Volatile Profile of Grilled Lamb as Affected by Castration and Age at Slaughter in Two Breeds

Vasiliki Gkarane[a,b], Nigel P. Brunton[a], Sabine M. Harrison[a], Rufielyn S. Gravador[a], Paul Allen[b], Noel A. Claffey[c], Michael G. Diskin[c], Alan G. Fahey[a], Linda J. Farmer[d], Aidan P. Moloney[e], Frank J. Monahan[a*]

[a] *University College Dublin, School of Agriculture and Food Science, Dublin 4, Ireland*

[b] *Teagasc, Food Research Centre, Ashtown, Dublin 15, Ireland*

[c] *Teagasc, Animal & Grassland Research and Innovation Centre, Athenry, Co. Galway, Ireland*

[d] *Agri-Food and Biosciences Institute, Newforge Lane, Belfast, BT9 5PX; United Kingdom*

[e] *Teagasc, Animal & Grassland Research and Innovation Centre, Grange, Co. Meath, Ireland*

* Corresponding author

E-mail addresses: Frank J. Monahan: frank.monahan@ucd.ie
Vasiliki Gkarane: vasiliki.gkarane@ucdconnect.ie; Nigel P. Brunton: nigel.brunton@ucd.ie; Sabine Harrison: sabine.harrison@ucd.ie; Rufielyn S. Gravador: rufielyn.gravador@ucd.ie; Alan G. Fahey: alan.fahey@ucd.ie; Paul Allen: paul.allen@teagasc.ie; Noel A. Claffey: noel.claffey@teagasc.ie; Michael G. Diskin: michael.diskin@teagasc.ie; Linda J. Farmer: Linda.Farmer@afbini.gov.uk; Aidan P. Moloney: aidan.moloney@teagasc.ie

Short version of title: Volatile profile of grilled lamb ….

Abstract

The aim of this study was to assess the effect of castration and slaughter age on the volatile profile of cooked meat from Scottish Blackface (SB) and Texel × Scottish Blackface (T×SB) lambs. *M. longissimus thoracis et lumborum* was sampled at slaughter and subjected to volatile analysis by SPME-GC-MS. Rams had higher relative proportions, expressed as relative abundance (RA), in lipid oxidation products while castrates had higher RA in pyrazines and benzenoid compounds. There was no consistent age effect on the RA of volatiles, although rams in November and January had a different volatile profile to castrates. There were higher proportions of free branched-chain fatty acids in muscle from SB compared to T×SB lambs. Overall, the results showed that production factors affected the volatile profile of cooked lamb meat which may explain differences in lamb flavor.

Keywords: aroma volatiles, headspace, meat, muscle, PCA

Practical Application: Lamb meat has a characteristic flavor which, according to the evidence to date, may be influenced by farm production factors like gender or slaughter age. Our results showed variations in the proportions of some flavor compounds between rams and castrated lambs while an increase in slaughter age did not have a consistent effect on proportions of compounds.

Introduction

Considering the significant role of aroma and flavor in determining the sensory quality of lamb meat, it is critical to clarify which components contribute to lamb aroma and flavor. Pre-slaughter animal production factors such as gender, age, diet and breed need to be considered as they can affect the composition of muscle and adipose tissue and hence, the characteristic flavor of lamb (Elmore et al., 2005; Resconi et al., 2010; Young et al., 2006) .

Various compounds are associated with the flavor of lamb meat, most notably branched chain fatty acids (BCFAs), such as 4-methyloctanoic (4-MOA), 4-ethyloctanoic (4-EOA) and 4-methylnonanoic acids (4-MNA), with studies in the past ascribing mainly negative connotations to them (Brennand, Ha, & Lindsay, 1989; Wong, Nixon, & Johnson, 1975) when they are detected in free form (Kaffarnik, Kayademir, Heid, & Vetter, 2014; Sutherland & Ames, 1995; Watkins et al., 2014) where their aroma impact is higher (Ha & Lindsay, 1990). However, other studies (reporting total BCFA content) found no correlation between these compounds and lamb odor or flavor (Young et al., 2006), or found a positive correlation with intensity of lamb flavor and flavor liking (Frank et al., 2016). In addition to BCFAs, compounds such as phenols (*p* and *m*-cresol), indole and 3-methyl-indole (skatole), lipid oxidation compounds (specifically some aldehydes for example heptanal, *(Z)*-4-heptenal, hexanal, *(E,E)*-2,4-heptadienal) (Vasta & Priolo, 2006), ketones (for example 2,3-octanedione, 1-octen-3-one, 2-heptanone) (Resconi et al., 2010; Vasta & Priolo, 2006), lactones (Caporaso, Sink, Dimick, Mussinan, & Sanderson, 1977) and Maillard products including pyrazines and sulfur compounds (Cramer, 1983), have been reported to contribute to lamb flavor and/or odor. In a previous study we reported (Gkarane et al., 2017) differences in the sensory quality of lamb from rams and castrates slaughtered at five different ages. The objective of the present study was to investigate how differences in the volatile profile of cooked lamb muscle might explain castration, age and breed differences in sensory quality.

Materials and Methods

Animal and Management

All animal procedures used in this study were conducted under experimental license from the Irish Health Products Regulatory Authority (HPRA) in accordance with the European Union (Protection of Animals used for Scientific Purposes) Regulations 2012 (S.I. No. 543/2012). Full details of the animals used in the study and their management are given in Gkarane et al. (2017). In brief, 200 lambs (100 Texel × Scottish Blackface (T×SB), 100 Scottish Blackface (SB)), born between February and April 2014, were used in the study. Within each breed type 50 lambs were castrated (castrates) and 50 were left as intact males (rams). All were raised at pasture from birth and selected for slaughter in groups of 40 (10 T×SB rams, 10 T×SB castrates, 10 SB rams, 10 SB castrates) in October 2014, November 2014, January 2015, March 2015 and April 2015. On selection, lambs received *ad libitum* a finishing diet consisting of the barley/maize-based concentrate ration (95% dietary dry matter (DM) intake) and grass silage (5% DM intake) for 36 days pre-slaughter. Lambs were slaughtered at a commercial abattoir (Gillivan's, Moate, Co. Westmeath, Ireland) at mean ages of 196, 242, 293, 344 and 385 days for the October, November, January, March and April groups, respectively. Carcasses were chilled overnight and transported to Teagasc, Food Research Centre, Ashtown, Dublin 15, Ireland, for dissection. Ultimate pH (pHu) of *M. longissimus thoracis et lumborum* (LTL) was measured 25 h post slaughter at the 13th rib using a SympHony SP70P hand-held pH meter (VWR, Dublin, Ireland). The LTL was excised from each carcass, cut into 2.5 cm thick steaks, vacuum packed, aged for 8 d at 4 °C and frozen at -20 °C until required for analysis.

Reagents and Fibers

Volatile standards, the alkane mixture (C7 - C30), methanol (for preparation of stock solutions of the standards), and sodium sulfate were supplied by Sigma-Aldrich Ireland Ltd (Arklow, Co. Wicklow, Ireland). The volatile standards hexanoic acid and α-terpineol were supplied by VWR International Ltd (Blanchardstown, Dublin 15, Ireland) while 1-pentadecanol was supplied by Fisher Scientific Ireland Ltd (Blanchardstown, Dublin 15, Ireland). Solid phase microextraction (SPME) fibers (50/30 μm CAR/DVB/PDMS fiber; 1 cm length) were supplied by Agilent Technologies (Part Number: SU57298U; Unit 3, Euro Business House, Cork, Ireland). All reagents and chemicals were of chromatographic quality.

Solid phase micro-extraction method development

A SPME extraction procedure for lamb muscle was developed as part of this study, following evaluation of four headspace sampling temperatures (65, 70, 80 and 90 °C), two fiber equilibration times (10 min *vs.* 20 min), two fiber exposure times (10 min *vs.* 20 min) and the inclusion of anhydrous sodium sulfate (Na_2SO_4). Method reproducibility was tested by performing triplicate analyses on grilled lamb (cooked to an internal temperature of 70°C), homogenized with Na_2SO_4 and using fiber equilibration and exposure times of 20 min and sampling temperatures of 65, 80 and 90 °C. The reproducibility depended on the compound, but on average, coefficients of variance (CV) were about 25%, in accordance with a previous study (Madruga, Elmore, Dodson, & Mottram, 2009). The optimum SPME conditions (adopted based on maximizing the number of compounds detected, the total peak area and the detection of BCFAs) are described in Section "Sample preparation and volatile analysis". The selection of compounds for identification was based on a review of more than 40 studies that reported volatile compounds in lamb meat (Table S1). The compounds were associated

with lamb flavor specifically (for example BCFAs, phenol, indoles) and were repeatedly detected in lamb samples during the method development.

Sample preparation and volatile analysis

Before analysis LTL samples were thawed by immersion of frozen vacuum packed samples in water at room temperature for 20 min. Thawed steaks (approximately 2.5 cm thickness) were grilled with the fat attached (Gkarane et al., 2017), using a clamshell grill until an internal temperature of 70°C (monitored using a hand-held digital thermometer; Eurolec, Dublin, Ireland) was reached. Adhering fat was removed and 7 g from the core was weighed and homogenized with 7 g Na_2SO_4 using a Kenwood CH180 Compact Mini Chopper (Kenwood, Hampshire, UK). A 5 ± 0.05 g sample of the homogenate was placed in a 20mL glass headspace vial sealed with a polytetrafluoroethylene (PTFE)-faced silicone septum (VWR, Dublin, Ireland). The vial containing the sample was equilibrated in a water bath set at 90 (± 2ºC) for 20 min and the fiber was exposed to the headspace over the sample for a further 20 min. After adsorption, the fiber was removed from the vial and immediately inserted into the injection port of the GC. Analysis of the volatile compounds was carried out using a Varian 3800 GC coupled to a Varian Saturn 2000 ion trap mass spectrometer (Varian Chromatography Systems, Walnut Creek, CA, USA). Volatile extraction, adsorption and injection were performed manually. The injector, operating in splitless mode, was set at 250°C and the desorption time was 8 min. Helium was used as carrier gas with a constant flow rate of 1.0 ml/min. Volatile compounds were separated using a ZB-5MS column (30 m length, 0.25 mm internal diameter, 0.25μm film thickness) (Phenomenex, Cheshire, UK). The GC oven temperature was programmed as follows: 40°C for 5 min, increasing to 230°C at 4°C/min and holding for 5 min, with a total acquisition time of 58 min. The GC/MS transfer line was heated at 280°C. Acquisition was performed in electron impact (EI) mode (70 eV) at

10 microscans/s, scanning the mass range 33–230 m/z. Saturated n-alkanes (C7-C30) injected directly onto the column were run under the same GC-MS conditions to obtain linear retention index (LRI) values for the volatile compounds detected. Compounds were identified by comparing their mass spectra with spectra from the NIST/EPA/NIH Mass Spectral Database (Version 2.0 g, 2011), those of authentic standards, and linear retention indices matching those of published values (Table 1). Integration of the peak areas of the volatile compounds used specific ions (Table 1) for each molecule (to deal with co-elution of some compounds) assuming a relative response factor of one for each compound. The response for each volatile was expressed as relative abundance (RA, percentage of the total peak area for all peaks identified). Individual animals were considered as experimental units and one meat sample from each animal was subjected to analysis using a randomized block design to avoid experimental bias. Thus, samples from rams and castrates at different ages across the two breeds were run each day.

Statistical analyses

Data required a log transformation to achieve a normal distribution and were analyzed using a mixed model with the fixed effects of castration (referred to as "gender" from this point onwards), age, breed and their interactions (gender × age, gender × breed, age × breed, gender × age × breed). Analysis was conducted in the MIXED procedure of SAS (v9.4). The P values presented are based on log transformed percentage RA values.

Correlations between the volatile compounds and other parameters (sensory attributes, intramuscular fat (IMF), pHu (full data set in Gkarane et al. (2017)), selected PUFA, and total (free and bound) BCFAs in subcutaneous (SC) fat (full data set submitted for publication and

under review) were determined by means of Spearman's correlation coefficient (r). Analysis was conducted using the CORR procedure of SAS (v9.4).

Principal component analysis (PCA) of volatile and sensory variables was performed using XLSTAT®statistical software (Version 19.01.41647, Addinsoft; Paris, France) and all variables were standardized to unit variance and zero mean prior to the analysis. The sensory variables used were those that showed significant effects (Gkarane et al., 2017). The same approach was used for the volatile variables, with the additional inclusion of phenols, indoles and BCFAs (well established lamb flavor compounds).

