RABBITS AND THEIR PRODUCTS

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Abstract

Rabbit husbandry constitutes a specialized field within animal science with considerable potential, owing to the nutritional and economic value of its derived products. The objective of this study is to examine the valorization pathways of rabbit products, with emphasis on meat, pelts, angora fiber, and manure. The analysis draws upon scientific literature, statistical databases, and comparative assessments of production and consumption patterns at both European and national levels. Findings indicate that rabbit meat represents a high-quality dietary resource, characterized by low fat and cholesterol content, while pelts and angora fiber provide valuable raw materials for the textile industry. In addition, rabbit manure demonstrates significant agronomic utility as an organic fertilizer. Market trends and future perspectives of rabbit farming in Romania are also discussed, highlighting the increasing demand for sustainable and health-oriented animal products. The study concludes that rabbit production holds strategic relevance for the diversification of animal husbandry and for the socio-economic development of rural communities.

Keywords: *rabbit, rabbit meat, rabbit fur, rabbit manure*

INTRODUCTION

Rabbit farming, as a specialized branch of animal husbandry, has developed significantly in recent decades, offering an efficient and sustainable alternative to other livestock sectors. Domestic rabbits (Oryctolagus cuniculus) are recognized for their efficient feed conversion capacity, rapid reproduction rate and adaptability to diverse environmental conditions, which make them attractive for both family and commercial farms. Rabbit farming is particularly important in a European and global agricultural context marked by the need to reduce the ecological footprint and diversify high-quality food sources [1,2].

Rabbit meat is appreciated for its remarkable nutritional qualities: it is a white meat, with a low fat and cholesterol content, rich in high-quality proteins and mineral salts. These characteristics make it suitable for dietary regimes, the nutrition of children, the elderly and people with cardiovascular diseases [3, 4, 5, 6]. In addition, rabbit skin and fur, as by-products, can be used in the leather and clothing industry, and rabbit manure is effectively used as a natural fertilizer in organic agriculture [7, 8].

In Romania, rabbit farming is practiced both in an extensive system, in individual households, and in semi-intensive forms, with real potential for economic development. Although per capita rabbit meat consumption remains low compared to other European countries, recent trends indicate an increase in interest in this type of meat, especially among consumers concerned about healthy eating [9].

The valorization of rabbit products requires a thorough knowledge of the entire production and distribution chain – from genetics, nutrition and veterinary management, to slaughter technology, processing and product marketing. In addition, in the context of European policies

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on the circular economy and reducing food waste, secondary products (fur, organs, offal) can acquire increased economic and ecological value if they are properly integrated into production systems [10, 1].

This paper aims to analyze in detail the main products obtained from rabbits - meat, skin, fur, crotines and other by-products, with a focus on current and potential ways of capitalizing, the economic impact and the prospects for sustainable development of rabbit farming.

ECONOMIC IMPORTANCE AND ROLE OF RABBITS IN AGRICULTURE AND INDUSTRY

Domestic rabbits play an important role in the diversification of agro-zootechnical production, being an efficient source of meat, fur, organic fertilizer and even biological materials used in industry. Due to their low technological requirements and high biological efficiency (short reproductive cycles, efficient feed conversion), rabbits are ideal for microfarms and family farms, but can also be integrated into industrial production systems [1].

Economically, rabbit farming contributes to reducing dependence on conventional meat sources, providing a viable alternative for domestic consumption and export. Rabbit meat is considered a premium product in many European countries, with growing demand in market segments concerned with healthy eating. In Italy, France and Spain, per capita consumption is significantly higher than the European average, and production is supported by cooperatives and local agricultural policies [11].

In Romania, the rabbit sector has significant economic potential, but it is insufficiently exploited. Although rabbit meat consumption is relatively low (0.2–0.3 kg/capita/year), compared to other types of meat, current trends show a gradual increase, fueled by the interest in organic products, lean meat and alternative sources of protein. Also, the higher selling price (compared to pork or chicken) makes rabbit farming a profitable activity, especially for small and medium-sized farmers targeting local markets or gourmet restaurants [12, 13, 14].

