Comparison of Venison and Beef Chemical Composition

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Abstract— **Deer meat is enjoyed in the form of jerky and roasts, and serves as a replacement for other red meat dishes. The main purpose of the current research was to evaluate differences in chemical composition of meat obtained from farmed and wild deer, and farmed cattle for comparison. The following chemical parameters were evaluated: content of amino acids (LVS ISO 13903:2005); fatty acids (GC-MS); cholesterol (colorimetric); nitrite (flow injection); Fe, Mn, Zn, Cu (AAS LVS EN ISO 6869:2002); proteins (Kjeldahl nitrogen); fats (LVS ISO 2446:1976); moisture (ISO 1442-1997); ash (ISO 936-1998). The results of current experiments demonstrate, that the content of cholesterol in meat sample obtained from farmed cattle was ~1.36 times higher comparing to venison obtained from wild and ~1.45 times higher comparing to venison obtained from farmed deer. The significant differences in moisture content of analysed meat samples were not found. Ash content in meat sample obtained from farmed deer was ~1.7 times lower than in meat samples obtained from wild deer and farmed cattle. The total content of essential amino acid of meat obtained from wild and farmed deer was higher comparing to amino acid content of meat obtained from farmed cattle. The lowest fat content was found in meat sample obtained from farmed deer. A higher polyunsaturated n-3 and n-6 fatty acid content was found in venison. Lower nitrite content was detected in meat obtained from farmed deer. The relevant differences in Fe, Mn and Cu content in meat samples were not found.**

Keywords— **venison, beef, chemical composition.**

I. INTRODUCTION

Meat has long been a central component of the human diet, both as a food in its own rights and as an essential ingredient in many other food products. Its importance has also attracted controversy [1].

In human diet beef is very popular. Grass-based beef production systems are low-input systems that are particularly suitable to meet the demand of meat retailers and consumers for naturally and animal-friendly produced beef. Beside such idealistic aspects, the perceived healthiness of food is becoming a key quality issue for consumers. In the case of meat, this is largely related to its fat content and its fatty acid composition [2]. In spite of being one of the few sources of dietary n−3 and n−6 highly polyunsaturated fatty acids, beef lipids are not generally regarded as a healthy component of the human diet. There are concerns about its relatively high concentrations of hypercholesterolemic, saturated fatty acids and low concentration of hypocholesterolemic polyunsaturated fatty acids [3].

Beef is considered to be a highly nutritious and valued food. The importance of meat as a source of high biological value protein and micronutrients (including for example vitamins A, B_6, B_{12}, D, E, iron, zinc, selenium) is well recognized. It is recommended that total fat, saturated fatty acids (SFA), n−6 polyunsaturated fatty acids (PUFA), n−3 PUFA and *trans* fatty acids should contribute <15–30%, <10%, <5–8%, <1–2% and <1% of total energy intake, respectively. Beef is dietary sources of conjugated linoleic acid: the dominant in beef is the *cis*-9, *trans*-11 isomer, which has being identified as possessing a range of health promoting biological properties including antitumoral and anticarcinogenic activities [4].

Deer meet will be advisable in human diet as alternative for beef. Deer have long economic significance to humans. Traditionally, deer are either harvested in the field with mobile abattoirs or are transported to commercial abattoirs [5].

In Latvia ‘Safari park’ is one of such deer harvesting gardens. ‘Safari park’ (‘Saulstari 1’) more is a garden of wild animals where fallow-deer and Europe stag (white and red deer) are being bred in the territory of 170 ha, in total ~300 animals.

Venison is also renowned for its low muscle lipid content and chemical composition of farmed venison, although higher levels (4.5% in red deer; 4.2% in

female reindeer) than that for African ungulates have also been noted. The later phenomenon is particularly noted when the animals have been finished off on pelleted diets. The effects of age, gender (including castration), region, and production system on the meat composition, including the fatty acid profile of the meat have been reported for fallow deer, red deer and reindeer [5]. Venison is popular as a healthy food because of its low fat and high lean meat and few for meat quality changes during storage. Venison is particularly interesting because of its high membrane contents and there are a lot of unsaturated fatty acids [6]. It is lower in fat than most meat, poultry and fish products. Deer farming presents an opportunity for livestock producers to satisfy consumer demands for lean meat [7 and 8]. Researchers have to be careful in evaluating the comparative nutritive values of different animal species because they depend so strongly on what part of the animal as tested and how many samples were taken [8 and 9]. Venison is recognized to be high in protein and low in fat, energy and cholesterol Table 1.

