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## Chromium content in the meat of male Saanen goat kids from Vojvodina (Northern Serbia)

V Tomovic<sup>1</sup>, M Jokanovic<sup>1</sup>, B Sojic<sup>1</sup>, S Skaljac<sup>1</sup>, M Lazovic<sup>2</sup>, I Vasiljevic<sup>2</sup>, I Tomasevic<sup>3</sup>, I Nikolic<sup>1</sup>, D Vujadinovic<sup>4</sup> and M Tomovic<sup>5</sup>

<sup>1</sup> University of Novi Sad, Faculty of Technology Novi Sad, Bulevar cara Lazara 1, 1000 Novi Sad, Serbia

<sup>2</sup> A BIO TECH LAB d.o.o., Vojvode Putnika 87, 21208 Sremska Kamenica, Serbia

<sup>3</sup> University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 Belgrade, Serbia

<sup>4</sup> University of East Sarajevo, Faculty of Technology Zvornik, Karakaj 1, 75400 Zvornik, Bosnia and Herzegovina

<sup>5</sup> Technical School Pavle Savić, Sajkaska 34, 21000 Novi Sad, Serbia

E-mail: tomovic@uns.ac.rs

**Abstract.** Goats, the earliest ruminant to be domesticated, are traditional sources of meat, milk, fibre, leather, related products of animal origin and as draught and pack animals. Meat is the major product of the goat. Meat quality is the sum of all sensory, nutritive, technological and hygienic-toxicological factors of meat.

The aims of this study were to investigate the chromium content of four different muscles (*M. psoas major*, *M. longissimus dorsi*, *M. semimembranosus* and *M. triceps brachii*) of Saanen goat male kids and to determine whether the chromium contents differed between the muscles. Chromium content was determined using inductively coupled plasma optical emission spectrometry (ICP-OES), after dry ashing mineralisation. The studied muscles did not significantly differ ( $P > 0.05$ ) with respect to chromium content. The chromium content ranged from 0.012 to 0.067 mg/100 g, with an average of 0.026 mg/100 g.

### 1. Introduction

Goats, the earliest ruminant to be domesticated, are traditional sources of meat, milk, fibre, leather, related products of animal origin and are used as draught and pack animals [1,2]. Saanen dairy goats originated from the Saanen valley of Switzerland, and are very famous for their excellent milk production, as well as for being the largest of the dairy breeds [3].

The most important category of goat meat in Serbia, as in developed countries, is kid meat [4]. The greatest demands for young goats in Serbia are seasonally during the springtime. Production is based on various breeds, more or less locally determined. In some regions, production of goats is quite extensive. The number of kids (and goats) that are slaughtered annually in Serbia is not negligible. These, however, are not available on the market, since most kids and adult goats are slaughtered and consumed on the farms where they were raised [4,5].

Traditionally, kids are slaughtered at 3-7 months old and 12-15 kg carcass weight [6]. According to Serbian legislation [7], kids are normally slaughtered between 3 weeks and 6 months of age. The



carcass weight with head, liver, heart, lungs, kidney and internal fat and without skin and distal parts of the legs should be between 4 and 12 kg.

Meat quality is the sum of all sensory, nutritive, technological and hygienic-toxicological factors of meat. The nutritive factors of meat quality include proteins and their composition, fats and their composition, minerals, vitamins, utilisation, digestibility and biological value [8,9]. Minerals are the inorganic elements, other than carbon, hydrogen, oxygen and nitrogen, which remain behind in the ash when food is incinerated. They are usually divided into two groups – macrominerals (main elements) and microminerals (trace elements) or into three groups – main elements (macrominerals), trace elements (microminerals) and ultra-trace elements. Many of the minerals are essential for plants, animals and humans. The main elements (Na, K, Ca, Mg, Cl, P, S) are essential for human beings in amounts >50 mg/day. Trace elements (Fe, I, F, Zn, Se, Cu, Mn, Cr, Mo, Co, Ni) are essential in amounts of <50 mg/day. Ultra-trace elements are: Al, As, Ba, Bi, B, Br, Cd, Cs, Ge, Hg, Li, Pb, Rb, Sb, Si, Sm, Sn, Sr, Tl, Ti and W [10,11]. The chromium (Cr) content of the human body varies considerably depending on the region; the range is 6-12 mg. The daily intake also varies greatly, from 5 to 200 µg. However, this supply is considered suboptimal. Cr is important in the utilisation of glucose. For instance, it activates the enzyme phosphoglucomutase and increases the activity of insulin; therefore, Cr deficiency causes a decrease in glucose tolerance. Additionally, Cr deficiency increases the risk of cardiovascular disease [11].

