

BIOECONOMIC ASPECTS OF DEER FARMING IN LATVIA

Līga Proškina

Latvia University of Agriculture

liigaproškina@inbox.lv

Abstract. Carcass quality in deer and purchasing prices in comparison with beef carcass quality and purchasing prices were assessed in the research from the bio-economic aspect. Specific gravity of muscle tissue in deer carcass in comparison with specific gravity of cattle carcass component was 13.2% higher and specific gravity of bone tissue was 2.8% higher, but adipose tissue was 16% less. Venison quality was higher than beef quality. In venison when compared with beef a cholesterol level (45.2 mg %) was 31.8 mg % lower, but crude protein content was 2.9% higher (23.4%). Meat quality index was 26.0, which is 8.9 higher than in beef. These indicators characterise venison as a healthy product of higher quality for consumer food in comparison with beef. Purchasing price (LVL 4.21 per kg) of venison carcass in 2009 was 1.6 times higher in comparison with beef carcass purchasing price. Research results lead to the conclusion that deer farming products on the market can be positioned as a high-quality, nutrient-rich food with higher sales price than one of beef.

Key words: deer farming, venison, meat quality, purchase price.

Introduction

One of the most perspective, potentially capable of export and rapidly growing non-conventional livestock farming industry is wild animals raising including breeding of deer in captivity. 70 farms were engaged in deer breeding in 2009. Latvian Wild Animal Breeders Association (SDAA) united 37 members, and in 2009, within its frame there were 26 fully developed deer gardens with a total fencing area of 8000 ha and 7500 different breeds of wild animals. Basically the red deer (*Cervus elaphus*) - 66% had been bred at farms, and few fallow deer (*Dama dama*) - 12%. There are approximately 30 fully established wildlife gardens running separately from the framework of association in which red deer, fallow deer, wild boars and other wild animals are reared. Other 10-15 wildlife gardens are currently under way (SDAA, 2009). Wild animals breeding in captivity makes it possible to supplement the market with food products of different animal assortment.

Conditions for animal keeping in deer gardens bear resemblance to wild conditions. Deer at farms live in the open air for a whole year; they are kept in small herds, fenced areas or enclosures. According to Animal Protection Law by the Republic of Latvia, the section 13, wild animals, including deer that are kept in enclosed areas for the acquisition of products of animal origin or for the purposes of species selection shall also be considered to be animals kept for farming purposes (Animal Protection Law, 1999).

Deer raising farms in Latvia specialize in three main areas - breed animal raising, meat production and animal raising for hunting trophy purposes. Not infrequently, the farms go for the fourth area of activity - agrotourism, which successfully combines the above-mentioned areas of activities (SDAA, 2009; Paeglītis et al., 2006). The main source of income in deer-breeding is a meat production (Paeglītis et al., 2006; Tuckwell, 2003; Fletcher, 1989). In 2008, SDAA members implemented a total sale of breed red deer amounting to LVL 333 701.64 and exported 8.6 tons of meat production (Agriculture and Rural Areas of Latvia, 2009), and within the framework of

cooperative "BG Eksport" (SDAA) 100 breed animals - approximately 11 tons of venison were exported in 2009. Most part of farms are now engaged in herd increasing, so only 10-15% of the total amount of animals kept in deer gardens are being implemented for meat realisation. In some works by individual authors it is mentioned that the most profitable income in deer raising farms is brought by trophy hunting (Holst, 2002), consequently the development of this area shall also be viewed as a perspective in Latvia. One of the increasing factors for competitiveness in cattle breeding production in the aspect of economic globalisation is a high-quality production. A quality concept in food production is defined as the quality set of the product based on the property ability to satisfy consumer needs while the production quality is assessed as one of the basic elements of the economic development in competitive production (Mihejeva, 1999). Deer meat quality has an essential role in deer breeding bio-economy determining its' market niche and product prices. The studies show that most part of consumers associate price level with a product quality, the production price to some extent is perceived as a fixed social status symbol (Upīte, 2000).

