

## FATTY ACID COMPOSITION OF MEAT OF WILD BOAR (*SUS SCROFA*) HUNTED IN THE SOUTHWEST REGION OF SLOVAKIA

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### Abstract

The aim of the this study was to determine the fatty acid profile, fat content and gross energy of meat of wild boar (*Sus scrofa*) hunted in hunting organization PZ Hôrka Rohožník, southwest region of Slovakia. Samples of *musculus semimembranosus* were collected immediately after hunting and gutting. A total Samples were organize according to age category (the youngest, sub adult and adult) and next according to month of hunting (August, November, December and January). The age category as well as the month of hunting did not have significant effect on fat and gross energy concentration of wild boar meat ( $P>0.05$ ). Significant effect of age category was detected for C16:1 and C18:3 n3 ( $P<0.05$ ). Significant effect of hunting month was detected for C16:0, C18:0, C20:1 n9 and SFA ( $P<0.05$ ). The lowest n6/n3 ratio (12.14) was detected in adult wild boars and animals hunted in August.

**Key Words:** Wild boar, age, meat, fatty acid, gross energy

Meat is a part of human nutrition at least for las two million years. First the meat have been acquired by hunt, nowadays it is mainly by livestock breeding. Without peradventure, the meat of game is the valuable product of hunting. Game meat is considered as a biologically worthier food than meat of farm animals (Dobiáš et al., 2009). Consumption of meat have impact on human health (Mrázová et al., 2017; Mrázová et al., 2011). Meat of wild boars lived in forest showed good characteristics in term of nutritional factors (Pedrazzoli et al., 2017). Nevertheless Blaška et al. (2018) published that in the nature, there are many factors than can affect the content of unsaturated fatty acids (FA) in intramuscular fat. The most important factor affecting the content of these acids is the species. Other factors than can affect the level of unsaturated fatty acids in the meat are the locality, which is related to climatic conditions, stress during the hunting season and changing the structure or amount of food. As published Gálik et al. (2018) next factor affecting the fatty acid composition in wild boar game is age. Therefore we aimed to determine the fatty acid profile of meat of wild boars with different age and hunted during different calendar months in the hunting organization PZ Hôrka Rohožník in southwest region of Slovakia.

### Material and Methods

In this study 16 carcasses of wild boar (*Sus scrofa*) were analysed. The carcass samples were collected from an individual as well from a collective hunting in the months August /n=4/, November /n=4/ and December /n=4/ of the year 2016 and from January /n=4/ of the year 2017 in the hunting organization PZ Hôrka Rohožník. Hunting organization PZ Hôrka Rohožník is situated in southwest region of Slovakia (GPS 48.456871945, 17.168884277). The hunting area is located in the lowland Záhorská nížina and in the mountain chain Malé Karpaty. The territory at lowland is covered mainly with scots pine and the territory of Malé Karpaty is covered mainly with oak, beech and witch hazel. During the winter period there is a supplementary feed served, which consist mainly from wheat, barley and maize grain mixture and silage, beet and apples. A total 16 animals of both sexes and three age categories were used in the trial (the youngest 11-18 months of age /n=5/, sub adult around 24 months of age /n=6/ and adult 36 or more months of age /n=5/). The samples for analysis were collected from *musculus semimembranosus* immediately after shooting and gutting. After collecting of all samples, they were predried by

