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PROPERTIES OF SUBCUTANEOUS FAT FROM ENTIRE MALE AND CASTRATED SLAUGHTER PIGS

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I. INTRODUCTION

Human nutrition and animal welfare are topics of interest in discussions about pork production. Avoiding surgical castration of male piglets have been stated to increase piglet welfare. However, pig carcass and meat from entire male pigs (boars) have been shown to differ from those of castrated male pigs [1]. Altered meat and fat properties may lead to changes in product formulation due to e.g. fat tissue composition or sensory properties of the boar meat.

Fatty acid profile of pork fat is dependent on e.g. the total fat content of the carcass, diet of the pig, genetic background and sex of the pig [2]. In a bending test, boar subcutaneous fat has been documented to be softer than that from surgically castrated (barrow) or immunocastrated male pig [1]. Additionally, fatty acid composition of boar fat has been shown to be more unsaturated than that from barrow, immunocastrated male or gilt [1,2]. Fat or moisture content or fatty acid profile of subcutaneous fat in current Finnish commercial male pig production has not been reported. Thus, the objectives of this study were to determine moisture and fat content and fatty acid profile of subcutaneous fat from boar and barrow carcasses in Finland.

II. MATERIALS AND METHODS

A total of 39 (21 boars, 18 barrows) animals with terminal sire breeds of TN Tempo and Muskeli in three different meat companies were included in the study. The diets of the boars and barrows were similar within meat company but had slight variation in feed ingredients and energy and protein content between the companies. Carcass weight and meat percentage for the boars were 94.8 kg and 60.9 and for the barrows 93.5 kg and 59.3, respectively. The subcutaneous fat pieces (60 g each) were cut from medial line towards lateral direction at second cervical vertebrae on right side of the carcass at 24 h *post mortem*. Any adhering muscle tissue and skin were removed from the samples before they were stored frozen at -20 °C until analysed. Moisture content of the samples was determined by freeze-drying using Martin Christ Delta 2-24 LSCplus (Martin Christ Gefriertrocknungsanlagen GmbH, Osterode am Harz, Germany). The ether extract (fat content) with acid hydrolysis was determined by modified standard method (ISO 6492: Animal feeding stuffs - Determination of fat content). The equipment used was Foss Soxtec/Hydrotec 8000™ system for total fat analysis, consisting of Soxtec™ 8000 extraction unit and Hydrotec™ hydrolysis unit, (FOSS, Hillerød, Denmark). The relative fatty acid proportions of the subcutaneous fat samples were analysed according to Shingfield et al. [3]. A bayesian general linear mixed model was fitted with normal distribution assumption and weak prior information (default values). Data were analysed by using SAS PROC BGLIMM (SAS 9.4 statistical software, SAS institute 2021).

III. RESULTS AND DISCUSSION

Moisture content of the fat tissue was higher (96.9 % probability) in boars than in barrows and the difference was on the average 28.1 g/kg (with 95 % probability interval of -0.9 – 57.2). This was in accordance with earlier studies [1,4]. Fat content of the dried fat tissue was lower (98.7 % probability) in boars than barrows and the difference was on average 33.0 g/kg DM (with 95 % probability interval of -60.4 – -9.38) which was an expected level based on earlier studies [1,5] (Table 1).

The relative proportion of sum of saturated and monounsaturated fatty acids (SFA, MUFA, respectively) did not show difference (probability<90 %) between boar and barrow fat, but that of polyunsaturated fatty acids (PUFA) was higher (94.7 % probability) in boar than barrow fat and the difference was on average 1.67 % units (with 95 % probability interval of -0.464 – 3.739) (Figure 1.). Boar fat tissue has been stated to contain more PUFA than barrow fat [2].

Relative proportion of the Omega 6 fatty acid, linoleic acid (18:2n-6, CLA) was found to be higher (92.0 % probability) in boar than barrow fat and the difference was on average 1.3 percentage points (with 95 % probability interval of 0.636 – 3.242). No difference between the sexes was found in the linolenic acid (18:3n-3, Omega 3). The relationship of sums of Omega-6 and Omega-3 fatty acids did not differ between the sexes (probability <90 %) (Figure 1a, 1b). The PUFA and CLA have been shown to be beneficial for human health [6]. Thus, utilization boar fat for meat products could be favorable from human nutrition viewpoint.