Results and Discussion

Gender effect

Sixty three volatile compounds were detected in the muscle from LTL of which 29 compounds were affected by gender (Table 2) and, of these, seven displayed gender × age and/or gender × breed interactions (Table 3). Muscle from rams had higher ($P<0.05$) RA than castrates for seven aldehydes: octanal, *(E,E)*-2,4-decadienal, decanal, undecanal, tridecanal, tetradecanal and pentadecanal (the odors associated with these compounds are listed in Table 1). These aldehydes are lipid degradation compounds, with octanal and decanal being formed from oleic acid (Fullana, Carbonell-Barrachina, & Sidhu, 2004), while *(E,E)*-2,4-decadienal is formed from linoleic acid (C18:2*n-6*) (Elmore et al., 2005). Octanal has been linked with lamb flavor and undecanal has been detected in adipose tissue of lamb in previous studies (Caporaso et al., 1977). An increase in chain length (C>12) gives aldehydes (that is, tridecanal, tetradecanal and pentadecanal) a clear fatty character (Parker, 2014); however, being high molecular weight compounds, they are less volatile and thus may have a limited influence on aroma.

Muscle from rams also had higher ($P<0.05$) RA in 1-octanol, 2-nonanone, γ-nonalactone, three hydrocarbons (tetradecane, hexadecane and heneicosane) and 4-MOA. Due to their relative high odor thresholds, alcohols and hydrocarbons, both deriving from lipid oxidation, are generally not considered to be important contributors to the flavors of lipid-based foods (Ho & Chen, 1994). 2-Nonanone, which has a "fatty, oily, fruity" odor (Table 1) is one of the ketones associated with lamb flavor in the study of Caporaso et al. (1977). Lactones ("fruity", "oily" aromas) are lipid oxidation compounds with a notable flavor contribution in meat due to their low odor threshold (Caporaso et al., 1977). The higher RA of 4-MOA in muscle from rams compared to castrates supports the literature reporting higher levels (Young et al., 2006) which may be attributed to intestinal conditions in rams favoring the formation of BCFAs (Ames & Sutherland, 1999).

Muscle from castrates had higher ($P<0.001$) RA of 2-methylbutanal which is a Strecker degradation aldehyde ("sweat", "mushroom", "malty" odor with a low odor threshold (3 μg/l; Table 1)) originating from proteolysis followed by amino acid degradation of isoleucine (Madruga et al., 2009). Lobley, Connell, Buchan, Skene, and Fletcher (1987) reported that testosterone improved nitrogen retention, decreasing the oxidation of amino acids (leucine) (that is, testosterone increases/stimulates muscle growth by suppressing muscle protein degradation). If this is the case, it may be that castrated lambs, lower in testosterone (Joo, Kim, Hwang, & Ryu, 2013), would have a lower nitrogen retention index associated with an increase in protein and amino acid oxidation, thus, promoting the formation of 2-methylbutanal.

Muscle from castrates also had higher ($P<0.05$) RA for four pyrazines (2-methylpyrazine, 2,5-dimethylpyrazine, 2-ethyl-3,5-dimethyl-pyrazine, 2-ethyl-3,6-dimethyl-pyrazine) compared to rams. Pyrazines are nitrogen-containing heterocyclic compounds that are formed through the Maillard reaction (Mottram, 1998). They have a "grilled meat" or

"roasted" odor note, low vapor pressure and low odor threshold (Table 1) and have been previously reported, following GC-olfactometry (GC-O), as important odor-impact volatiles in cooked lamb muscle (Frank et al., 2017; Resconi et al., 2010; Watkins, Frank, Singh, Young, & Warner, 2013). In agreement with the data relating to pyrazines, the sensory study (Gkarane et al., 2017) using the same animals as those used in this study showed that lamb from castrates had higher ($P<0.05$) *Intensity of Roast Meat Aroma* and *Intensity of Roast Meat Flavor* than lamb from rams. The Spearman correlation (Table S2) confirmed positive (although weak) correlations ($r=0.17$-0.22; $P<0.05$) between 2,5-dimethylpyrazine, 2-ethyl-3,5-dimethyl-pyrazine, 2-ethyl-3,6-dimethyl-pyrazine and these two attributes.

Muscle from castrates had a higher RA ($P<0.05$) of benzaldehyde, phenylacetaldehyde and toluene. Phenylacetaldehyde (benzeneacetaldehyde) is a Strecker aldehyde formed from phenylalanine oxidation (Farmer, 1994), with a "floral, honey" odor (Table 1). Chu and Yaylayan (2008) reported phenylacetaldehyde as a precursor of benzaldehyde formation. Benzaldehyde ("nutty, almond" odor, Table 1) has been previously reported in lamb muscle (Rivas-Cañedo et al., 2013). Toluene, although very often detected in lamb tissues (Rivas-Cañedo et al., 2013), is mostly correlated with the type of diet (Sivadier, Ratel, & Engel, 2010) rather than the gender of the animal. In fact, the PCA (Figure 1), accounting for 89.77% of the variance, showed that the pyrazines, benzenoid compounds and the Strecker aldehydes (2- and 3-methylbutanal) were closely clustered with *Intensity of Roast Meat Aroma* and *Intensity of Roast Meat Flavor* and were associated with the castrates, located on the left side of the plot.

The results clearly show that muscle from rams differed significantly from castrates (that is, had higher RA) in compounds deriving from lipid oxidation, which, in many cases, leads to deterioration in the quality of meat and unacceptable flavor changes for consumers (Mottram, 1998). Testosterone increases muscle growth and mass and decreases

intramuscular lipid deposition (Joo et al., 2013) while increasing muscle protein synthesis (Griggs et al., 1989). Thus, since rams tend to be leaner than castrates, the IMF content of muscle from rams is generally lower (2.61% in rams *vs* 3.19% in castrates, in the samples used in this study (Gkarane et al., 2017)), resulting in a lower intramuscular triglyceride lipid to phospholipid ratio and higher polyunsaturated fatty acid/saturated fatty acids (PUFA/SFA) ratio in rams than in castrates (0.19 compared with 0.17 PUFA/SFA ratio in rams and castrates, respectively; $P < 0.05$, unpublished results). The increased proportion of phospholipids, and the polyunsaturated fatty acids (PUFA) associated with them (Mottram, 1998) in muscle from rams (7.45 compared with 6.65 g PUFA/100g total fatty acids in rams and castrates, respectively, $P<0.05$; unpublished results) is likely to increase their susceptibility to lipid oxidation and the formation of volatiles deriving from lipid oxidation and this may explain the higher RA of lipid oxidation compounds in muscle from rams. The Spearman correlation (Table S2) confirmed positive correlations of PUFA proportion and/or PUFA/SFA ratio with lipid oxidation compounds (pentanal, hexanal, decanal, undecanal, dodecanal, tridecanal, tetradecanal, 1- hexanol, 1-octen-3-ol, 2-octen-1-ol, 2-heptanone, 2-pentylfyran ($r=0.19$-0.32, $P <0.05$)), some of which had higher RAs in rams.

The differences in volatile profile between the two genders observed here may explain the sensory differences in lamb from rams and castrates, reported in a companion paper (Gkarane et al., 2017). For example, we reported higher *Intensity of Lamb Aroma* and higher scores for some undesirable attributes (*Animal Smell/Farm Smell, Woolly Aroma, Rancid Aroma and Flavor, Off-flavors*) in rams compared to castrates, which may be partly explained by the formation of lipid oxidation compounds and/or by the higher RA of 4-MOA. The PCA (Figure 1) associated rams with lipid oxidation compounds but also with the total BCFAs in fat and the free BCFAs (except for 4-EOA) in lean meat, located on the right side of the plot. The Spearman correlation (Table S2) confirmed positive (although weak)

correlations (r=0.15-0.34; P<0.05) between *Off-flavors* and (*E,E*)-2,4-heptadienal, (*E,E*)-2,4-decadienal, (*E,Z*)-2,6-nonadienal, nonanal, decanal, dodecanal, tridecanal, tetradecanal, pentadecanal, hexadecanal, 2-octen-1-ol, 1-pentadecanol, 2-nonanone, indole, skatole, 4-EOA (muscle), 4-MNA (muscle), 4-MOA (SC fat). *Intensity of Lamb Aroma* was positively correlated with γ-nonalactone, γ-octalactone, α-terpineol, undecanal, 4-EOA (SC fat) and nonanoic acid (r = 0.15-0.25; P < 0.05).

The data agrees with other studies that also linked lamb flavor/odor with lipid degradation compounds (Elmore et al., 2005; Resconi et al., 2010) or the detection of BCFAs (Young, Lane, Priolo, & Fraser, 2003). While lipids are believed to contribute to desirable meat flavor (Farmer, 1994; Mottram, 1998), increased levels of PUFAs and high levels of oxidation in phospholipids (Brunton, Cronin, & Monahan, 2002) may negatively affect the palatability of cooked meat.

Age effects

Twenty volatile compounds were significantly affected by age (Table 2), five of which showed gender × age and/or age × breed interactions (Table 3). The age effects were not consistent for most of the compounds. The compounds *(Z)*-4-heptenal, *(E)*-2-nonenal, 2-heptanone, 2-nonanone and 2-ethyl-3,6-dimethylpyrazine decreased (P < 0.05) with slaughter age (Table 2). *(Z)*-4-Heptenal derives from linolenic acid (C18:3*n-3*) and has been correlated with lamb flavor in previous studies (Elmore et al., 2005), while *(E)*-2-nonenal and 2-heptanone derive from C18:2*n-6* (Elmore et al., 2005). The decreased RA of 2-ethyl-3,6-dimethylpyrazine with age (P ≤ 0.05) and the absence of a positive correlation with the other pyrazines in the (older) April lambs; Figure 1) could be related to decreased levels of free amino acids (for example cysteine, glycine) that promote their formation (Madruga, Dantas,

Queiroz, Brasil, & Ishihara, 2013) or a decrease in body protein content and synthesis in sheep with age (9 mo *vs* 13 mo of age) (Lobley, 1993).

The RA of 4-MOA ("sweaty-sour", "goaty", "waxy" odor, Table 1) increased with age, with April (12.7 months of age) being higher ($P < 0.05$) than October (7 months of age) (Table 2). This BCFA was identified more frequently and at higher RA than the other two BCFAs (that is, 4-MOA, 4-EOA and 4-MNA were detected in 60%, 12% and 4% of muscle samples, respectively), in accordance with other studies (Brennand & Lindsay, 1992; Young et al., 2006) reporting a predominance of 4-MOA compared to 4-MNA and/or 4-EOA. Similarly, other studies reported an increase of BCFAs with slaughter age, although subcutaneous fat was analyzed in those studies: Ames and Sutherland (1999) reported increased levels of 4-MOA and 4-MNA in subcutaneous fat of 7.5-month-old lambs (rams and castrates) compared to 3month-old lambs. Young et al. (2006), in a study involving rams and castrates of age four to 22 months, found that although BCFAs increased with the age, there was no impact on sensory quality. In contrast, Salvatore et al. (2007) found higher levels of 4-MOA in 8-month-old lambs compared to 22-month old hoggets, although there was a confounding effect of diet. While studies have shown BCFAs to be present at higher levels in subcutaneous fat than lean meat (Wong, Nixon, et al., 1975), reports for lean meat are rare (for example, Brennand and Lindsay (1992) reported 7.7 ppm and 0.6 ppm for 4-MOA in shoulder and leg muscle tissue, respectively). To the best of our knowledge, detection of BCFAs (in free form) using a static headspace method of detection like SPME is rarely reported (Zhan, Tian, Sun, Zhang, & Chen, 2017), although the method in our study proved effective for BCFA detection only when Na_2SO_4 was used in sample preparation. Brennand and Lindsay (1992) noted that concentrations of BCFAs in lean meat are below the level required to create a supra-threshold stimulus (that is, stimulus above detection

threshold) but that levels of BCFAs that are apparently below the detection threshold may, in combination with other fatty acids, contribute to subtle species flavors in lean meats.