lyophilisation at  $-40^{\circ}\text{C}$ , homogenized and analysed for dry matter, fat and gross energy concentration. From fat gained out of samples the fatty acids were determined. Standard laboratory methods and procedures were used in the Laboratory of Quality and Nutritive Value of Feeds (Department of Animal Nutrition, Faculty of Agrobiolgy and Food Resources, Slovak University of Agriculture in Nitra, Slovak republic). The content of dry matter (DM) was determined gravimetrically by drying of sample to constant weight by temperature  $103\pm 2^{\circ}\text{C}$ . The crude fat content was determined by extraction according to the Soxhlet principle. For the characterization of the lipid fraction, the triglycerides were hydrolysed (saponified) into glycerol and free fatty acids. Fatty acids were derivatized to the methyl esters (FAMES). After the FAMES preparation, they were separated according to the carbon number (number of carbon atoms in the fatty acid chain, excluding the methyl ester carbon) and the degree of unsaturation by gas chromatography (GC) with flame ionisation detector (FID). The analyses were performed on an Agilent 6890A GC (Agilent technologies, U.S.A.) analyser with a flame ionization detector. Automated split injection was performed using an Agilent autosampler (Agilent technologies, U.S.A.). FAMES were separated on DB-23 analytical column and identified by FID. Gross energy concentration was determined by Calorimeter LECO AC 500 (Leco Corporation, USA). Gained results were statistically processed with IBM SPSS v. 20.0 by ANOVA. Differences of means between the age categories or between the months of hunting were tested by Tukey HSD test. A P value less than 0.05 was considered as significant.

## Results and Discussion

The analysed nutritional parameters of meat of wild boar are shown in Tab.1 and Tab. 2. The highest concentration of intramuscular fat was determined in sub adult age category and in wild boars hunted in January. The highest concentration of gross energy was in samples of sub adult age category and in samples from December all without significance between groups. Kováčiková et al. (2001) published for wild boar leg content of 6.26 % of crude fat and  $630 \text{ kJ}\cdot 100\text{g}^{-1}$  of gross energy.

Razmaite et al., (2012) published content of intramuscular fat 1.68 % for females and 1.61 %

for male wild boars, which is less than show Tab.1 and Tab. 2. Razmaite et al. (2012) also determined increased content of intramuscular fat with increased weight of wild boars. In this study increase of intramuscular fat was detected only between the youngest age category and sub adult age category. On the other hand Gálik et al. (2018) determined lower fat content in sub adult age category compared to young age category. In contrast with detected intramuscular fat content in this study Gálik et al. (2018) detected 10.74 to 18.07 % of intramuscular fat. Increased content of intramuscular fat from August to January (Tab. 2) was also detected in study of Razmaite et al. (2012).

Fatty acid profile of analysed samples is shown in Tab. 3 and Tab. 4. Oleic acid (C18:1 cis n9), palmitic acid (C16:0) and stearic acid (C18:0) were the most abundant FA in all analysed groups of samples. With the increased age of wild boars, the proportion of oleic acid decreased, whereas palmitic and stearic acid increased. Linoleic acid (C18:2 cis n6) was the highest in the youngest age category and with aging of wild boars decreased.  $\alpha$ -linolenic acid (C18:3 n3) was the highest in the adult wild boars as well as was highest in the August and then decreased to the January. Proportion of PUFA decreased with aging of wild boar, whereas SAF increase with aging. Significant effect of age category was detected for palmitoleic acid (C16:1) and  $\alpha$ -linolenic acid (C18:3 n3) ( $P<0.05$ ). Effect of hunting month was significant ( $P<0.05$ ) for palmitic acid (C16:0), stearic acid (C18:0), cis-11-eicosenoic acid (C20:1 n9) and SFA. Pedrazzoli et al. (2017) claimed, that most abundant fatty acids in wild boar meat are palmitic (C16:0) and stearic (C18:0) acids. However in this study the most abundant FA was oleic acid (C18:1 cis n9) followed by palmitic acid (C16:0) and stearic acid (C18:0). The two most abundant FA (C18:1 cis n9 and C16:0) were found by Gálik et al. (2018) in meat of wild boar from mountain range Trbeč, which is 70 km far from Rohožník as well as by Razmaite et al. (2012) in intramuscular fat of wild boar from central parts of Lithuania. In addition Razmaite et al. (2012) did not determined effect of month of hunting during winter season on SFA, however in this study was determined significant ( $P<0.05$ ) difference in palmitic acid (C16:0) and SFA proportion between months December and January. Wild boar game eat a great variety of indigenous plants,

grains, seeds, roots, fruits, insects, earthworms, slugs and small mammals, and carrion (Schley and Roper, 2003). The effect of consumed feed on the fatty acid composition of wild boar meat was confirmed by Dimatteo et al. (2003). n6 and n3 fatty acids are essential for humans. Both have

to be ingested from diet. World Health Organization recommend n6/n3 ratio lower than 4 (WHO, 2003). The lowest ratio of n6/n3 fatty acids of wild boar meat was detected in August and in adult age category. This can be affected by the highest consumption of green forages which contains linolenic acid (Strazdina et al., 2013).