So far, venison usage in food in Latvia has not been sufficiently popular, since pork and beef has been used as the main meat production. Venison consumption is prevented by both insufficient knowledge on its' quality and a lack of market recognition. So far, farm-raised venison in Latvia could be purchased only in certain shops. Venison products sold in supermarkets are mainly imported frozen meat from New Zealand.

It shall be stressed that consumer knowledge about venison as a high quality product is quite poor. Under conditions of Latvia, no significant research in the deer breeding industry has been done; therefore, bio-economic in-depth studies are required that will position the deer breeding products on the market as a high-quality, nutrient-rich food.

Consequently, the following **research object** has been defined – bio-economic indicator analysis of venison production. The research **hypothesis:** Venison

quality and purchase prices of carcass are relatively higher than in beef quality and its' purchase prices. The research **aim** was to assess the qualitative and quantitative indicators of venison raised in captive and the purchase prices in comparison with the respective beef indicators.

Tasks of the set aim:

1. To clarify specific gravity of deer carcass components;
2. To study venison quality of deer kept in captive;
3. To assess the purchase prices of venison and beef carcasses.

Materials and Methods

Both qualitative and quantitative indicators of captive bred red deer (*Cervus elaphus*) by agricultural holding "Saulstari-1" from age of 16 to 18 months old ($n_1=6$) were carried out for studies performance purposes. The obtained data were compared with the 1st grade cross LBxHE (Latvian brown x Hereford) beef qualitative and quantitative indicators ($n_2=7$) raised in biological farming system in agricultural holding „Kalna Bērziņi”. Age of cattle: 15 - 18 months.

Venison and beef quality was assessed according to the dry matter, crude protein and fats, cholesterol and crude ash content in muscle tissue. Biochemical analysis was carried out by the Research Laboratory of Biochemistry and Microbiology of the Research Institute of Biotechnology and Veterinary Medicine "Sigra" of Latvia University of Agriculture, according to ISO standard method (LATAK reg. № LATAK-T-038-06-99-A). Specific gravity of deer and cattle carcass components was assessed according to the actual abattoir data.

According to the study data, meat quality index was calculated as follows: crude protein ratio in muscle tissue (%) against the crude fat amount in muscle tissue (%). Energy value of meat was calculated according to formula applied in nutrition science: [dry matter % - (fat% + ash %)] x 4.1 + (fat% x 9.3) (Zariņš and Neimane, 2002).

The information by Latvian Wild Animal Breeders Association (SDAA, 2009) was used for data

assessment, as well as venison and beef purchase prices published by the Agricultural market promotion centre (LTVC, 2009).

Appropriate qualitative and quantitative economic research techniques - monographic descriptive, grouping and comparing data, methods of analysis and synthesis were applied for handling of research data, and a non-parametric method (Mann-Whitney U test) was applied for data comparison. Two independent variables – count of deer ($n_1=6$) and count of cattle ($n_2=7$) were compared at the essentiality level $\alpha=0.05$.

Results and Discussion

There are widespread endeavours in the world to produce food-stuffs characterised by specified quality. The investigations carried out to determine market strategy influence on production profitability indicate that high correlation between corresponding products quality and enterprise profitability exists (Miller, 1993). The primary production of animal husbandry is connected with living organisms that in large extent influences economic effectiveness of the whole production. The quantitative and qualitative indices of obtained products are directly dependent from such factors as animals' species, breed, climate and welfare conditions, and physiological processes in organism, which directly or indirectly influence product quality.

The quality of deer and cattle carcasses is basically determined by ratio of muscle tissue, connective tissue, adipose tissue and bone tissue amount and nutritional value indexes. According to literature data, the meat of the highest quality is obtained from young stock deer usually slaughtered at the age of 14-16 months, their carcass weight at this age amounts approx. to 60 kg (Vigh-Larsen, 1987). The age of slaughtered deer assessed in the trial ranged from 16 - 18 months and their carcass weight ranged from 63.0 to 69.1 kg, an average was of 66.0 kg (Table 1). Specific gravity of components in carcass of the 1st grade cross LBxHE (Latvian brown x Hereford) beef (15-18 months of age) was comparatively assessed; their average carcass weight was 240.0 kg, which corresponds to a cross standard carcass weight.