Four compounds (*(E)*-2-octenal, 1-octen-3-ol, 2-octen-1-ol, 2-pentyl-furan) (odors described in Table 1) had lower ($P < 0.05$) RA in November and/or January than the other months. All of these compounds derive from oxidation of C18:2*n-6* (Elmore et al., 2005). Five compounds had higher ($P < 0.05$) RA in November and/or January: three aldehydes (2-methylbutanal, hexadecanal and phenylacetaldehyde), one ketone (2-pentanone) and one hydrocarbon (tridecane). Meynier and Mottram (1995) reported that the Maillard reaction between amino acids (glycine, lysine, cysteine, methionine) and sugars was pH dependent. In addition, Cremer and Eichner (2000) stated that the formation of 2-methylbutanal, 3-methylbutanal and acetaldehyde in paprika and tomato powders was linearly dependent on pH. In the current study the muscle pHu increased ($P < 0.05$) from October (mean pH 5.37) to January (mean pH 5.67) but not thereafter (Gkarane et al., 2017), supporting the contention that it could affect (that is, increase) the production of the Strecker aldehydes (that is,phenylacetaldehyde and 2-methylbutanal) up to January. The stabilization of the muscle pHu from January onwards may explain the lack of a further increase in the formation of these aldehydes with age. Hexadecanal had the highest RA (~8%) of all aldehydes detected but, being a high molecular weight aldehyde, its contribution to aroma may be minor due to its low volatility. The lower RA of some compounds, combined with the higher RA of some others in November and/or January could be the reason why sensory scores of *Fatty Aroma, Sour Aroma, Manure/Faecal Aroma, Rancid Flavor* and *Sour Flavor* were at their highest in those months and decreased afterwards (Gkarane et al., 2017). Another factor that could have influenced age effects is monthto-month variation in the composition of the pasture that lambs received, prior to housing and concentrate feeding.

There were gender × age interactions for 12 volatile compounds. For eight of these compounds (hexanal, nonanal, 2-ethyl-hexanol, *α*-terpineol, 1-pentadecanol, 4-EOA, 4-MNA, hexanoic acid) muscle from rams had higher ($P < 0.05$) RA in November and/or January than castrates (Table 3). In contrast, castrates had higher ($P<0.05$) RA for dimethyldisulfide, 3-methylbutanal, methional in November and/or January and higher RA in October for pentanol than rams. The results may partly explain the gender × age differences in sensory attributes, whereby rams had lower ($P < 0.05$) *Intensity of Roast Meat Aroma* and *Intensity of Roast Meat Flavor* and higher ($P < 0.05$) *Manure/Faecal Aroma*, *Rancid Flavor* and *Off-flavors* in November and/or January than castrates (Gkarane et al., 2017). The PCA (explaining 51.83% of the variance) (Figure S1) showed that January rams and April rams were associated with 1-octanol, octanal, nonanal, decanal, *α*-terpineol, tridecanal, tetradecanal, dodecanal, undecanal, tetradecane, hexadecane, 4-MOA (SC fat), 4-MNA (SC fat), *Off-flavors* and *Farmyard Flavor* (factor loadings 0.7-1 in PC1). November rams were only associated with *Sour Aroma* and *Sour Flavor* (factor loadings 0.7-1 in PC2; data not shown). Groups in the lower right quadrant (January castrates, March castrates and November castrates) were associated with 2-ethyl-3,5-dimethylpyrazine, 2-ethyl-3,6-dimethylpyrazine, 2,5-dimethylpyrazine, 2- and 3-methylbutanal, dimethyl disulfide, toluene, benzaldehyde, methional and *Intensity of Roast Meat Flavor* (factor loadings 0.7-1 in PC3).

Breed effect

Twenty four volatile compounds were significantly affected by breed with SB having higher RA for 18 of them: seven aldehydes (*(Z)*-4-heptenal, heptanal, *(E)*-2-octenal, octanal, *(E,Z)*-2,6-nonadienal, *(E)*-2-nonenal, *(E)*-2-decenal; $P < 0.05$), two alcohols (1-hexanol, 1-heptanol; $P < 0.01$), three ketones (2-pentanone, 2-heptanone, 2-nonanone; $P < 0.05$), one lactone (*γ*-nonalactone; $P<0.05$), two pyrazines and one pyridine (2-ethyl-3,5-

dimethylpyrazine, 2-ethyl-3,6-dimethylpyrazine and 2-pentylpyridine; $P < 0.05$) as well as two BCFAs (4-MOA, 4-MNA; $P < 0.05$). 1-Pentadecanol showed a gender × breed and an age × breed interaction (Table 3).

As mentioned previously, the triglyceride to phospholipid ratio in muscle lipids is affected by IMF content. Thus, the higher IMF in muscle from SB lambs ((3.28% for SB *vs* 2.52% for T×SB) (Gkarane et al., 2017) should reflect a lower phospholipid (and PUFA) proportion (6.48 compared with 7.62 g PUFA/100g of total fatty acids in SB and T×SB, respectively; $P < 0.05$, unpublished results), resulting in lower amounts of volatiles deriving from lipid oxidation (that is, aldehydes, alcohols, ketones); however this was not apparent in our comparison of breeds in this study. The explanation given for the gender differences regarding their fat content and volatile profile (that is, leaner muscles may be more susceptible to oxidation) appears not to apply in the context of breed differences. In support of this, many of the volatile compounds that were significantly affected by gender (see above) were not affected by breed (Table 2), while most of the compounds (six out of the 10) that were significantly affected by both gender and breed appeared not to be influenced by the leanness (IMF) of muscle. Thus, rams which were leaner than castrates, had lower RA of some compounds, while T×SB lambs, which are leaner than SB lambs, had higher RA of the same compounds. However, a possible reason for the higher RAs of some lipid oxidation-derived volatiles in SB compared to T×SB, is that PUFA content increases with increasing IMF (192 mg PUFA/100 g muscle in T×SB compared to 213 mg PUFA/100 g muscle on SB, unpublished results). Spearman correlation showed strong positive correlations between IMF and PUFA content (mg/100 g muscle) ($r=0.75$, $P<0.001$) and between PUFA content and the RAs for many lipid oxidation products (pentanal, 2-hexenal, hexanal, heptanal, 2-octenal, (*E*,*E*)-2,4-decadienal, pentanol, hexanol, heptanol, 1-octen-3-ol, 2-octen-1-ol, 2-heptanone and 2-pentylfuran) (Table S2).

Other studies have shown that significant differences in amino acid content (which may act as precursors for Maillard reaction) exist among pure-bred and cross-bred lambs (mainly in the non-essential amino acids, for example cysteine, serine, tyrosine) (Brzostowski & Tański, 2006). This could explain the differences in the levels of the two pyrazines and one pyridine between breeds.

Regarding the higher RA of two of the BCFAs in muscle from the SB lambs, the presence of BCFAs has been found to be related to excess propionate (deriving from concentrate diets, mainly barley-based diets), which is not metabolized by the liver but is incorporated into fatty acids via methylmalonate in the synthesis of fatty acids (Garton, Hovell, & Duncan, 1972). However, propionate is also formed by bacterial fermentation in the rumen (Scheifinger & Wolin, 1973) and the microorganisms involved may be influenced by genetic factors (Hernandez-Sanabria, Goonewardene, Wang, Zhou, & Moore, 2013). This could explain the differences in BCFAs detected among the two breeds. The higher RA of both lipid oxidation products and BCFAs in SB lambs may be the reason why in a previous study we reported that *Intensity of Lamb Aroma*, *Intensity of Lamb Flavor* and *Intensity of Lamb Aftertaste* were higher ($P < 0.05$) for SB lambs (Gkarane et al., 2017). In fact a number of other studies have linked intensity of lamb attributes with lipid oxidation compounds (Elmore et al., 2005; Young, Braggins, West, & Lane, 1999) or the presence of BCFAs (Frank et al., 2016).

On the other hand, muscle from T×SB lambs had higher ($P < 0.05$) RA for four aldehydes (tetradecanal, pentadecanal, hexadecanal, benzaldehyde) and toluene. The higher molecular weight aldehydes (that is, $C > 12$) are produced from plasmalogens on transmethylation of phospholipids (Fogerty, Whitfield, Svoronos, & Ford, 1989). In support of this, having a lower IMF compared to the SB lambs, the phospholipid/triglyceride lipid ratio should be higher in muscle from the T×SB lambs (0.16 compared with 0.19 PUFA/SFA

ratio in SB and T×SB, respectively; $P < 0.05$, unpublished results) and lipid oxidation products are therefore more likely to derive from the phospholipid fraction in the T×SB lambs. Benzaldehyde formation is linked to phenylalanine oxidation (Mottram, 1998) and the higher RA in muscle from T×SB lambs could be explained by its higher ($P<0.001$) protein content compared to SB lambs (Gkarane et al., 2017) .

A gender × breed interaction was found for five compounds (Table 3), with tetradecane, dodecanal and 1-pentadecanol of muscle from SB rams having higher RA than SB castrates while there was no difference between rams and castrates for T×SB lambs. Similarly, tridecane in muscle of T×SB rams had a lower ($P < 0.05$) RA than T×SB castrates; however, this was not observed in SB lambs. 1-Pentanol was detected at higher ($P < 0.05$) RA in muscle of SB castrates compared to T×SB castrates with no difference among SB rams and T×SB rams. Dodecanal was detected at higher RA ($P < 0.05$) in muscle of SB rams compared to T×SB rams, with no difference among SB castrates and T×SB castrates.

An age × breed interaction was found for three compounds. The RA of *(E,E)*-2,4-decadienal (deriving from C18:2*n-6*) increased ($P < 0.05$) with slaughter age in muscle from the T×SB lambs but not in SB lambs, while RA of *p*-cresol decreased with time ($P<0.05$) in T×SB lambs but not in SB lambs. For November, SB lambs had lower ($P<0.05$) RA for 1-pentadecanol than T×SB lambs, but there was no difference due to breed at the other slaughter dates. *p*-Cresol (4-methylphenol), with characteristic “animal”, “barnyard”, “stable” and “leather” odor notes (Table 1), is formed from the degradation of tyrosine occurring in rumen microflora or coming from forage and feed fermentations (Ha & Lindsay, 1991). The decline in the RA of this compound with the increase of slaughter age in T×SB lambs ($P<0.05$) (but also in SB lambs, though without reaching significance) coincides with the decrease in the intensity of the attribute “*Animal Smell/Farm Smell*” as reported following the sensory analysis of the same samples (Gkarane et al., 2017).

In general, the breed interactions are challenging to explain based on the data collected in this study, but they could be attributed to genetic parameters (associated with the two breed types) combined with hormonal variations (attributed to gender or slaughter age) that may affect IMF and fatty acid composition and as a consequence the generation of the above volatiles.

Conclusions

The RAs of many volatile compounds in cooked lamb meat are affected by lamb production factors (gender, age and breed). A higher abundance of lipid oxidation-derived volatiles in muscle from rams, which can be associated with less desirable flavor attributes, may reflect their lower IMF and higher PUFA/SFA ratio. The higher RA of pyrazines and benzenoid compounds in castrates, associated with a roast meat aroma, may be due to differences in amino acid composition that promote their formation. Differences in the volatile profile between muscle for rams and castrates in the November/January period, with possible undesirable flavor effects in rams, may be related to differences in hormone-dependent fatty acid metabolism. Breed differences may be due to genetic parameters that may affect amino acid composition and influence the formation of BCFAs deriving in the rumen.

Acknowledgements

The financial support of the Irish Dept. of Agriculture, Food and the Marine (project 11/SF/310) and of the Teagasc Walsh Fellowship programme (award 2013058) is gratefully acknowledged. The authors also thank colleagues at the Agri-Food and Biosciences Institute

for the provision of some standards used in the volatile analysis. There are no conflicts of interest.

Authors contributions

V Gkarane conducted the experimental work, collected the data and drafted the manuscript. N Brunton contributed to the method development for volatile analysis, interpretation of the results and manuscript revision. S Harrison contributed to the identification of volatile compounds and manuscript revision. R Gravador contributed to fatty acid analysis (unpublished results) and manuscript revision. P Allen contributed to the study design and manuscript revision. N Claffey contributed to the animal management and sample collection. M Diskin contributed to the study design and animal management oversight. A Fahey contributed to the study design, the statistical analysis and the manuscript revision. L Farmer contributed to the method development for volatile analysis and manuscript revision. A Moloney contributed to the study design and manuscript revision. F. Monahan had overall responsibility for the project, contributed to the study design, method development, interpretation of the results and manuscript revision.

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Table 1. Linear retention indices (LRIs) (derived experimentally and from the literature), ions used for identification and peak area integration, odor descriptors and odor threshold values of volatile compounds detected in lamb meat.