**Table 1. Nutritional parameters of meat of wild boar according to age category**

Trait	Age category			P
	Youngest (n=5)	Sub adult (n=6)	Adult (n=5)	
DM (%)	29.23 ± 3.85	28.20 ± 2.69	28.98 ± 4.16	
Fat (%)	3.18 ± 1.42	4.17 ± 1.96	2.84 ± 1.41	
GE (kJ.100g <sup>-1</sup> )	692.2 ± 91.6	692.8 ± 90.4	687.1 ± 101.2	

DM – dry matter, GE – gross energy, P – significance between groups

**Table 2. Nutritional parameters of meat of wild boar according to month of hunting**

Trait	Month of hunting				P
	8/2016 (n=4)	11/2016 (n=4)	12/2016 (n=4)	1/2017 (n=4)	
DM (%)	26.46 <sup>a</sup> ± 1.83	28.27 ± 3.58	32 <sup>b</sup> .32 ± 2.98	28.00 ± 2.43	
Fat (%)	2.30 ± 1.65	3.54 ± 1.56	3.66 ± 1.71	4.28 ± 1.64	
GE (kJ.100g <sup>-1</sup> )	626.6 ± 68.05	677.6 ± 98.32	765.5 ± 68.40	693.6 ± 79.85	

DM – dry matter, GE – gross energy, P – significance between groups, <sup>ab</sup> – the difference of means bearing different superscript within the row is significant at the 0.05 level.

**Table 3. Fatty acid composition of meat of wild boar according to age category**

Fatty acid (g.100g <sup>-1</sup> FA)	Age category			P
	Youngest (n=5)	Sub adult (n=6)	Adult (n=5)	
C14:0	1.43 ± 0.27	1.64 ± 0.34	1.63 ± 0.10	
C16:0	26.33 ± 3.56	27.14 ± 3.74	28.68 ± 2.00	
C16:1	2.94 ± 0.77	2.73 <sup>a</sup> ± 0.42	3.78 <sup>b</sup> ± 0.61	*
C17:0	0.52 ± 0.25	0.41 ± 0.14	0.35 ± 0.10	
C18:0	11.93 ± 2.38	12.83 ± 2.52	16.63 ± 1.47	
C18:1 cis n9	42.77 ± 4.60	40.40 ± 5.86	39.68 ± 2.81	
C18:2 cis n6	4.42 ± 2.20	3.75 ± 2.26	2.69 ± 1.35	
C18:3 n3	0.33 ± 0.00	0.15 ± 0.01	0.39 ± 0.00	*
C20:0	0.28 ± 0.06	0.22 ± 0.06	0.27 ± 0.05	
C20:1 n9	0.86 ± 0.38	0.85 ± 0.28	0.82 ± 0.12	
C20:2 n6	n.d.	0.20 ± 0.00	n.d.	
C24:0	0.40 ± 0.14	0.41 ± 0.11	0.36 ± 0.05	
PUFA	4.49 ± 2.20	3.86 ± 2.41	2.77 ± 1.50	
MUFA	46.57 ± 4.46	43.99 ± 6.18	44.28 ± 3.18	
SFA	40.56 ± 6.07	42.59 ± 6.56	44.73 ± 3.57	
Σ unidentified	8.38 ± 0.89	9.57 ± 1.33	8.22 ± 0.46	
Σn3/Σn6 ratio	0.08	0.02	0.08	
Σn6/Σn3 ratio	12.61	43.23	12.14	

PUFA – polyunsaturated fatty acids, MUFA – monounsaturated fatty acids, SFA saturated fatty acids, \* – significance between groups at P<0.05, <sup>ab</sup> – the difference of means bearing different superscript within the row is significant at the 0.05 level, n.d. – not detected.