Table 1 Chemical composition of 100g meat [10]

Meat sample	Fats, g	Protein, g	Energy, kJ	Iron, mg	Cholesterol, mg
Venison haunch	1.6	22.2	432.0	3.3	29.0
Chicken without skin	2.1	22.3	453.0	0.7	90.0
Beef topside	12.9	20.4	830.0	1.7	48.0
Lamb loin	12.3	19.0	784.0	1.4	78.0
Pork loin	2.2	21.7	448.0	0.8	64.0

After literature data analyzing the aim of the current research was developed to evaluate differences in chemical composition of meat obtained from farmed and wild deer, and farmed cattle for comparison.

II. METHODS AND MATERIALS

The meat of farmed red deer (*Cervus elaphus*) was obtained from a local farm "Saulstari 1", located in Sigulda region, in Latvia; the meat of wild red deer was obtained from association 'Huntsman Club of Latvia University of Agriculture' Jelgava, Latvia; the meat of farmed cattle *(Colloquially cows)* from Ltd. 'Kebeco" located in Jekabpils region, Latvia. Wild breeding conditions of animals was very similar, without feeding with special forage. Animals were slaughtered at ~2 years of age. For the experiments *Longissimus dorsi* muscle from venison and beef saddle was used after two weeks storage in freezer at -20±2 ºC temperature and future defrosting at +4±2 ºC temperature in the refrigerator for 24±1 h.

The following chemical parameters of meat samples were evaluated: copper, iron, manganese and zinc were analyzed using atomic absorption spectrometry (AAS LVS EN ISO 6869:2002), moisture content (ISO 1442-1997), ash content (ISO 936-1998), content of amino acids (LVS ISO 13903:2005), fat content (LVS ISO 2446:1976), proteins content was determined according to the Kjeldahl nitrogen method [11], determination of nitrite by FIAstar 5000 FOSS Application note 5210 [adopted form 12], moisture content (ISO 1442-1997), fatty acids composition was analyzes using GC-MS method [13], cholesterol content in meat samples was analyzed using Blur colorimetric method [13].

Data are presented as a mean standard deviation. The differences between independent groups were specified by two way analysis of variance (ANOVA), and values of $p < 0.05$ were regarded as statistically significant.

III. RESULTS AND DISCUSSION

During current experiments main differences were found in cholesterol content of analysed meat samples. As a result the content of cholesterol in meat sample obtained from farmed cattle (60.71 mg%) was ~1.36 times higher comparing to venison obtained from wild (44.64 mg%) and ~1.45 times higher comparing to venison obtained from farmed deer (41.96 mg%) what is significantly ($p < 0.05$). However, substantial differences were not found in cholesterol content of venison samples. Therefore, such results forecast that the venison could be healthier in human diet.

Traditionally meat composed of naturally occurring water, muscle, connective tissue, fat, and bone. The percentage of naturally occurring water in meat varies with the type of muscle, the kind of meat, the season of the year, and the pH of the meat from

56% to 73% [14]. The significant differences in moisture content in analysed meat samples was not found ($p > 0.05$), the moisture content of meat samples was ~74.5% (Fig. 1).

In scientific literature found data that increased ash content have a negative effect on protein in meat [15]. The results of current research demonstrate that there is not found significant difference in ash content ($p > 0.05$) in meat obtained from wild deer and farmed cattle, what mainly could be explained with forage. However, ash content in meat sample obtained from farmed deer were ~1.9 times lower (what is significantly, $p < 0.05$) than of meat samples obtained from wild deer and ~1.32 times lower than in meat obtained from farmed cattle (Fig. 1); mainly because special forage were used for farmed deer feeding. However, there is not found significant differences of protein content (Fig. 1) in analyzed meat samples.