	LRI (exp)[a]	LRI (lit)[b]	Method of Identification[c]	Ions used[d]	Odor descriptor (OD)[Ref]	Odor threshold value (OTV) in ppb in water[Ref]	References to studies showing odor-active character (using GC-O or similar technique)
Sulphur compounds							
Dimethyl sulfide		521 [28],[35],[36]	NIST, Std, LRI	63,62,61	cauliflower [2]	1 [3]	
Dimethyl disulfide	719	753 [32],[35],[41]	NIST, Std, LRI	94,79	cabbage-like [3]	7.6 [3]	[5][18][32]
Dimethyl trisulfide	963	964 [22],[26],[41]	NIST, Std, LRI	126	cabbage-like [3]	0.01 [3]	[5][18][32]
Aldehydes							
2-Methylbutanal		657 [37],[46],[47]	NIST, Std, LRI	39,41,57	sweat, pungent [2]	3 [11]	[5][9][27]
3-Methylbutanal		650 [37],[46],[47]	NIST, Std, LRI	41,43,58	brothy,sweaty [17],malty [38]	0.2 [11]	[9][17][18][49]
Pentanal		699 [32],[42]	NIST, Std, LRI	43,44,58	green, floral [4], burning [32]	12 [11]	[4][5][9][32]
(*E*)-2-Hexenal	849	853 [22],[32],[46]	NIST, Std, LRI	39,41,55	green apple-like, bitter almond-like [16]	190 [16]	[32]
Hexanal	800	799 [32],[42],[46]	NIST, Std, LRI	39,41,56	green, grassy [46]	10 [16]	[5][9][17][18][27][32][46][49]
Methional	905	909 [23],[29],[30]	NIST, Std, LRI	48,104	cooked potato [14],[38]	0.2 [11]	[5][17][18]
(*E*,*E*)-2,4-Heptadienal	1008	1008 [4],[22],[42]	NIST, Std, LRI	81,53	metallic, dirt[17],fried potato [38]	0.057(in air) [7]	[4][9][17][27]
(*Z*)-4-Heptenal	898	901 [22],[30],[37]	NIST, Std, LRI	67,39,55	fishy, fish-oil like [17],[16]	0.06 [16]	[4][17][18]
Heptanal	900	901 [24],[28],[42]	NIST, Std, LRI	39,41,70	jasmine, mint [8]; burnt fat, green, lingers [4],baked[17]	3 [11]	[4][5][8][17][18][32][49]
(*E*)-2-Octenal	1056	1060 [4],[22],[37]	NIST, Std, LRI	39,55,83	wet ground, bitter, grass [8]; meat, coffee [38];	3 [10]	[4][5][8][9][32][49]
Octanal	1002	1004 [32],[35],[46]	NIST, Std, LRI	41,67,69	citrus-like, green [38]; nutty, fatty [32]	6.9 [16]; 0.7 [31]	[4][5][8][17][18][27][32][46][49]
(*E*,*Z*)-2,6-Nonadienal	1150	1155 [22],[35],[46]	NIST, Std, LRI	41,69,70	cucumber like [29], floral[46]	0.0045 [16]	[46]
(*E*)-2-Nonenal	1158	1156 [23],[26],[35]	NIST, Std, LRI	29,41,55	fatty, green [38]; cardboard, wood [8]	0.19 [16]	[4][5][8][9][17][18][27][32][49]
Nonanal	1101	1105 [23],[28],[46]	NIST, Std, LRI	69,81,57	wax, fat [38]; citrus-like, soapy [16]; hay/sweet [14]	1 [10], [31]	[4][8][18][32][46][49]
(*E*,*E*)-2,4-Decadienal	1315	1320 [22],[24],[26]	NIST, Std, LRI	81,67	rancid oils, meat, fried [8]	0.03 [16]; 0.07 [10],[11]	[4][8][9][17][27]
(*E*)-2-Decenal	1260	1264 [22],[35],[42]	NIST, Std, LRI	39,81,55	hay, fatty[14], tallow, orange [41]	0.077 (in air) [7]	[5][9][17][49]

Decanal	1204	1202 [22],[23],[32]	NIST, Std, LRI	41,67,55	soap, orange peel, tallow [41]	0.1[31]	[5][17][18][27][49]
Undecanal	1306	1306 [22],[23],[32]	NIST, Std, LRI	41,67,81	grassy, rain, dirt [17]	5 [31]	[5][17][18]
Dodecanal	1406	1411 [22],[23],[42]	NIST, Std, LRI	41,67,81	onion, green, yeast, vomit [8]	0.53 (OTV)/ 1 (FTV) [1]	[5][8][32]
Tridecanal	1510	1511 [22],[32]	NIST, LRI	41,67,81	nutty [32]		[32]
Tetradecanal	1607	1608 [22],[32],[44]	NIST, LRI	41,67,81	roasted, fried meat [44]		[49]
Pentadecanal	1705	1728 [22], [32]	NIST, LRI	41,67,81	hot timber [48]		
Hexadecanal	1818	1811 [22],[32]	NIST, LRI	41,67,81	sweet [32]		[32]
Alcohols							
1-Pentanol	809	764 [35],[37],[47]	NIST, Std, LRI	41,55,70	fuel oil, fruit, balsamic [2], sweet [32]	4000 [10]	[32]
1-Hexanol	868	866 [22],[32],[42]	NIST, Std, LRI	41,56,39	woody, cut grass, chemical-winey, fatty, fruity [2][49]	500 [10]	[49]
1-Heptanol	969	955 [36],[37],[47]	NIST, Std, LRI	41,55,70	fragrant, woody, oily, green, fatty [2]	520 [21]	[32]
1-Octen-3-ol	980	974 [22],[28],[47]	NIST, Std, LRI	43,57,69	mushroom, smoke [8]	1 [10]	[5][8][46][49]
2-Octen-1-ol	1066	1060 [22],[35],[36]	NIST, Std, LRI	41,57,67	green citrus [13]	4 [3]	[5]
2-Ethyl-1-hexanol	1027	1032 [23],[35],[41]	NIST, Std, LRI	41,55,57	resin, flower, green [13]	25000 [19]	[5]
1-Octanol	1069	1070 [22],[37],[41]	NIST, Std, LRI	41,55,69	fatty, waxy, oily, walnut , burnt [13]	126 [19]	[5][8]
α-Terpineol	1191	1195 [41]	NIST, Std, LRI	93,59,121	nail polish remover, naphthalene balls [3]	280 [1]	
1-Pentadecanol	1766	1787 [20]	NIST, Std, LRI	69,83,97			
Ketones							
2-Pentanone		683 [23],[35]	NIST, Std, LRI	43,71,86	fruity, banana-like [21][32]	2300 [21]	[32]
2-Heptanone	887	890 [32],[35],[47],	NIST, Std, LRI	43,58	sweet flowers; spicy, rancid almonds [21]	140 [11]	[5][9][32]
2-Nonanone	1089	1094 [22],[32],[35]	NIST, Std, LRI	43,58	fatty, oily [32]; fruity [21]	190 [21]	[9][32]
Lactones							
γ-Octalactone	1251	1261 [29],[41]	NIST, Std, LRI	85,57	coconut-like [29]	6.5 [16]	
γ-Nonalactone	1356	1361 [29],[41],[26]	NIST, Std, LRI	85,29	peach-like, woodruff-like [29]	9.7 [16]	

Phenols							
p-Cresol	1071	1072 [42], [45],[47]	NIST, Std, LRI	107,108	animal [45]; barnyard-like, leather [38]	3.9[16]	[8][9][17][27]
Indoles							
Indole	1287	1301 [22],[23],[41]	NIST, Std, LRI	117,89	fecal, goaty [29], musty [46]	11[16];	[46]
Skatole (3-Methyl indole)	1379	1383 [29],[41],[42]	NIST, Std, LRI	130,131	mothballs, camphorus [6], fecal, stable-like[29]	0.2[11] 0.13[16]	[46]
Pyrazines							
2-Methyl pyrazine	822	828 [24]	NIST, Std, LRI	94,67	meaty [13]	60000 [10]	
2,5-Dimethyl pyrazine	909	908 [22],[32],[42]	NIST, Std, LRI	108,42	beef stew, fried, barbecue [8]	1700 [11]	[5][8][32]
2,6-Dimethyl pyrazine	909	910 [22],[42],[43]	NIST, Std, LRI	108,42	nutty, solvent [32],	1500 [11]	[5][8][9][32]
2-Ethyl-3,5-dimethyl-pyrazine	1071	1081 [15],[34],[25]	NIST, Std, LRI	135,134	burnt, fragrant, meaty, green [2]	0.04 [10]	[8][17][9][18]
2-Ethyl-3,6-dimethyl-pyrazine	1083	1074 [15],[34],[25]	NIST, Std, LRI	135,136	burnt, fragrant, meaty, green [2]	8 [10]	[9][27]
Pyridines							
2-Pentyl-pyridine	1191	1203 [22],[32],[42]	NIST, Std, LRI	93,106	fatty, tallowy aroma [12]	0.6 [12]	
Benzenoid compounds							
Benzaldehyde	957	963 [22],[23],[32]	NIST, Std, LRI	105,77	nutty; almond, burnt sugar [32], [41]	350 [3]	[32][49]
Phenylacetaldehyde	1039	1044 [32],[30, [35]	NIST, Std, LRI	91,92	floral, honey [17]	4 [11]	[5][17]
Toluene	748	772 [35],[41]	NIST, Std, LRI	91,92			
Furans							
2-Pentyl-furan	987	995 [24],[28],[32]	NIST, Std, LRI	81,138,53	geranium, spicy[10] [11]	6 [10]	[5][8][18][32][49]
Hydrocarbons							
Tridecane		1300 [22]	NIST, Std, LRI	41,57,71			
Tetradecane		1400 [22]	NIST, Std, LRI	41,57,71			
Pentadecane		1500 [22]	NIST, Std, LRI	41,57,71			
Hexadecane		1600 [22]	NIST, Std, LRI	41,57,71			
Heneicosane		2100 [22]	NIST, Std, LRI	41,57,71			

BCFAs							
4-Methyl octanoic acid	1232	1223 [29],[32],[45]	NIST, Std, LRI	55,57,73	sour/goaty/waxy [14]; fatty, muttony [38]; sweaty-sour ("Soo") [40]	20 [6]; 500 (in minced mutton meat) [39]	[40]
4-Ethyl octanoic acid	1313	1364 [14],[29],[43],	NIST, Std, LRI	55,57,71	waxy/honey [14]; mutton, fatty [38];	6 [6]	[40][49]
4-Methyl nonanoic acid	1323	1324 [32],[45]	NIST, Std, LRI	55,57,71	waxy-sweet, soapy, fatty, muttony, wet wood [6],[33]; sweaty-sour ("Soo") [40];	650 [6]; 45000 (in minced mutton meat) [39]	[40][49]
Organic acids							
Hexanoic acid	979	985 [22],[23],[29]	NIST, LRI	60	urine-like, pungent; sweaty [29],[14]	3000 [10]	[49]
Nonanoic acid	1275	1271 [29]	NIST, Std, LRI	60	fatty, fecal, goaty [29]	342000 [33]	[4][49]

[a] Linear retention indices calculated from the n-alkanes (C7-C30) run under the same GC-MS conditions as LTL muscle samples; [b] Average LRI from the referenced literature on the ZB-5MS column or equivalent; [c] Method of Identification: NIST (NIST library), Std (authentic standard) and LRI; [d] Specific ions used for volatile identification.