Table 1

An average component mass and specific gravity of deer and cattle carcasses

Species	Average carcass weight	Muscle tissue mass		Bone tissue mass		Adipose tissue mass		Correlation mass of bone tissue and muscle tissue
	kg	kg	%	kg	%	kg	%	
Red deer (<i>cervus elaphus</i>)	66.0	47.7	72.2	13.7	20.8	4.6	7.0	3.5
Cattle (LBxHE)	240.0	141.6	59.0	43.2	18.0	55.2	23.0	3.3

Source: made by the author according to the Research Institute "Sigra", 2009

As it is seen from Table 1, in organic farms cattle carcasses the specific weight of high value beef (muscle tissue) was essentially ($\alpha=0.05$) less, but increased average value (fat tissue) specific weight in comparison with corresponding deer meat carcasses components. Specific gravity of muscle tissue (lean meat) in red deer (*Cervus elaphus*) carcasses was approximately 72.2%, i.e., 13.2% more than the specific gravity of lean meat in beef carcass (Table 1). Whereas a specific gravity of adipose tissue mass in red deer carcass was 7%, i.e. approx. of 16% less than the specific gravity of adipose tissue in beef carcass. Bone tissue mass in red deer carcass drew up 20.8%, i.e. 2.8% more than a specific gravity of bone tissue mass in beef carcass. Correlation mass of muscle tissue and bone tissue in deer and cattle carcass did not differ significantly ($\alpha=0.05$, $n_1=6$, $n_2=7$), and it was respectively 3.5 and 3.3. The research data on a specific gravity of deer carcass components are similar to the research data mentioned in literature by other authors (Paeglītis et al., 2006; Vigh-Larsen, 1987). Overall assessment shows that according to the specific gravity of muscle tissue and bone tissue mass, red deer carcass quality was higher than beef carcass quality.

The qualitative indicators for venison are one of the factors that make it possible to take a certain market niche as a product of superior quality. The row of meat quality indices was evaluated in this aspect that determines products dietetics value and consumers state of health.

The mass of deer muscle tissue contained approx. 24.3% of dry matter, 23.4 % - crude protein, 0.9% - crude fat and 45.2 mg kg⁻¹ cholesterol. Venison in comparison with beef contains more of dry matter (about 1.2%), crude protein (2.9%) and crude ash (0.5%) ($\alpha=0.05$, $n_1=6$, $n_2=7$) (Table 2).

Cholesterol level in diet influences its content in blood to part of people, that can be considered

as cardiovascular diseases risk factor and promotes arteriosclerotic changes in organism. Constantly increased cholesterol level taken up with diet can unfavourably influence human health.

A special notice shall be taken to the fact that a cholesterol level (by 31.8 mg kg⁻¹) and total fat amount (by 0.3%) are less than in beef ($\alpha=0.05$, $n_1=6$, $n_2=7$). The results of investigation testify, that deer meat is healthier for a consumer than beef.

Meat quality is essentially characterised by amino acid tryptophan and oxiprolin amount ratio. The amount of amino acid tryptophan in meat determines the richness and quality of protein. The higher level of tryptophan amount defines higher quality of meat. The amount of amino acid oxiprolin characterises the fibroidity and the leatharity of meat. So the meat quality is lower. Amino acid tryptophan and oxiprolin amount ratio were analysed for characteristics of meat nutritional value (Мысик and Белова, 1986). The amino acid ratio in venison was 3.1, which is about 0.8 lower when compared with the ratio of amino acids in beef (3.9). The level of amino acid oxiprolin was elevated, the meat was more stringy. The amount of tryptophan was of equal level both in venison and beef; therefore, tryptophan and oxiprolin amount ratio were lower in venison, compared with beef. Such a slightly lower ratio of tryptophan and oxiprolin in meat does not reduce nutritional value in venison (Table 3).

Nutritional value of meat is also characterised by the meat quality index. The higher is meat quality index, the higher is meat quality. The meat quality index of venison was 26.0, i.e. 8.9 higher than the beef quality index (17.1) (Table 3). Thus, venison quality was higher than the beef quality when assessed according to meat quality index.