There is a lack of information about the mineral composition, and especially about the Cr content, of meat from goat kids. Therefore, the aims of this study were to determine the Cr contents of four major muscles (*M. psoas major*, *M. longissimus dorsi*, *M. semimembranosus*, and *M. triceps brachii*) derived from intensively reared male Saanen goat kids, and to determine whether the contents of this trace element differed in the different muscle types.

## 2. Materials and methods

Twenty, from 67 to 83 day-old, male Saanen goat kids (body weight from 19.5 to 23.9 kg) of similar background were used in the experiment. All kids were raised under intensive, identical husbandry; management and feeding conditions and pre-slaughter handling practices were as described in detail in Tomović et al. [12,13].

At the end of the fattening period, all kids were transported to a commercial abattoir. Kids were held overnight without feed before slaughter. Kids were slaughtered and dressed using standard commercial procedures. Carcasses were conventionally chilled for 24 h in chiller at 0-4°C. The cold carcasses were split down the dorsal midline and right sides were used for the present study. The following four muscles were excised from the right side of each carcass: *M. psoas major* (PM), *M. longissimus dorsi* (LD), *M. semimembranosus* (SM) and *M. triceps brachii* (TB). The meat samples were trimmed of visible adipose and connective tissue.

After trimming, each muscle was homogenised (Waring 8010ES Blender, USA; capacity 1 L, speed 18,000 rpm, duration of homogenisation 10 s, temperature after homogenisation <10°C), vacuum packaged in polyethylene bags and stored at -40°C until determination of Cr content.

The Cr content in the muscle tissues was determined using inductively coupled plasma optical emission spectrometry (ICP-OES) (iCP 6000 Series, Thermo Scientific, Cambridge, United Kingdom), after dry ashing mineralisation as described in detail in Tomović et al. [14,15,16] and Jokanović et al. [17].

All data are presented as mean, standard deviation (SD) and range. Analysis of variance (Duncan's multiple range test) was used to test the hypothesis about differences among mean values. The software package STATISTICA 10 [18] was used for analysis.

## 3. Results and discussion

The average content, standard deviation and range of Cr in the investigated samples of the meat tissues from four different muscles are presented in Table 1. The Cr contents found in the present study did not differ significantly ( $P = 0.142$ ) amongst the meat tissue belonging to different muscles of male

Saanen goat kids. The mean Cr content in the PM, LD, SM and TB muscles was 0.033, 0.019, 0.027 and 0.026 mg/100 g, respectively. The average content of Cr in the meat from these male Saanen goat kids in Vojvodina was 0.026 mg/100 g. The minimum Cr content found in the male goat kid meat was 0.012, while the maximum Cr content was 0.067 mg/100 g.

**Table 1.** Chromium content of four muscles from male Saanen goat kids

Muscle		Cr (mg/100 g wet weight)
<i>M. psoas major</i>	Mean ± SD	0.033 ± 0.009
	Range	0.022–0.053
<i>M. longissimus dorsi</i>	Mean ± SD	0.019 ± 0.009
	Range	0.012–0.042
<i>M. semimembranosus</i>	Mean ± SD	0.027 ± 0.020
	Range	0.012–0.067
<i>M. triceps brachii</i>	Mean ± SD	0.026 ± 0.010
	Range	0.014–0.048
<i>P</i> value		0.142
All muscles	Mean ± SD	0.026 ± 0.013
	Range	0.012–0.067

In the scientific literature there is a lack of information about the Cr content in meat from male goat kids. Generally, the Cr content, in the meat of male Saanen goat kids from Vojvodina, obtained in this study, was somewhat higher than the values reported for the Cr content of other types of red meat (beef, lamb, pork) reported in the Danish Food Composition Database [19].

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