1) Ahmed, Dennison, Dougherty, and Shaw (1978) **2)** Ba, Hwang, Jeong, and Touseef (2012) **3)** Belitz, Grosch, and Schieberle (2004) **4)** Braggins (1996) **5)** Bravo-Lamas, Barron, Farmer, and Aldai (2018) **6)** Brennand et al. (1989) **7)** Bueno, Campo, Cacho, Ferreira, and Escudero (2014) **8)** Bueno et al. (2011) **9)** Bueno et al. (2013) **10)** Buttery (1999) **11)** Buttery, Ling, and Stern (1997) **12)** Buttery, Ling, Teranishi, and Mon (1977) **13)** Calkins and Hodgen (2007) **14)** Carunchia-Whetstine, Karagul-Yuceer, Avsar, and Drake (2003) **15)** Chetschik, Granvogl, and Schieberle (2008) **16)** Czerny et al. (2008) **17**) Frank et al. (2017) **18**) Frank et al. (2016) **19)** Giri, Osako, Okamoto, and Ohshima (2010) **20)** Göğüş, Özel, and Lewis (2007) **21)** Kochhar (1993) **22)** Kondjoyan and Berdagué (1996) **23)** Madruga et al. (2013) **24)** Madruga et al. (2009) **25)** Poehlmann and Schieberle (2013) **26)** Rapisarda et al. (2012) **27)** Resconi et al. (2010) **28)** Roldán, Ruiz, del Pulgar, Pérez-Palacios, and Antequera (2015) **29)** Siefarth and Buettner (2014) **30)** Sivadier et al. (2010) **31)** Stahl (1973) **32)** Sutherland and Ames (1995) **33)** Sutherland and Ames (1996) **34)** Tairu, Hofmann, and Schieberle (2000) **35)** Vasta, D'Alessandro, Priolo, Petrotos, and Martemucci (2012) **36)** Vasta et al. (2011) **37)** Vasta, Ratel, and Engel (2007) **38)** Watkins et al. (2013) **39)** Wong, Johnson, and Nixon (1975) **40)** Wong, Nixon, et al. (1975) **41)** www.flavornet.org/flavornet.html **42)** www.pherobase.com **43)** www.pubchem.ncbi.nlm.nih.gov/ **44)** Xie, Sun, Zheng, and Wang (2008) **45)** Young, Berdagué, Viallon, Rousset-Akrim, and Theriez (1997) **46)** Young et al. (2003) **47)** Yu, Sun, Tian, and Qu (2008) **48)** Zagustina et al. (2010) **49)** Zhan et al. (2017)

Table 2-Least square mean values for relative abundances of volatile compounds, detected in the headspace of grilled LTL muscle, as affected by gender, age at slaughter and breed.

	Gender		Age at slaughter[1]					Breed[1]			Significance[2]		
	Ram	Castrate	Oct	Nov	Jan	Mar	Apr	SB	T×SB	SEM	Gender	Age	Breed
Sulfur compounds													
Dimethyl sulfide	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00			
Dimethyl disulfide	0.03	0.05	0.04	0.04	0.05	0.04	0.04	0.04	0.04	0.00	0.000		
Dimethyl trisulfide	0.28	0.36	0.28	0.31	0.40	0.27	0.34	0.28	0.36	0.03			
Aldehydes													
2-Methylbutanal	0.59	0.83	0.57^{a}	0.81^{b}	0.98^{b}	0.63^{a}	0.59^{a}	0.75	0.68	0.03	<0.001	<0.001	
3-Methylbutanal	0.71	1.06	0.78^{a}	0.93^{ab}	1.12^{b}	0.79^{a}	0.80^{a}	0.86	0.90	0.04	<0.001	0.016	
Pentanal	0.41	0.38	0.36	0.39	0.46	0.39	0.36	0.42	0.36	0.02			
(E)-2-Hexenal	0.06	0.08	0.09	0.06	0.07	0.11	0.05	0.07	0.08	0.01			
Hexanal	3.43	3.29	3.39	2.99	3.35	3.39	3.67	3.49	3.23	0.09			
Methional	0.36	0.61	0.42	0.52	0.58	0.51	0.39	0.48	0.49	0.02	<0.001		
(E,E)-2,4-Heptadienal	0.23	0.23	0.20	0.19	0.27	0.30	0.19	0.26	0.20	0.02			
(Z)-4-Heptenal	0.27	0.26	0.32^{b}	0.26^{b}	0.30^{b}	0.29^{b}	0.15^{a}	0.30	0.23	0.02		0.022	0.01
Heptanal	2.90	2.90	3.46	2.76	3.07	2.71	2.50	3.38	2.43	0.10			<0.001
(E)-2-Octenal	0.54	0.49	0.55^{b}	0.42^{a}	0.51^{ab}	0.54^{b}	0.55^{b}	0.55	0.48	0.02		0.020	0.011
Octanal	4.82	4.35	4.31	4.38	4.48	4.68	5.05	4.89	4.27	0.10	0.013		0.001
(E,Z)-2,6-Nonadienal	0.24	0.24	0.27	0.21	0.25	0.25	0.20	0.26	0.21	0.01			0.014
(E)-2-Nonenal	1.45	1.37	1.91^{b}	1.33^{a}	1.44^{ab}	1.34^{a}	1.04^{a}	1.76	1.06	0.08		0.011	<0.001
Nonanal	19.21	16.49	17.75	16.95	16.69	17.98	19.89	18.23	17.47	0.40	0.000		
(E,E)-2,4-Decadienal	0.34	0.29	0.33^{bc}	0.25^{a}	0.28^{ab}	0.33^{c}	0.36^{c}	0.33	0.29	0.02	0.041	0.018	
(E)-2-Decenal	0.88	0.78	0.96	0.82	0.83	0.88	0.66	1.00	0.66	0.05			<0.001
Decanal	1.22	1.00	1.03	1.15	1.15	1.06	1.15	1.14	1.07	0.03	<0.001		
Undecanal	0.66	0.47	0.50	0.64	0.57	0.52	0.59	0.63	0.50	0.06	0.016		
Dodecanal	0.44	0.36	0.39	0.38	0.40	0.41	0.44	0.41	0.39	0.01	<0.001		

Tridecanal	0.48	0.40	0.45	0.45	0.41	0.42	0.46	0.43	0.45	0.01	<0.001		
Tetradecanal	1.38	1.10	1.30	1.24	1.16	1.18	1.30	1.18	1.29	0.03	<0.001		0.033
Pentadecanal	1.83	1.62	1.73	1.82	1.58	1.69	1.82	1.61	1.85	0.04	0.013		0.003
Hexadecanal	8.75	8.13	8.88^{bc}	9.86^{c}	7.16^{a}	7.98^{ab}	8.33^{abc}	7.72	9.17	0.27		0.041	0.002
Alcohols													
1-Pentanol	0.15	0.15	0.15	0.14	0.15	0.17	0.15	0.16	0.14	0.01			
1-Hexanol	0.34	0.32	0.40	0.31	0.34	0.30	0.29	0.37	0.28	0.02			0.000
1-Heptanol	0.50	0.49	0.51	0.48	0.53	0.50	0.47	0.55	0.44	0.02			0.002
1-Octen-3-ol	1.20	1.12	1.19^{bc}	0.96^{a}	1.08^{ab}	1.24^{bc}	1.31^{c}	1.15	1.17	0.03		0.002	
2-Octen-1-ol	0.19	0.17	0.19^{c}	0.15^{a}	0.17^{ab}	0.18^{bc}	0.20^{c}	0.18	0.17	0.01		0.001	
2-Ethyl-1-hexanol	0.57	0.45	0.39^{a}	0.50^{ab}	0.54^{b}	0.58^{b}	0.52^{b}	0.54	0.48	0.02	0.004	0.044	
1-Octanol	2.32	1.94	2.02	2.04	2.12	2.12	2.35	2.20	2.06	0.01	<0.001		
α-Terpineol	0.63	0.49	0.53	0.54	0.60	0.59	0.55	0.60	0.52	0.03	0.007		
1-Pentadecanol	1.88	1.64	1.02^{a}	1.41^{b}	2.14^{c}	2.04^{c}	2.19^{c}	1.65	1.87	0.07		<0.001	0.042
Ketones													
2-Pentanone	0.04	0.04	0.02^{a}	0.08^{b}	0.03^{a}	0.03^{a}	0.02^{a}	0.06	0.02	0.01		0.044	0.004
2-Heptanone	0.17	0.16	0.21^{b}	0.13^{a}	0.16^{a}	0.16^{a}	0.16^{a}	0.18	0.15	0.02		0.000	0.018
2-Nonanone	0.18	0.14	0.20^{b}	0.16^{a}	0.16^{a}	0.15^{a}	0.13^{a}	0.17	0.14	0.01	0.001	0.003	0.006
Lactones													
γ-Octalactone	0.02	0.01	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.00			
γ-Nonalactone	0.04	0.03	0.03	0.03	0.04	0.05	0.04	0.04	0.03	0.02	0.017		0.044
Phenols													
p-Cresol	0.57	0.57	0.97^{b}	0.52^{b}	0.55^{b}	0.48^{ab}	0.35^{a}	0.54	0.61	0.05		0.002	
Indoles													
Indole	0.003	0.001	0.000	0.003	0.002	0.002	0.002	0.002	0.002	0.00			
Skatole (3-methylindole)	0.005	0.006	0.006	0.005	0.006	0.009	0.002	0.005	0.006	0.06			

Pyrazines													
2-Methyl pyrazine	0.13	0.27	0.19	0.20	0.28	0.21	0.12	0.22	0.18	0.02	0.001		
2,5-Dimethyl pyrazine	2.30	3.23	2.63	2.83	3.05	3.22	2.08	2.95	2.57	0.03	<0.001		
2,6-Dimethyl pyrazine	0.02	0.07	0.03	0.00	0.03	0.12	0.04	0.03	0.05	0.02			
2-Ethyl-3,5-dimethyl-pyrazine	0.23	0.31	0.27	0.29	0.31	0.26	0.22	0.32	0.22	0.03	0.012		0.027
2-Ethyl-3,6-dimethyl-pyrazine	1.95	2.39	2.27^{b}	2.35^{b}	2.50^{b}	2.13^{ab}	1.61^{a}	2.37	1.97	0.03	0.005	0.049	0.044
Pyridines													
2-Pentyl-pyridine	0.16	0.10	0.13	0.13	0.08	0.19	0.11	0.17	0.09	0.02			0.032
Benzenoid compounds													
Benzaldehyde	28.77	32.05	30.13	30.59	30.80	30.42	30.12	28.62	32.21	0.44	<0.001		<0.001
Phenylacetaldehyde	2.14	2.79	2.16^{a}	2.69^{b}	3.08^{b}	2.26^{a}	2.15^{a}	2.49	2.44	0.07	<0.001	<0.001	
Toluene	0.89	1.00	0.94	1.03	0.92	0.94	0.91	0.88	1.02	0.03	0.014		0.011
Etherocyclic compounds													
2-Pentylfuran	0.77	0.76	0.85^{b}	0.63^{a}	0.67^{a}	0.89^{b}	0.79^{ab}	0.77	0.77	0.03		0.011	
Hydrocarbons													
Tridecane	0.58	0.58	0.67^{b}	0.83^{c}	0.43^{a}	0.50^{a}	0.49^{a}	0.58	0.59	0.02		<0.001	
Tetradecane	0.43	0.39	0.41	0.40	0.40	0.41	0.43	0.42	0.40	0.01	0.006		
Pentadecane	0.64	0.62	0.63	0.70	0.62	0.60	0.59	0.62	0.64	0.02			
Hexadecane	0.35	0.28	0.28	0.35	0.37	0.28	0.30	0.32	0.32	0.02	0.011		
Heneicosane	0.05	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.002		
BCFAs													
4-Methyloctanoic acid	0.019	0.012	0.010^{a}	0.018^{ab}	0.016^{ab}	0.011^{a}	0.024^{b}	0.019	0.012	0.00	0.025	0.046	0.021
4-Ethyloctanoic acid	0.002	0.005	0.001	0.009	0.004	0.000	0.003	0.004	0.003	0.11			

4-Methylnonanoic acid	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.13	0.031
Organic acids											
Hexanoic acid	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.00	
Nonanoic acid	0.26	0.21	0.23	0.27	0.21	0.20	0.27	0.25	0.21	0.02	

[1]October (Oct), November (Nov), January (Jan), March (Mar), April (Apr), Scottish Blackface (SB), Texel x Scottish Blackface (T×SB)
[2] $P < 0.05$ considered significant; significant interactions are presented in Table 3.
[a,b,c] Mean values that do not share a common superscript are significantly different ($P < 0.05$)

Table 3-Least square mean values for relative abundances of volatile compounds (detected in the headspace of grilled LTL muscle) showing significant gender, age at slaughter and breed interactions.