Energy value in venison was 99.4 kcal per 100 g⁻¹, the energy value in beef was 96.9 kcal per 100 g⁻¹.

Table 2

Comparison of venison and beef quality indicators

Species	Dry matter, %	Crude protein, %	Crude fat, %	Crude ashes, %	Cholesterol, mg kg ⁻¹
Venison (<i>Cervus elaphus</i>)	24.3	23.4	0.9	1.2	45.2
Beef (LBxHE)	23.1	20.5	1.2	0.7	77.0
+/- to venison	1.2	2.9	-0.3	0.5	-31.8

Source: made by the author according to the Research Institute "Sigra", 2009

Table 3

Tryptophan and oxiprolin ratio, meat quality index and energy value of venison and beef

Species	Tryptophan and oxiprolin ratio	Meat quality index	Energy value of meat, kcal 100g ⁻¹
Venison (<i>Cervus elaphus</i>)	3.1	26.0	99.4
Beef (LBxHE)	3.9	17.1	96.9
+/- to venison	-0.8	8.9	2.5

Source: made by the author according to the Research Institute "Sigra", 2009

Table 4

The purchase prices of beef and venison carcasses in 2006 – 2009 in Latvia LVL kg⁻¹

Indexes	2006	2007	2008	2009*	Mean in period
Venison, LVL	2.45	2.90	3.15	4.21	3.18
Beef, LVL	1.22	1.27	1.56	1.64	1.42
+/- to venison, LVL	1.23	1.63	1.59	2.57	1.76
% to venison	101.6	128.5	101.4	156.7	122.07

Source: made by the author according to SDAA, personal communication, 2010, LTVC, 2009; *provisional results

The energy value in venison estimated in the research was practically equivalent to the energy value in the beef, the differences are not significant ($\alpha=0.05$, $n_1=6$, $n_2=7$). Correspondingly to chemical composition properties deer meat production has higher diet value in comparison with analysed beef meat during the investigations.

As it is known, product quality, consumers' satisfaction and enterprise profitability are mutually closely connected factors. Higher quality indices create higher consumer satisfaction by giving possibility to sell products by significantly higher prices (Kotlers, 2006). It is possible to sell by significantly higher prices only products of the highest quality.

The purchase prices of venison and beef carcass in Latvia were comparatively assessed in the period from 2006 – 2009. The research ascertained that during this period the average price of a deer carcass ranged from LVL 2.45 to 4.21 per kg (Table 4).

The average purchase price of venison carcass in 2006 was LVL 2.45 per kg, namely it was LVL 1.23 per kg higher than the purchase price of beef carcass. It was observed that in the period between 2006 – 2009 the venison carcass purchase prices increased rapidly. In comparison with the year of 2006, the purchase price increase was: in 2007 - by 18%, in 2008 - 29% and in 2009 - 72%. Purchase price of venison in 2009 mounted to LVL 4.21 per kg exceeding beef purchase price by 1.6 times or by 2.57 LVL kg⁻¹.

During the period 2006 – 2009 the purchase price of the beef carcass has also been increased. In comparison with the year 2006, the purchase price increase was: in 2007 - by 4%, in 2008 - 28% and in 2009 - 34%. In 2009 the purchase price of beef mounted to LVL 1.64 per kg.

Over the analysed period, a venison carcass

price was about 1.2 times higher than that of beef. In 2009, the average purchase price of venison carcass exceeded the beef carcass purchase price by 1.6 times or 156.7%. It is related to a high quality of venison and unsaturated market niche with unconventional assortment of meat production in Latvia.