Figure 1. Rabbit carcass [47]

The economic importance of rabbits is not limited to meat. Fur and skin are valuable by-products, used in the textile, leather and clothing industries. Although the demand for natural fur has decreased in recent decades due to ethical debates, rabbit fur remains a viable option in niche markets due to its softness, natural color and easy processing [7]. In some cases, rabbit fur is combined with other types of natural or synthetic fibers to create hybrid textiles [15].

Another valuable role of rabbits in agriculture is the use of their manure. Rabbit droppings are rich in nitrogen and phosphorus, and are considered one of the most effective organic fertilizers. Unlike other types of animal manure, rabbit droppings can be applied directly to the soil without requiring prior fermentation, which makes it very valuable in agriculture.
ecological and urban gardening [16].

In industry, products derived from rabbit farming also include biological materials such as serum, digestive enzymes and collagen, used in biomedical research, cosmetology and the pharmaceutical industry. For example, rabbit skin is used as a biological model in biocompatibility tests, and the fat and oils derived from it can be used in traditional ointments [17].

Due to its versatility, the rabbit has multiple economic, agricultural and industrial values, justifying the inclusion of rabbit farming in rural development policies and sustainable food production diversification strategies [14, 18].

BENEFITS AND NUTRITIONAL PROPERTIES OF RABBIT MEAT

Rabbit meat is considered one of the most valuable sources of high-quality protein, being appreciated both from a nutritional and dietary point of view. It has a low fat and cholesterol content, being recommended in the diet of people with cardiovascular diseases, diabetes or weight problems. At the same time, rabbit meat is rich in essential amino acids, B vitamins and minerals such as iron, zinc and selenium [3]. Compared to other types of meat, such as pork or beef, rabbit meat has a superior nutritional profile, especially in terms of the protein-fat ratio. It is easily digestible due to the fine structure of muscle fibers and the low content of connective tissue, which makes it suitable even for children, the elderly or people in convalescence [19].

Table 1 presents the chemical composition of rabbit meat compared to other commonly consumed types of meat.

Rabbit meat is also an excellent source of vitamin B12, essential for cellular metabolism and the normal functioning of the nervous system. Other vitamins present in significant amounts include niacin (B3), pyridoxine (B6) and riboflavin (B2), which contribute to skin health, liver function and energy production [20, 21]. In terms of mineral content, rabbit meat provides easily absorbable iron, important in preventing anemia, as well as phosphorus, zinc and selenium. Selenium, in particular, plays an essential role in combating oxidative stress and protecting endocrine functions [17].

Table 1 - Nutritional values of different types of meat (per 100 g of raw product) [3]

Type	P (g)	G (g)	C (mg)	Calories (kcal)
Rabbit	21.2	4.5	56	130
Chicken	22.5	1.8	60	114
Pig	20.0	9.0	72	165
Beef	19.5	8.5	70	170
Lamb	18.0	16.5	75	210

P-protein; G-fat; C-cholesterol

Although it is less consumed than other types of meat, rabbit meat is increasingly appreciated for its health benefits. In many European countries, it is included in diets recommended by nutritionists and is promoted as a functional food, contributing to the prevention of chronic diseases [22]. Moreover, due to its low saturated fat content and the absence of hormonal residues, rabbit meat is suitable for organic diets, while also being an ethical and sustainable choice for consumers concerned about healthy eating and environmental protection [23, 17].

RABBIT FUR CHARACTERISTICS AND ITS INDUSTRIAL USES

Rabbit fur consists of two distinct layers: the down, which acts as an insulator, and the longer, coarser outer hairs. The quality of the fur is influenced by breed, age, season of harvest, diet, and maintenance conditions. In general, the ideal fur is dense, soft, elastic, and shiny, with a uniform color and a fine texture. Specialized fur breeds, such as Chinchilla, Alaska, and Champagne Silver, are valued for the thickness and fineness of the down layer, as well as for their special aesthetic appearance. The Rex, for example, is characterized by short hairs, equal in length, offering a unique velvety texture, similar to natural velvet [17, 24].

In the leather industry, rabbit furs are classified according to quality, size, and color.

Table 2 – Characteristics of some rabbit breeds used for fur [7, 24]

Breed	Fur type	Frequent color	Main use
Rex	smooth	White, brown, black	Luxury clothing
Champagne Silver	Thick, glossy	Driftwood	Fashion and accessories
Large chinchilla	Thick, fluffy	Gray	Coats, linings
Alaska	Fine, dense	Deep black	Collar, hats

An important aspect is the optimal slaughter period for obtaining high-quality fur: between 5 and 8 months, when the hair is fully developed and does not enter the molting phase [25].