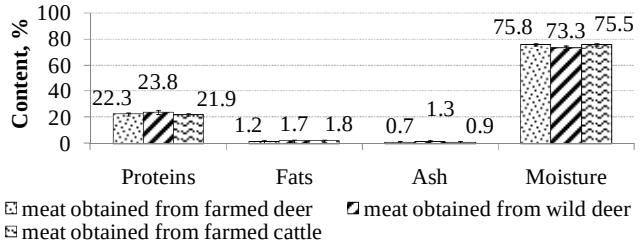

Fig. 1 Meat chemical composition

Lower nitrite (0.006 mg $100g^{-1}$) content was detected in meat obtained from farmed deer; it was ~9 times less than in meat obtained from farmed cattle and ~5 times less than in meat obtained from wild deer, what mainly could be explained with growing conditions.

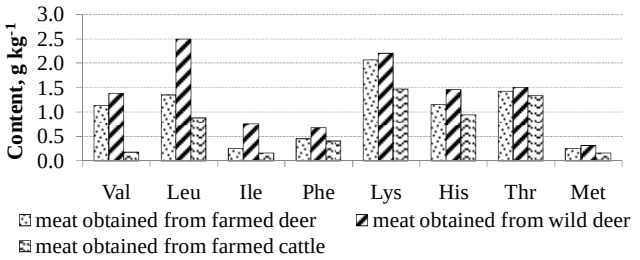

Fig. 2 Content of essential amino acids in meat

The efficiency of amino acid utilization is best when all amino acids are at or slightly below, but not above, their need for protein accretion and maintenance. In addition, formulating diets that meet, but do not exceed, amino acid needs also results in less nitrogen excretion [16]. In the current experiments main differences in essential amino acid profile in analysed meat samples (Fig. 2) were found. The content of total essential amino acid content in meat obtained from wild deer was ~2.0 times higher; in meat obtained from farmed deer − ~1.5 times higher comparing to amino acid content in meat obtained from farmed cattle (Fig. 2). As a result in the present research it was proved that the venison have higher nutritive value than beef.

There has been a continuous trend to reduce fat consumption and particularly saturated fat in our diet over the past two decades. Fat is important in providing texture, flavor and juiciness in meat batters but is also a calorie dense nutrient [17]. Obtained results demonstrate, that the low fat content was found in meat sample obtained from farmed deer, it was significantly lower ($p < 0.05$, by 1.5 times) comparing to meat obtained from farmed cattle and by 1.3 times comparing to meat obtained from wild deer (Fig. 1). Therefore, the meat obtained from farmed deer is lean; such differences in fat content of meat samples mainly could be explained with growing conditions and season. However, higher polyunsaturated n-3 and n-6 fatty acid content was found in venison. Amount of linoleic acid in venison obtained from farmed and wild deer comparing to beef was 3.98 and 5.17 times higher respectively. The content of α-linolenic acid in venison was approximately 3.50 times higher comparing to beef.

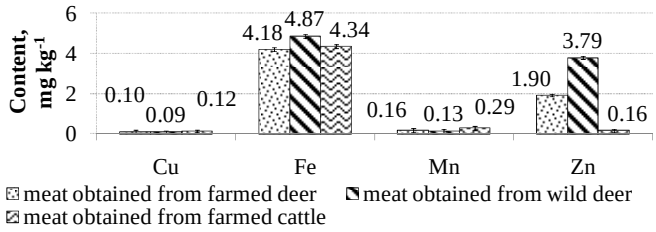

Fig. 3 Content of micronutrients in meat

The relevant differences in Fe, Mn and Cu content in meat samples were not found (Fig. 3) ($p > 0.05$). However, significant differences ($p < 0.05$) in Zn content in meat samples obtained from wild and farmed deer comparing with meat samples obtained from farmed cattle were found.

IV. CONCLUSIONS

The content of cholesterol in meat sample obtained from farmed cattle was ~1.36 times higher comparing to venison obtained from wild and ~1.45 times higher comparing to venison obtained from farmed deer.

Significant differences in moisture Fe, Mn and Cu content in analysed meat samples were not found.

Ash content in meat sample obtained from farmed deer was ~1.7 times lower than in meat samples obtained from wild deer and farmed cattle.

The total content of essential amino acid of meat obtained from wild and farmed deer was higher comparing to amino acid content of meat obtained from farmed cattle.

The lowest fat content was found in meat sample obtained from farmed deer. A higher polyunsaturated n-3 and n-6 fatty acid content was found in venison.

Lower nitrite content was detected in meat obtained from farmed deer.

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