Conclusions

1. Deer carcass quality and purchase prices in comparison with beef carcass quality and purchase prices have been considered.
2. High value meat (muscle tissue) specific weight was essentially higher (by 13.2) in clear carcass in comparison with cattle carcass components specific weight and less average value meat (fat tissue) specific weight (by 16%).
3. Deer meat quality is higher than that of beef. Cholesterol level in deer meat was lower than in beef 31.8 mg % and 45.2 mg % correspondingly, but by 2.9% higher total protein content that composes 23.4%.
4. Deer meat quality index (26.0) is by 8.9 higher than that of beef.
5. It can be concluded, that deer meat higher quality is precondition for comparatively higher market price determination. Deer carcasses purchase prices are higher than beef carcasses purchase prices. Deer carcasses purchase price was 4.21 LVL kg⁻¹ or by 156.7% higher than beef carcass purchase price in the year 2009.

Acknowledgements

Academic study and publication is financed by the project „Support for Doctoral Studies in LUA” / 2009/0180/1DP/1.1.2.1.2/09/IPIA/VIAA/017/ agreement Nr. 04.4-08/EF2.D1.03

References

1. *Dzīvnieku aizsardzības likums (Animal Protection Law)* (1999) Latvijas Republikas (LR) likums. Pieņemts 09.12.1999, publicēts: Latvijas Vēstnesis, 444/445 (1904/1905). Available at: <http://www.likumi.lv/doc.php?id=107353&from=off>, 12 September 2009. (in Latvian).
2. Fletcher J. (1989) Deer Farming in Europe. In: Hudson R.J., Drew K.R. and Baskin L.M. (eds.) *Wildlife Production Systems*. Cambridge University Press, Cambridge, UK, pp. 323-334.
3. Holst A. (2002) *Optimal Harvesting Strategies in Fallow and Red Deer Production*. Examenarbete 227. Institution for husdjursgenetik, Sveriges Lantbruksuniversitet, pp. 20-21.
4. Kotlers F. (2006) *Mārketinga Pamati (Marketing Basics)* Rīga, Jumava, lpp. 75-111. (in Latvian).
5. Latvijas Lauksaimniecība un Lauki (Agriculture and Rural Areas of Latvia) (2009) LR Zemkopības ministrija, Rīga, 65. lpp. (in Latvian).

6. Lauksaimniecības tirgus veicināšanas centrs (LTVC) (Promotion Centre of Agricultural Market) (2009) Market and Price Data Storage Data Base. Publikācijas, Available at: <http://www.ltv.lv/publikacijas.php?doktypenode=&zinaid=3934>, 28 December 2009. (in Latvian).
7. Mihejeva L. (1999) Kvalitātes tehnoloģiskā un organizatoriskā vadīšana kā konkurētspējas pirmais pamatnosacījums (The Technological and Organizational Management of Quality – The first Main Condition of Competitiveness). No: (Strīķis V. eds) *Latvijas lauksaimniecības zinātniskie pamati (Scientific Foundations of Agriculture of Latvia)*, Jelgava, 115. lpp. (in Latvian).
8. Miller S.C. (1993) U.S. Firms Lag in Meeting Global Quality Standards, *Marketing News*, 15 February 1993.
9. Paeglītis D., Dusalijeva I., Flečers Dž., Skriba G. (2006) *Staltbriežu audzēšana un selekcija (Breeding and Selection of Red Deer)*. Rīga: SDAA, lpp. 10-30. (in Latvian).
10. Tuckwell C. (2003) *The Deer Farming Handbook*. Australian government, Rural Industries Research and Development Corporation, RIRDC Publication No. 03/029, Canberra, 97 p.
11. Upīte Ī. (2000) Cenu noteikšana. No: (Rivža B. eds) *Lauksaimniecības un pārtikas produktu mārketinga menedžments (Agricultural and Food Marketing Management)*. Latvijas Lauksaimniecības universitāte, Jelgava, lpp. 125-143. (in Latvian).
12. Vigh-Larsen F. (1987) *Hjorteproduktion (Deer Production)* Odense: AiO Tryck as., pp. 112, 118. (in Swedish).
13. Zariņš Z., Neimane L. (2002) *Uztura mācība (Nutrition Lessons)* Rīga, lpp. 99-103. (in Latvian).
14. Мысик А.Т., Белова С.М. (1986) *Справочник по качеству продуктов животноводства (Handbook of quality of livestock products)*. Москва: АГРОПРОМИЗДАТ. с. 56-70. (in Russian).