		Age at slaughter					Breed[1]		SEM	P values)		
		October	November	January	March	April	SB	T×SB		G x A	G x B	A x B
Gender × Age												
Dimethyldisulfide	Rams	0.035^{ab}	0.044^{b}	0.028^{ax}	0.036^{ab}	0.030^{ab}			0.00	<0.001		
	Castrates	0.041^{b}	0.037^{a}	0.069^{by}	0.046^{a}	0.040^{a}			0.00			
3-Methylbutanal	Rams	0.52^{ax}	0.89^{c}	0.74^{abcx}	0.78^{bc}	0.61^{abx}			0.04	0.003		
	Castrates	1.04^{ay}	0.97^{a}	1.49^{by}	0.81^{a}	0.98^{ay}			0.06			
Hexanal	Rams	3.13	3.41^{y}	3.71	3.41	3.47			0.14	0.038		
	Castrates	3.65^{c}	2.58^{ax}	2.99^{ab}	3.36^{bc}	3.87^{c}			0.12			
Methional	Rams	0.33^{abx}	0.40^{abx}	0.29^{ax}	0.46^{b}	0.32^{ab}			0.03	0.002		
	Castrates	0.52^{ay}	0.64^{ay}	0.88^{by}	0.55^{a}	0.45^{a}			0.04			
Nonanal	Rams	18.64	17.48	20.00^{y}	18.50	21.43			0.60	0.036		
	Castrates	16.85^{b}	16.42^{b}	13.38^{ax}	17.46^{b}	18.36^{b}			0.50			
Pentanol	Rams	0.12^{ax}	0.16^{b}	0.14^{a}	0.19^{b}	0.15^{ab}			0.01	0.042		
	Castrates	0.17^{by}	0.12^{a}	0.15^{ab}	0.14^{ab}	0.16^{ab}			0.01			
2-Ethyl-1-hexanol	Rams	0.36^{a}	0.60^{by}	0.67^{by}	0.69^{by}	0.51^{b}			0.04	0.013		
	Castrates	0.45	0.40^{x}	0.40^{x}	0.49^{x}	0.54			0.02			
α-Terpineol	Rams	0.45^{a}	0.68^{by}	0.79^{by}	0.67^{ab}	0.59^{ab}			0.04	0.016		
	Castrates	0.60	0.40^{x}	0.40^{x}	0.52	0.51			0.03			
1-Pentadecanol	Rams	0.92^{a}	1.75^{by}	2.51^{c}	2.14^{bc}	2.08^{bc}			0.12	0.048		
	Castrates	1.11^{a}	1.07^{ax}	1.78^{b}	1.94^{b}	2.30^{b}			0.08			
4-Ethyloctanoic acid	Rams	0.001^{a}	0.000^{ay}	0.009^{b}	0.000^{a}	0.002^{ab}			0.00	0.021		
	Castrates	0.000^{a}	0.018^{bx}	0.000^{a}	0.001^{a}	0.004^{a}			0.00			
4-Methylnonanoic acid	Rams	0.000^{a}	0.003^{by}	0.000^{a}	0.002^{ab}	0.000^{a}			0.00	0.041		
	Castrates	0.001	0.000^{x}	0.001	0.000	0.000			0.00			
Hexanoic acid	Rams	0.00^{ax}	0.02^{by}	0.03^{b}	0.01^{ab}	0.02^{b}			0.00	0.049		
	Castrates	0.02^{y}	0.01^{x}	0.02	0.01	0.02			0.00			

Gender × Breed											
Tridecane	Rams						0.60	0.56^{x}	0.03	0.032	
	Castrates						0.55	0.62^{y}	0.03		
Tetradecane	Rams						0.45^{by}	0.40^{a}	0.01	0.021	
	Castrates						0.39^{x}	0.39	0.01		
Dodecanal	Rams						0.48^{by}	0.41^{a}	0.02	0.003	
	Castrates						0.35^{x}	0.38	0.01		
Pentanol	Rams						0.15	0.15	0.01	0.047	
	Castrates						0.17^{b}	0.13^{a}	0.01		
1-Pentadecanol	Rams						3.20^{y}	3.17	0.12	0.021	
	Castrates						3.06^{ax}	3.22^{b}	0.08		
Age × Breed											
(E,E)-2,4-Decadienal	SB	0.42^{by}	0.29^{a}	0.28^{a}	0.34^{ab}	0.32^{ab}			0.02		0.025
	T×SB	0.25^{abx}	0.21^{a}	0.28^{ab}	0.33^{bc}	0.40^{c}			0.02		
p-Cresol	SB	0.59^{x}	0.56	0.56	0.55	0.43			0.04	0.038	
	T×SB	1.35^{by}	0.48^{a}	0.52^{a}	0.41^{a}	0.28^{a}			0.09		
1-Pentadecanol	SB	0.93^{a}	1.02^{ax}	2.13^{b}	2.27^{b}	1.91^{b}			0.10	0.021	
	T×SB	1.10^{a}	1.80^{by}	2.15^{bc}	1.81^{b}	2.47^{c}			0.10		

[1]Scottish Blackface (SB), Texel x Scottish Blackface (T×SB).

[a,b,c] Within rows, mean values that do not share a common superscript are significantly different ($P < 0.05$).

[x,y] Within columns, mean values that do not share a common superscript are significantly different between genders or between breeds ($P < 0.05$).

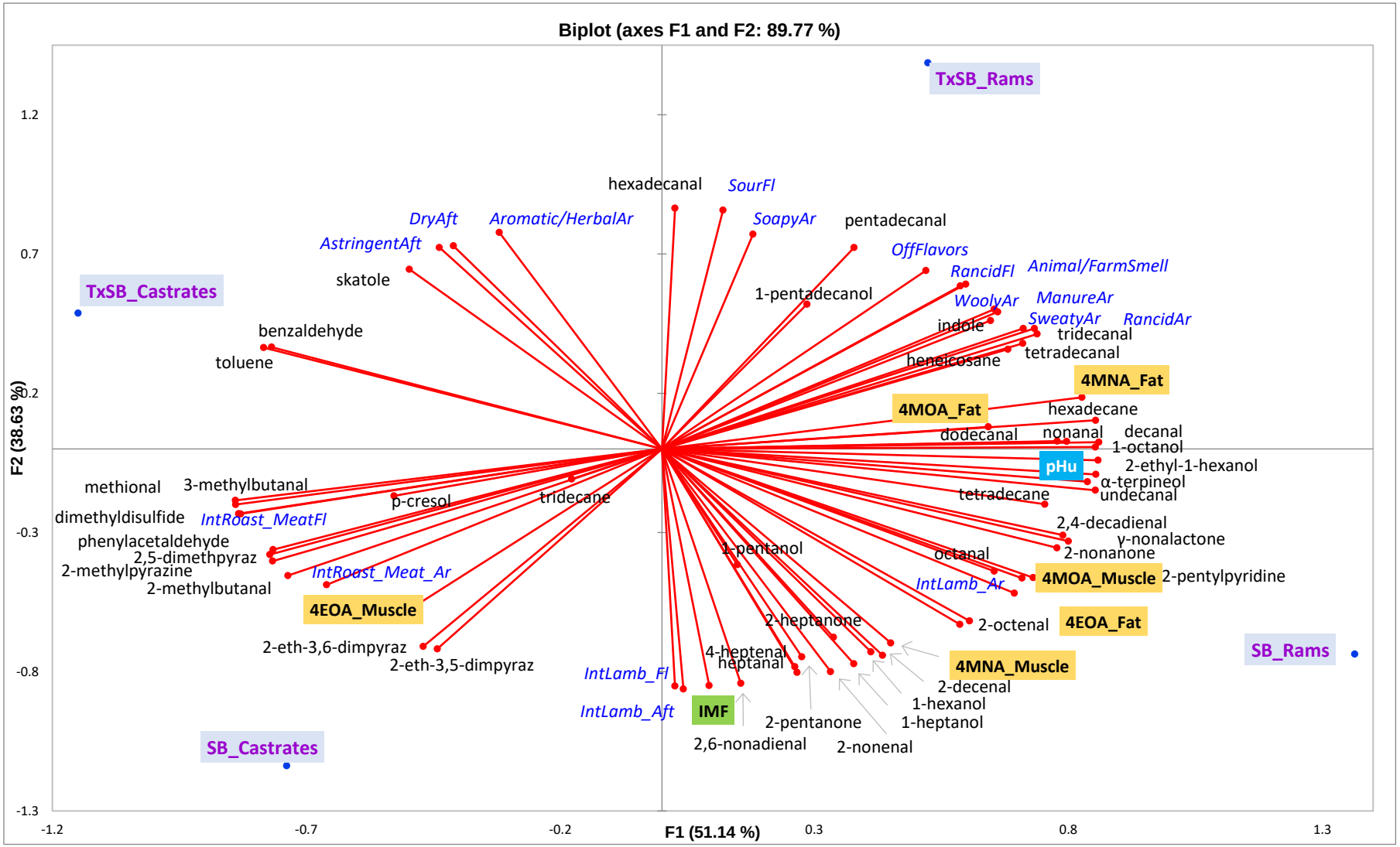
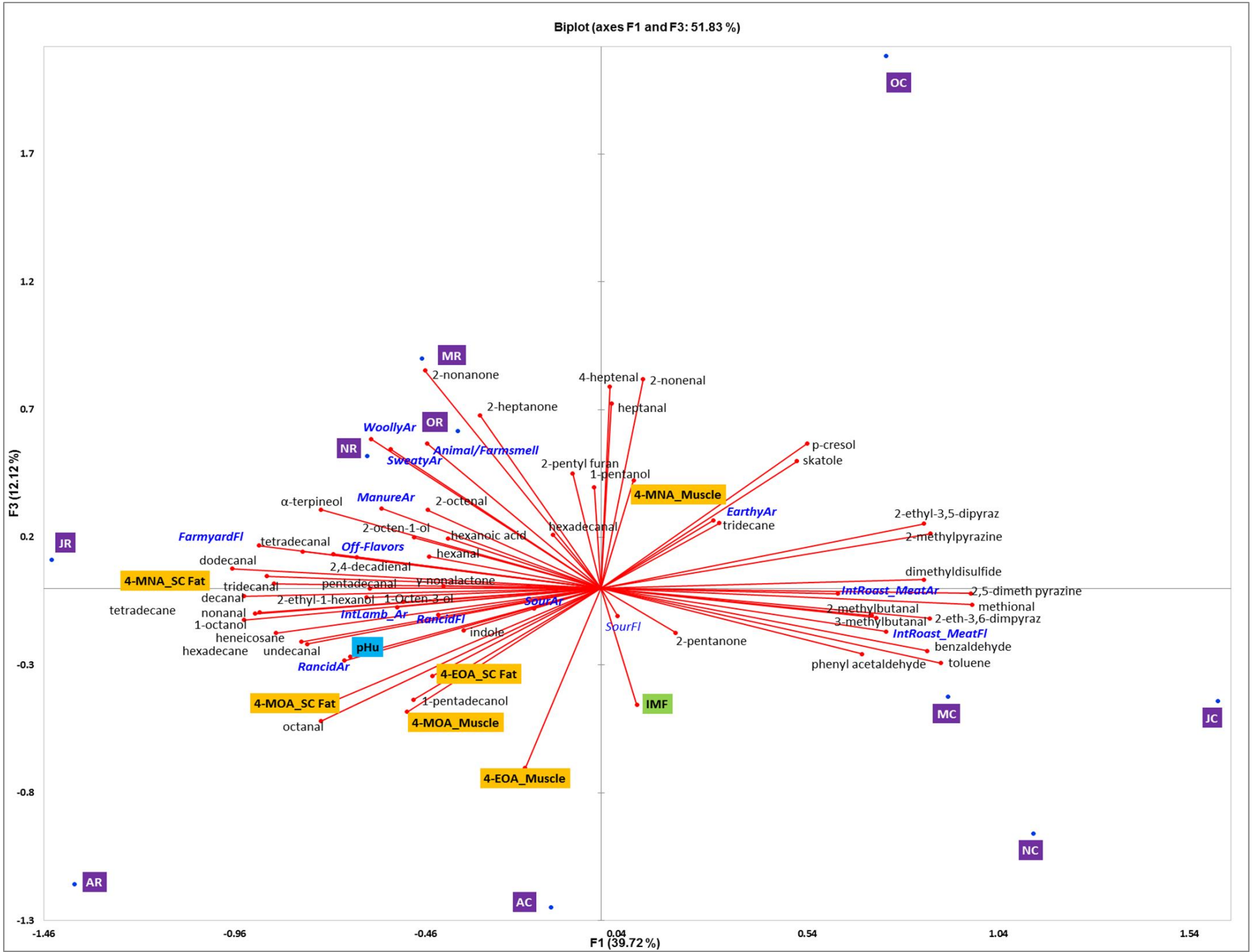


Figure 1-Principal component analysis (PCA) loadings plots for selected volatile compounds, sensory attributes, BCFAs (total and free), pHu and IMF (intramuscular fat) affected by gender and/or breed or having breed x gender interaction. “Ar”, “Fl” and “Aft” refer to Aroma, Flavor and Aftertaste attributes, respectively. **4-EOA_Fat** (4-ethyloctanoic acid detected in subcutaneous fat), **4-MOA_Fat** (4-methyloctanoic acid detected in subcutaneous fat); **4-MNA_Fat** (4-methylnonanoic acid detected in

subcutaneous fat) (Gravador et al., unpublished); **4-EOA_Muscle** (4-ethyloctanoic acid detected in cooked LTL muscle), **4-MOA_Muscle** (4-methyloctanoic acid detected in cooked LTL muscle); **4-MNA_Muscle** (4-methylnonanoic acid detected in cooked LTL muscle). **2-eth-3,6-dimpyraz**, (2-ethyl-3,6-dimethylpyrazine), **2-eth-3,5-dimpyraz** (2-ethyl-3,5-dimethylpyrazine), **2,5-dimethpyraz** (2,5-dimethylpyrazine) and **2-methylpyraz** (2-methylpyrazine) detected in cooked LTL muscle.


