentina is under whole carcass presentation, however, in Spain the meat in trays, bags or packages is the second format preferred by buyers (Montero de Vicente, 2015).

Rabbit breeding can contribute to improving family nutrition with very low input costs and family labor. This activity at the family level can be carried out for self-consumption, to increase the protein intake in the diet and could generate income through the sale of meat. The commercialization of rabbits is difficult because the demand can be unstable in Argentina, mainly in the interior of the provinces. However, raising rabbits for family consumption represents a valid alternative to improve the diet of low-income families.

It is necessary to publicize rabbit production and the qualities of the meat and, as far as possible, disseminate proposals for preparing dishes (paellas, garlic, roasts, stews, fried, baked, etc.) to attract new consumers and achieve higher marketing prices. It is clear that the economic sustainability of the farms in the region depends on the cost of feed, the cost of labor and the

added value in the marketing chain of the rabbits produced, changing the usual rabbit sales formats, pickle production, marketing of leather and compost.

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