On the international market, rabbit fur is considered a valuable yet affordable product, making it suitable for the mass industry. Sales are dominated by dyed and processed products, originating mainly from China, France and Eastern Europe [7, 26].

ANGORA WOOL

The Angora rabbit is one of the oldest breeds of domesticated rabbits bred specifically for the production of fine textile wool. Originally from the Ankara region of Turkey (where its name comes from), the Angora was introduced to Europe in the 18th century, initially bred by the aristocracy for its spectacular fur and extremely soft texture of the fiber. Over time, the breed was improved in different regions of the world, leading to the emergence of several varieties known today: French, German, English, Satin and Giant Angora. Of these, the German Angora is the most productive in terms of wool yield, while the English Angora is renowned for its decorative appearance and very long fur [1,17, 26, 27].

Angora wool is one of the finest and warmest animal fibers known. Its composition makes it particularly sought after in the luxury textile industry.

Table 3 - Characteristics of Angora wool [25]

Property	Average values
Fiber fineness	12–16 microns
Fiber length	6–10 cm
Combing efficiency	85–95%
Insulation capacity	7 times greater than sheep's wool
Elasticity and shine	Very good, silky appearance

Angora fibers do not contain lanolin, making them ideal for people with wool allergies. They are also biodegradable and sustainable [28, 29,30].

RABBIT SKIN AND POSSIBLE INDUSTRIAL USES

In the agri-food and rabbit-based industries, leather is often an underestimated by-product. However, its industrial potential is considerable, especially in the field of fine leather goods, handicrafts and in some niches of the textile and technical industry. Due to its particular thin, elastic and soft structure, rabbit leather has diverse applications, both in its natural form and after tanning and finishing. Currently, there is a trend towards the valorization of all of animal products, especially in organic farming and the circular economy, which increases interest in this resource [31].

Through modern processing technologies and integration into short production chains (local slaughtering, artisanal tanning, direct marketing), rabbit skin can significantly contribute to increasing the added value in rabbit farming. It also aligns with current requirements regarding sustainability and the circular economy, being a renewable and biodegradable raw material. Some European companies collect and process skins from small slaughterhouses, adding value to the rural economy and family farming [1,32].

Table 4 The structure and characteristics of rabbit skin [26]

Parameter	Average value	Observations
Thickness	0.5 – 1mm	Varies by race and age
Total area	0.2 – 0.4 m²/skin	Large breeds offer larger surfaces
Weight (dry)	60 – 120 g/skin	After tanning
Texture	Soft, matte, fine	Appreciated in fine garments

UTILIZATION OF RABBIT WASTE FOR SOIL FERTILIZATION

Rabbit farming not only brings benefits through the production of meat, fur and wool, but also through an important agricultural contribution: obtaining a valuable organic fertilizer. Rabbit droppings, resulting from solid manure and straw or sawdust from the shelter, are one of the most balanced natural fertilizers used in agriculture, with an excellent ratio between nitrogen (N), phosphorus (P) and potassium (K) [33, 34,35]

Rabbit manure is considered a "warm" fertilizer, with a high content of essential nutrients [33, 35].

Table 5 - Chemical composition and agronomic value [28]

Compound	Average value (%)
Nitrogen (N)	2.4–2.8
Phosphorus (P_2O_5)	1.0–1.5
Potassium (K_2O)	0.6–1.0
Calcium (Ca)	0.8–1.0
Organic matter	25–30

Unlike cattle or sheep manure, rabbit manure can be applied to the soil without long-term prior fermentation, due to its dry composition and reduced risk of burning plants [36].

Rabbit droppings are ideal for fertilizing sandy soils that need organic matter, vegetable crops (e.g. tomatoes, peppers, zucchini), where an increase in production of up to 20% compared to the control variants is observed, fruit trees and vines, applied in autumn or early spring, at the base of the trunk, greenhouses and solariums, due to the rapid decomposition and uniform effect on the soil [37].