Table 1 – Carcass properties and moisture and fat content of carcass subcutaneous fat obtained from boars and barrows at three slaughterhouses (95 % probability interval).

	Boars	Barrows	Difference	Bayes p boar-barrow difference >0
Carcass weight, kg	94.8 (88.2–102.5)	93.5 (85.9–100.5)	1.27 (-9.03–11.5)	0.610
Meat percentage, %	60.9 (59.3–62.6)	59.3 (57.6–60.9)	**1.65 (-0.62 – 3.94)**	**0.928**
Subcutaneous fat				
-moisture content, g/kg	131 (10.9–15.1)	103 (8.2–12.5)	**28.1 (-0.9–57.2)**	**0.969**
-fat content g/kg DM	760 (741–778)	793 (771–812)	**-33.0 (-60.4– -9.38)**	**0.013**

DM=dry matter

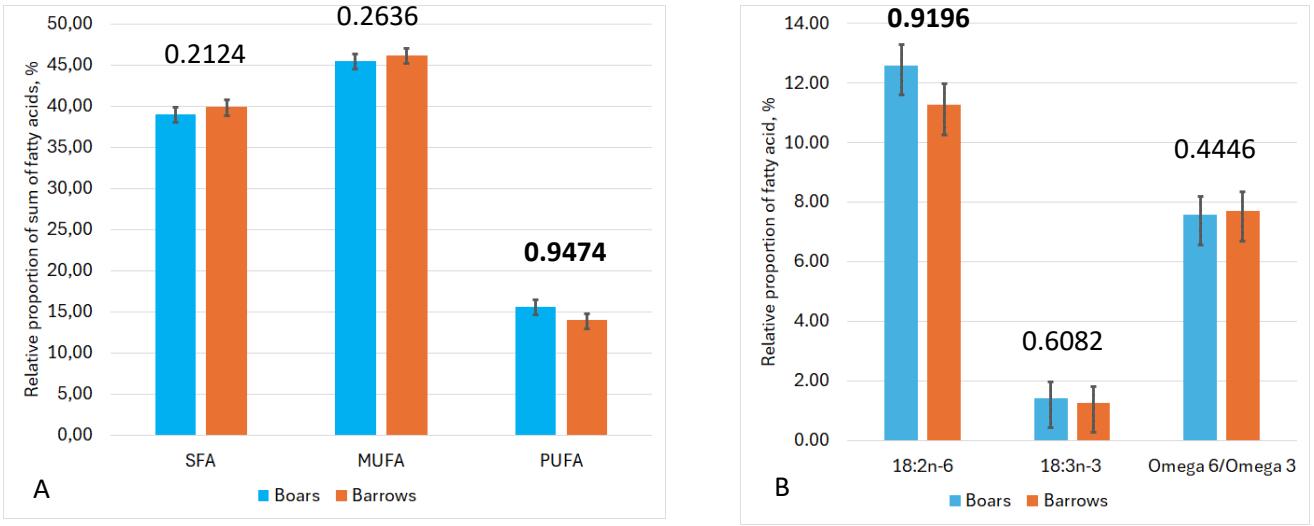


Figure 1. A) Relative proportions of sums of fatty acids and B) relative proportions of Omega fatty acids in subcutaneous fat from boars and barrows. Means with error bars of standard deviation. SFA=saturated fatty acids, MUFA=monounsaturated fatty acids, PUFA=polyunsaturated fatty acids, 18:2n-6=linoleic acid, 18:3n-3 linolenic acid, Omega 6/Omega 3=relationship of sums of omega 6 and omega 3 fatty acds. Bayes p value for boar-barrow difference>0.

IV. CONCLUSION

Subcutaneous fat from boars contained more moisture and less fat in dried fat tissue in comparison to that from barrows. Boar fat contained more PUFA, especially CLA compared to barrow fat, and could be favorable to meat products from human nutrition viewpoint.

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