Biplot (axes F1 and F3: 51.83 %)
F3 (12.12 %)
F1 (39.72 %)
1.7
1.2
0.7
0.2
-0.3
-0.8
-1.3
-1.46
-0.96
-0.46
0.04
0.54
1.04
1.54
OC
MR
OR
NR
JR
AR
AC
MC
NC
JC
IMF
pHu
4-MNA_SC Fat
4-MNA_Muscle
4-EOA_SC Fat
4-EOA_Muscle
4-MOA_SC Fat
4-MOA_Muscle
2-nonanone
2-heptanone
4-heptenal
2-nonenal
heptanal
WoollyAr
Animal/Farmsmell
SweatyAr
2-pentyl furan
1-pentanol
p-cresol
skatole
ManureAr
α-terpineol
2-octenal
2-octen-1-ol
hexanoic acid
hexadecanal
EarthyAr
tridecane
2-ethyl-3,5-dipyraz
2-methylpyrazine
FarmyardFl
tetradecanal
Off-Flavors
hexanal
2,4-decadienal
dodecanal
γ-nonalactone
pentadecanal
tridecanal
decanal
2-ethyl-1-hexanol
1-Octen-3-ol
tetradecane
nonanal
1-octanol
heneicosane
hexadecane
undecanal
IntLamb_Ar
RancidFl
SourAr
indole
RancidAr
SourFl
2-pentanone
dimethyldisulfide
IntRoast_MeatAr
2,5-dimeth pyrazine
methional
2-methylbutanal
3-methylbutanal
2-eth-3,6-dimpyraz
IntRoast_MeatFl
benzaldehyde
toluene
phenyl acetaldehyde
1-pentadecanol
octanal

Supplementary Figure S1. Principal component analysis (PCA) loadings plots for selected volatile compounds, sensory attributes (aroma and flavor), BCFAs (free and total), ultimate pH (pHu) and intramuscular fat (IMF) significantly affected by gender and/or age or having a gender x age interaction. “Ar”, “Fl” and “Aft” refer to Aroma, Flavor and Aftertaste attributes, respectively. **4EOA_SC Fat** (4-ethyloctanoic acid detected in subcutaneous fat), **4MOA_SC Fat** (4-methyloctanoic acid detected in subcutaneous fat), **4MNA_SC Fat** (4-methylnonanoic acid detected in subcutaneous fat) (Gravador et al., unpublished results); **4EOA_Muscle** (4-ethyloctanoic acid detected in cooked LTL muscle), **4MOA_Muscle** (4-methyloctanoic acid detected in cooked LTL muscle), **4MNA_Muscle** (4-methylnonanoic acid detected in cooked LTL muscle); **2-eth-3,6-dimpyraz**, 2-ethyl-3,6-dimethylpyrazine; **2-eth-3,5-dimpyraz**, 2-ethyl-3,5-dimethylpyrazine; **2,5-dimethpyraz**: 2,5-dimethylpyrazine; **2-methylpyraz**: 2-methylpyrazine. “**OR**”, October rams; “**OC**”, October castrates; “**NR**”, November rams; “**NC**”, November castrates; “**JR**”, January rams; “**JC**”, January castrates; “**MR**”, March rams; "**MC**", March castrates"; "**AR**", April rams; "**AC**", April castrates".

Supplementary Table S1. List of studies that have reported important flavor compounds in lamb meat

	List of studies
Sulphur compounds	
Dimethyl sulfide	(Madruga, Dantas, Queiroz, Brasil, and Ishihara (2013); Rivas-Cañedo *et al.* (2013); Roldán, Ruiz, del Pulgar, Pérez-Palacios, and Antequera (2015); Vasta *et al.* (2010))
Dimethyl disulfide	(Frank *et al.* (2016); Ma *et al.* (2016); Roldán *et al.* (2015); Young, Berdagué, Viallon, Rousset-Akrim, and Theriez (1997))
Dimethyl trisulfide	(Braggins (1996); Elmore, Mottram, Enser, and Wood (2000); Frank *et al.* (2017); Frank *et al.* (2016); Ma *et al.* (2016); Rapisarda *et al.* (2012); Resconi *et al.* (2010); Sutherland and Ames (1995))
Aldehydes	
2-Methylbutanal	(Bravo-Lamas, Barron, Farmer, and Aldai (2018); Bueno *et al.* (2013); Elmore *et al.* (2000); Ma *et al.* (2016); Madruga *et al.* (2013); Resconi *et al.* (2010); Sutherland and Ames (1995))
3-Methylbutanal	(Bueno *et al.* (2013); Elmore *et al.* (2005); Frank *et al.* (2017); Frank *et al.* (2016); Ma *et al.* (2016); Madruga *et al.* (2013); Resconi *et al.* (2010); Roldán *et al.* (2015))
Pentanal	(Braggins, 1996; Bravo-Lamas *et al.* (2018); Bueno, Campo, Cacho, Ferreira, and Escudero (2014); Bueno *et al.* (2013); Caporaso, Sink, Dimick, Mussinan, and Sanderson (1977); Donadel *et al.* (2013); Elmore *et al.* (2005); Elmore *et al.* (2000); Madruga *et al.* (2013); Nieto, Bañón, and Garrido (2011); Resconi *et al.*, 2010; Sutherland and Ames (1995))
(*E*)-2-Hexenal	(Braggins (1996); Bueno *et al.* (2014); Bueno *et al.* (2013); Caporaso *et al.* (1977); Elmore *et al.* (2005); Elmore *et al.* (2000); Rapisarda *et al.* (2012); Resconi *et al.* (2010); Sivadier, Ratel, and Engel (2010); Sutherland and Ames (1995); Vasta, D'Alessandro, Priolo, Petrotos, and Martemucci (2012a); Vasta *et al.* (2010); Young, Lane, Priolo, and Fraser (2003))
Hexanal	(Almela *et al.* (2010); Braggins (1996); Bueno *et al.* (2014); Bueno *et al.* (2013); Caporaso *et al.* (1977); Donadel *et al.* (2013); Elmore *et al.* (2005); Elmore *et al.* (2000); Frank *et al.* (2016); Ma *et al.* (2016); Madruga *et al.* (2013); Nieto *et al.* (2011); Rapisarda *et al.* (2012); Resconi *et al.* (2010); Roldán *et al.* (2015); Sutherland and Ames (1995))
Methional	(Bravo-Lamas *et al.* (2018); Bueno *et al.* (2011); Elmore *et al.* (2000); Frank *et al.* (2017); Frank *et al.* (2016); Madruga *et al.* (2013); Rapisarda *et al.* (2012); Resconi *et al.* (2010); Sivadier *et al.* (2010); Sutherland and Ames (1995))
(*E,E*)-2,4-Heptadienal	(Almela *et al.* (2010); Braggins (1996); Bueno *et al.* (2014); Bueno *et al.*, 2011; Bueno *et al.* (2013); Caporaso *et al.* (1977); Elmore *et al.* (2005); Elmore *et al.* (2000); Resconi *et al.* (2010); Rivas-Cañedo *et al.* (2013); Sivadier *et al.* (2010); Vasta *et al.* (2012a); Vasta *et al.* (2010); Vasta *et al.* (2012b))
(*Z*)-4-Heptenal	(Braggins (1996); Elmore *et al.* (2005); Frank *et al.* (2017); Frank *et al.* (2016); Rivas-Cañedo *et al.* (2013); Sivadier *et al.* (2010); Vasta *et al.* (2012a); Vasta *et al.* (2010); Vasta *et al.* (2012b); Young *et al.* (2003))

Heptanal	(Almela *et al.* (2010); Braggins (1996); Bueno *et al.* (2014); Bueno *et al.* (2011); Bueno *et al.* (2013); Elmore *et al.* (2005); Elmore *et al.* (2000); Frank *et al.* (2017); Frank *et al.* (2016); Ma *et al.* (2016); Madruga *et al.* (2013); Nieto *et al.* (2011); Osorio, Zumalacárregui, Cabeza, Figueira, and Mateo (2008); Rapisarda *et al.* (2012); Resconi *et al.* (2010); Rivas-Cañedo *et al.* (2013); Roldán *et al.* (2015); Sivadier *et al.* (2010); Vasta *et al.* (2012a); Vasta *et al.* (2010); Vasta *et al.* (2012b); Young *et al.* (2003))
(*E*)-2-Octenal	(Almela *et al.* (2010); Braggins (1996); Bueno *et al.* (2014); Bueno *et al.* (2011); Bueno *et al.* (2013); Caporaso *et al.*, 1977; Elmore *et al.* (2005); Elmore *et al.* (2000); Madruga *et al.* (2013); Osorio *et al.* (2008); Rapisarda *et al.* (2012); Resconi *et al.* (2010); Rivas-Cañedo *et al.* (2013); Sutherland and Ames (1995); Young *et al.* (2003))
Octanal	(Almela *et al.* (2010); Braggins (1996); Bravo-Lamas *et al.* (2018); Bueno *et al.* (2014); Bueno *et al.* (2011); Bueno *et al.* (2013); Caporaso *et al.* (1977); Donadel *et al.* (2013); Elmore *et al.* (2005); Elmore *et al.* (2000); Frank *et al.* (2016); Madruga *et al.* (2013); Nieto *et al.* (2011); Resconi *et al.* (2010); Roldán *et al.* (2015); Sutherland and Ames (1995))
(*E*,*Z*)-2,6-Nonadienal	(Elmore *et al.* (2005); Resconi *et al.*, 2010; Vasta *et al.* (2012a); Vasta *et al.* (2012b); Young *et al.* (2003))
(*E*)-2-Nonenal	(Almela *et al.* (2010); Braggins (1996); Bravo-Lamas *et al.* (2018); Bueno *et al.* (2014); Bueno *et al.* (2011); Bueno *et al.* (2013); Caporaso *et al.* (1977); Elmore *et al.* (2005); Elmore *et al.* (2000); Frank *et al.* (2017); Frank *et al.* (2016); Madruga *et al.* (2013); Osorio *et al.* (2008); Rapisarda *et al.* (2012); Resconi *et al.* (2010); Sutherland and Ames (1995); Vasta *et al.* (2012a); Vasta *et al.* (2010); Vasta *et al.* (2012b))
Nonanal	(Almela *et al.* (2010); Braggins (1996); Bueno *et al.* (2014); Bueno *et al.* (2011); Bueno *et al.* (2013); Caporaso *et al.* (1977); Donadel *et al.* (2013); Elmore *et al.* (2005); Elmore *et al.* (2000); Frank *et al.* (2016); Ma *et al.* (2016); Madruga *et al.* (2013); Nieto *et al.* (2011); Osorio *et al.* (2008); Rapisarda *et al.* (2012); Resconi *et al.* (2010); Roldán *et al.* (2015); Vasta *et al.* (2012a); Vasta *et al.* (2012c); Watkins, Rose, Warner, Dunshea, and Pethick (2012); Young *et al.* (1997); Young *et al.* (2003))
(*E*,*E*)-2,4-Decadienal	(Braggins (1996); Frank *et al.* (2017); Frank *et al.* (2016); Resconi *et al.* (2010))
(*E*)-2-Decenal	(Braggins (1996); Bueno *et al.* (2014); Bueno *et al.* (2011); Caporaso *et al.* (1977); Elmore *et al.* (2005); Frank *et al.* (2017); Frank *et al.* (2016); Madruga *et al.* (2013); Osorio *et al.* (2008); Rapisarda *et al.* (2012); Rivas-Cañedo *et al.* (2013); Vasta *et al.* (2012a); Vasta *et al.* (2010))
Decanal	(Bueno *et al.* (2014); Bueno *et al.* (2011); Bueno *et al.* (2013); Caporaso *et al.* (1977); Frank *et al.* (2016); Madruga *et al.* (2013); Osorio *et al.* (2008); Resconi *et al.* (2010); Rivas-Cañedo *et al.* (2013); Sutherland and Ames (1995); Watkins *et al.* (2012))
Undecanal	(Bravo-Lamas *et al.* (2018); Caporaso *et al.* (1977); Frank *et al.* (2017); Frank *et al.* (2016); Madruga *et al.* (2013); Sutherland and Ames (1995); Watkins *et al.* (2012))
Dodecanal	(Bravo-Lamas *et al.* (2018); Bueno *et al.* (2011); Madruga *et al.* (2013); Rivas-Cañedo *et al.* (2013); Sutherland and Ames (1995); Watkins *et al.* (2012))
Tridecanal	(Lorenz *et al.* (1983); Rivas-Cañedo *et al.* (2013); Watkins *et al.* (2012))
Tetradecanal	(Caporaso *et al.* (1977); Osorio *et al.* (2008); Rivas-Cañedo *et al.* (2013); Sutherland and Ames (1995); Watkins *et al.* (2012))
Pentadecanal	(Osorio *et al.* (2008); Rivas-Cañedo *et al.* (2013))
Hexadecanal	(Osorio *et al.* (2008); Sutherland and Ames (1995); Watkins *et al.* (2012))