**Table 4. Fatty acid composition of meat of wild boar according to month of hunting**

Fatty acid (g.100g <sup>-1</sup> FA)	Month of hunting				P
	8/2016 (n=4)	11/2016 (n=4)	12/2016 (n=4)	1/2017 (n=4)	
C14:0	1.70 ± 0.27	1.56 ± 0.23	1.72 ± 0.15	1.30 ± 0.24	
C16:0	28.49 ± 1.82	26.84 ± 2.11	30.19 <sup>a</sup> ± 2.28	23.97 <sup>b</sup> ± 3.04	*
C16:1	3.43 ± 0.93	2.97 ± 0.29	3.53 ± 0.66	2.55 ± 0.65	
C17:0	0.46 ± 0.13	0.51 ± 0.25	0.36 ± 0.17	0.41 ± 0.17	
C18:0	14.26 <sup>a</sup> ± 1.97	12.53 ± 1.58	13.87 ± 1.75	10.53 <sup>b</sup> ± 1.65	*
C18:1 cis n9	38.54 ± 4.29	40.75 ± 3.56	38.63 ± 4.33	45.74 ± 3.09	
C18:2 cis n6	3.63 ± 1.05	4.24 ± 2.15	1.61 ± 0.75	5.03 ± 2.27	
C18:3 n3	0.39 ± 0.00	0.24 ± 0.13	n.d.	0.14 ± 0.00	
C20:0	0.27 ± 0.03	0.18 ± 0.00	0.30 ± 0.06	0.21 ± 0.02	
C20:1 n9	0.83 ± 0.13	0.67 <sup>a</sup> ± 0.06	0.73 ± 0.06	1.15 <sup>b</sup> ± 0.38	*
C20:2 n6	n.d.	0.21 ± 0.00	n.d.	0.20 ± 0.00	
C24:0	0.37 ± 0.06	0.40 ± 0.05	0.39 ± 0.13	0.41 ± 0.13	
PUFA	3.73 ± 1.20	4.42 ± 2.31	1.61 ± 0.75	5.11 ± 2.28	
MUFA	42.81 ± 5.13	44.40 ± 3.52	42.89 ± 4.92	49.44 ± 2.94	
SFA	45.27 ± 4.27	41.68 ± 3.64	46.75 <sup>a</sup> ± 4.27	36.78 <sup>b</sup> ± 4.81	*
Σ unidentified	8.19 ± 0.49	9.51 ± 1.27	8.74 ± 1.72	8.67 ± 0.59	
Σn3/Σn6 ratio	0.08	0.05	n.d.	0.03	
Σn6/Σn3 ratio	12.14	30.83	n.d.	37.40	

PUFA – polyunsaturated fatty acids, MUFA – monounsaturated fatty acids, SFA saturated fatty acids, \* – significance between groups at P<0.05, <sup>ab</sup> – the difference of means bearing different superscript within the row is significant at the 0.05 level, n.d. – not detected.

## Conclusion

The average fat and gross energy concentration of wild boar meat hunted in hunting organization PZ Hôrka Rohožník was 2.30 to 4.28 % and 626.6 to 765.5 kJ.100g<sup>-1</sup>. The three most abundant fatty acids were oleic acid (C18:1 cis n9), palmitic acid (C16:0) and stearic acid (C18:0). Significant effect of age category on fatty acids proportion was determined for palmitoleic acid (C16:1) and α-linolenic acid (C18:3 n3). Significant effect of month of hunting on fatty acids proportion was determined for palmitic acid (C16:0), stearic acid (C18:0), cis-11-eicosenoic acid (C20:1 n9) and sum of all saturated fatty acids. Because of high n6/n3 ratio is meat of wild boar not desirable for day-to-day consumption.

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