USE OF RABBIT BY-PRODUCTS IN THE MEDICAL AND PHARMACEUTICAL FIELD

In addition to their primary economic value, domestic rabbits (Oryctolagus cuniculus) provide a wide range of biological by-products that can be exploited in the medical and pharmaceutical fields. These resources include blood, fat, skin, organs and hard parts (bones, cartilage), which, through appropriate processing, provide compounds of biomedical interest: antibodies, collagen, gelatin, enzymes and bioactive lipids. Also, due to their moderate size, physiology comparable to that of humans and susceptibility to infectious diseases, rabbits are extensively used as models for biomedical research [38, 26].

Table 6 - Collagen and gelatin – biomedical ingredients [39]

Compound	Extraction method	Medical application
Collagen	Acid hydration + thermal extraction	Dressings, tissue engineering matrices
Gelatine	Enzymatic hydrolysis	Excipient in capsules, cell culture

In experimental medicine, rabbits are widely used as animal models due to their small size, short life cycle, easy handling and robust immune response. These characteristics have established them in fields such as immunology, ophthalmology, cardiology or experimental pharmacology. In atherosclerosis studies, rabbits are considered excellent models because they rapidly develop atheromatous lesions when fed high-cholesterol diets, which allows researchers to study the progression of the disease and the effectiveness of treatments. In immunology, rabbit blood is used for the

production of highly specific polyclonal antibodies. The process involves repeated immunization with a target antigen, followed by blood collection and purification of immunoglobulins from the serum [40].

Rabbit subcutaneous and visceral fat, due to its composition in unsaturated fatty acids and low cholesterol content, has significant therapeutic and cosmetic value. It can be used as a base for dermatological ointments and creams, especially in combination with plant extracts or antibiotics, providing emollient, anti-inflammatory and antimicrobial properties [39].

Another valuable by-product is rabbit skin, which can be processed for the extraction of collagen and gelatin. Type I and III collagen obtained from the dermis can be used in the production of chronic wound dressings, in tissue engineering, but also as a support material for cell cultures. Gelatin obtained by enzymatic hydrolysis of collagen is used in the pharmaceutical industry as an excipient in the production of capsules, tablets or microcapsules, and also has applications in molecular biology. Unlike gelatin from bovine or porcine sources, that obtained from rabbit skin may present an attractive alternative for industries wishing to avoid prion risks or taking into account cultural or religious constraints related to the consumption of certain species [39, 41, 42].

Rabbit internal organs, such as liver, spleen or kidneys, can be used for scientific purposes, being used as sources of enzyme extracts, cell lysates or specific biomarkers in pharmacological and toxicological experiments. In toxicology studies, these organs are tested to evaluate the harmful effects of drugs, chemicals or food additives on living tissues. Rabbit liver is also used for the isolation of important metabolic enzymes involved in the biotransformation of drugs in the human body [28].

In recent years, biotechnologies are exploring new uses of rabbit by-products in the manufacture of advanced materials. Collagen extracted from rabbit bones and skin is being tested for the development of bioresorbable matrices for tissue regeneration, while lipids and proteins can be integrated into controlled drug delivery systems. These directions confirm the increased potential for the use of animal-derived biomaterials in regenerative medicine, a growing field. Therefore, the valorization of rabbit by-products in medicine and pharmacy represents an example of integrated and intelligent use of biological resources. This approach not only reduces waste, but also actively contributes to innovation in the health sector, making the rabbit a zootechnical species of strategic interest for the bioeconomy [43, 44, 45, 46].

CONCLUSION

Rabbit meat is recognized for its high nutritional content, being a healthy and economically efficient alternative for consumers.

Efficient production involves the application of modern breeding techniques, genetic selection and environmental control, all of which contribute to higher yields and superior quality. The distribution of rabbit meat products is developing internationally, with growth trends in the organic and gourmet markets.

Fur and wool, especially Angora wool, are valuable raw materials in the textile industry, with various applications in fashion and design, due to their fineness, elasticity and thermal insulation capacity. The methods of harvesting and processing Angora wool must be adapted to preserve quality and reduce stress on the animal, balancing productivity and ethics.

Organic waste from rabbits can be transformed into an effective natural fertilizer, contributing to organic farming and environmental protection.

By-products, such as skin, internal organs or excrement, are successfully utilized in industrial and medical fields, proving the versatility of these animals.

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