Alcohols	
1-Pentanol	(Almela *et al.* (2010); Caporaso *et al.* (1977); Elmore *et al.* (2005); Elmore *et al.* (2000); Madruga *et al.* (2013); Nieto *et al.* (2011); Rivas-Cañedo *et al.* (2013); Sivadier *et al.* (2010); Sutherland and Ames (1995); Vasta *et al.* (2012a); Vasta *et al.* (2010))
1-Hexanol	(Almela *et al.* (2010); Caporaso *et al.* (1977); Donadel *et al.* (2013); Elmore *et al.* (2005); Elmore *et al.* (2000); Madruga *et al.* (2013); Roldán *et al.* (2015); Sutherland and Ames (1995))
1-Heptanol	(Almela *et al.* (2010); Braggins (1996); Caporaso *et al.* (1977); Elmore *et al.* (2005); Madruga *et al.* (2013); Nieto *et al.* (2011); Rapisarda *et al.* (2012); Rivas-Cañedo *et al.* (2013))
1-Octen-3-ol	(Almela *et al.* (2010); Braggins (1996); Bueno *et al.* (2011); Donadel *et al.* (2013); Elmore *et al.* (2005); Elmore *et al.* (2000); Frank *et al.* (2016); Madruga *et al.* (2013); Nieto *et al.* (2011); Osorio *et al.* (2008); Rivas-Cañedo *et al.* (2013); Roldán *et al.* (2015); Sutherland and Ames (1995); Vasta *et al.* (2012b); Young *et al.* (2003))
2-Octen-1-ol	(Almela *et al.* (2010); Braggins (1996); Bravo-Lamas *et al.* (2018); Donadel *et al.* (2013); Elmore *et al.* (2005); Madruga *et al.* (2013); Rivas-Cañedo *et al.* (2013); Vasta *et al.* (2013); Vasta *et al.* (2012a); Vasta *et al.* (2010))
2-Ethyl-1-hexanol	(Almela *et al.* (2010); Bravo-Lamas *et al.* (2018); Madruga *et al.* (2013); Rivas-Cañedo *et al.* (2013); Vasta *et al.* (2012a); Vasta *et al.* (2010); Vasta *et al.* (2012b))
1-Octanol	(Almela *et al.* (2010); Braggins (1996); Caporaso *et al.* (1977); Elmore *et al.* (2005); Elmore *et al.* (2000); Madruga *et al.* (2013); Osorio *et al.* (2008); Sutherland and Ames (1995); Watkins *et al.* (2012))
α-Terpineol	(Prache *et al.* (2009))
1-Pentadecanol	-
Ketones	
2-Pentanone	(Almela *et al.* (2010); Bueno *et al.* (2014); Bueno *et al.* (2013); Caporaso *et al.* (1977); Elmore *et al.* (2000); Madruga *et al.* (2013); Resconi *et al.* (2010); Rivas-Cañedo *et al.* (2013); Roldán *et al.* (2015); Sutherland and Ames (1995); Vasta *et al.* (2012a); Watkins *et al.* (2012))
2-Heptanone	(Bueno *et al.* (2014); Bueno *et al.* (2013); Caporaso *et al.* (1977); Elmore *et al.* (2005); Elmore *et al.* (2000); Frank *et al.* (2016); Ma *et al.* (2016); Madruga *et al.* (2013); Resconi *et al.* (2010); Rivas-Cañedo *et al.* (2013); Vasta *et al.* (2012a); Vasta *et al.* (2010))
2-Nonanone	(Bueno *et al.* (2014); Bueno *et al.* (2013); Caporaso *et al.* (1977); Elmore *et al.* (2005); Elmore *et al.* (2000); Ma *et al.* (2016); Madruga *et al.* (2013); Resconi *et al.* (2010); Rivas-Cañedo *et al.* (2013); Sutherland and Ames (1995); Vasta *et al.* (2012a); Young *et al.* (2003))
Lactones	
γ-Octalactone	Caporaso *et al.* (1977)

γ-Nonalactone	(Caporaso *et al.* (1977); Osorio *et al.* (2008); Rapisarda *et al.* (2012))
Phenols	
p-Cresol	(Almela *et al.* (2010); Braggins (1996); Bueno *et al.* (2013); Farouk, Tavendale, Lane, Pulford, and Waller (2007); Frank *et al.* (2017); Frank *et al.* (2016); Resconi *et al.* (2010); Watkins *et al.* (2014); Young *et al.* (2006))
Indoles	
Indole	(Almela *et al.* (2010); Devincenzi, Prunier, Meteau, Nabinger, and Prache (2014); Farouk *et al.* (2007); Madruga *et al.* (2013); Osorio *et al.* (2008); Schreurs *et al.* (2007); Vasta *et al.* (2012c); Young *et al.* (2006); Young *et al.* (2003))
Skatole (3-Methyl indole)	(Devincenzi *et al.* (2014); Farouk *et al.* (2007); Frank *et al.* (2017); Frank *et al.* (2016); Osorio *et al.* (2008); Prache *et al.* (2009); Priolo *et al.* (2004); Schreurs (2013); Schreurs *et al.* (2007); Vasta *et al.* (2012c); Watkins *et al.* (2014); Young *et al.* (1997); Young *et al.* (2006); Young *et al.* (2003))
Pyrazines	
2-Methyl pyrazine	(Buttery, Ling, Teranishi, and Mon (1977); Frank *et al.* (2017); Frank *et al.* (2016); Lorenz *et al.* (1983); Madruga *et al.* (2013); Young *et al.* (1997))
2,5-dimethyl pyrazine	(Braggins (1996); Bueno *et al.* (2011); Bueno *et al.* (2013); Buttery *et al.* (1977); Elmore *et al.* (2000); Frank *et al.* (2016); Sutherland and Ames (1995); Vasta *et al.* (2012c); Watkins *et al.* (2012))
2,6-Dimethyl pyrazine	(Bueno *et al.* (2014); Bueno *et al.* (2011); Bueno *et al.* (2013); Buttery *et al.* (1977); Elmore *et al.* (2000); Frank *et al.* (2016); Sutherland and Ames (1995))
2-Ethyl-3,5-dimethyl-pyrazine	(Bueno *et al.* (2014); Bueno *et al.* (2011); Bueno *et al.* (2013); Frank *et al.* (2017); Frank *et al.* (2016); Lorenz *et al.* (1983))
2-Ethyl-3,6-dimethyl-pyrazine	(Bueno *et al.* (2014); Bueno *et al.* (2013); Buttery *et al.* (1977); Frank *et al.* (2017))
Pyridines	
2-Pentyl-pyridine	(Buttery *et al.* (1977); Sutherland and Ames (1995))

Benzenoid compounds	
Benzaldehyde	(Almela *et al.* (2010); Braggins (1996); Bueno *et al.* (2014); Bueno *et al.* (2011); Bueno *et al.* (2013); Elmore *et al.* (2005); Elmore *et al.* (2000); Frank *et al.* (2017); Frank *et al.* (2016); Ma *et al.* (2016); Madruga *et al.* (2013); Osorio *et al.* (2008); Rivas-Cañedo *et al.* (2013); Sivadier *et al.* (2010); Sutherland and Ames (1995))
Phenylacetaldehyde	(Bravo-Lamas *et al.* (2018); Elmore *et al.* (2000); Frank *et al.* (2017); Madruga *et al.* (2013); Rivas-Cañedo *et al.* (2013); Sutherland and Ames (1995); Vasta, Ratel, and Engel (2007); Watkins *et al.* (2012))
Toluene	(Caporaso *et al.* (1977); Elmore *et al.* (2005); Madruga *et al.* (2013); Rivas-Cañedo *et al.* (2013); Sivadier *et al.* (2010); Sutherland and Ames (1995); Vasta *et al.* (2012a); Vasta *et al.* (2010); Vasta *et al.* (2012b); Vasta *et al.* (2012c))
Furans	
2-Pentyl-furan	(Braggins (1996); Bueno *et al.* (2011); Elmore *et al.* (2005); Frank *et al.* (2017); Frank *et al.* (2016); Ma *et al.* (2016); Madruga *et al.* (2013); Resconi *et al.* (2010); Rivas-Cañedo *et al.* (2013); Roldán *et al.* (2015); Sivadier *et al.* (2010))
Hydrocarbons	
Tridecane	(Braggins (1996); Elmore *et al.* (2005); Elmore *et al.* (2000); Madruga *et al.* (2013); Rivas-Cañedo *et al.* (2013); Sivadier *et al.* (2010); Sutherland and Ames (1995); Watkins *et al.* (2012))
Tetradecane	(Elmore *et al.* (2005); Elmore *et al.* (2000); Madruga *et al.* (2013); Rivas-Cañedo *et al.* (2013); Sivadier *et al.* (2010); Sutherland and Ames (1995); Watkins *et al.* (2012))
Pentadecane	(Braggins (1996); Elmore *et al.* (2005); Elmore *et al.* (2000); Madruga *et al.* (2013); Rivas-Cañedo *et al.* (2013); Sivadier *et al.* (2010); Sutherland and Ames (1995); Watkins *et al.* (2012))
Hexadecane	(Braggins (1996); Elmore *et al.* (2005); Elmore *et al.* (2000); Osorio *et al.* (2008); Rivas-Cañedo *et al.* (2013); Sivadier *et al.* (2010); Sutherland and Ames (1995); Watkins *et al.* (2012))
Heneicosane	(Lorenz *et al.* (1983); Watkins *et al.* (2012))
BCFAs (in free form)	
4-Methyl octanoic acid	(Brennand and Lindsay (1992); Kaffarnik, Preuss, and Vetter (2014); Sutherland and Ames (1995); Watkins *et al.* (2014); Young *et al.* (1997))
4-Ethyl octanoic acid	(Brennand and Lindsay (1992); Kaffarnik *et al.* (2014); Sutherland and Ames (1995); Watkins *et al.* (2014); Young *et al.* (1997))
4-Methyl nonanoic	(Brennand and Lindsay (1992); Kaffarnik *et al.* (2014); Sutherland and Ames (1995); Watkins *et al.* (2014); Young *et al.* (1997))

acid	
Organic acids	
Hexanoic acid	(Almela *et al.* (2010); Brennand and Lindsay (1992); Frank *et al.* (2017); Madruga *et al.* (2013); Ortuño, Serrano, and Bañón (2016); Rivas-Cañedo *et al.* (2013); Sutherland and Ames (1995); Vasta *et al.* (2010)),
Nonanoic acid	(Brennand and Lindsay (1992); Madruga *et al.* (2013); Ortuño *et al.* (2016); Osorio *et al.* (2008); Sutherland and Ames (1995); Vasta *et al.* (2013))

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Supplementary Table S2. Spearman correlations between volatile compounds, sensory attributes, IMF, pHu, BCFAs (detected in subcutaneous fat and muscle), fatty acids (PUFA, SFA).

	Intensity of Roast Meat Aroma	Intensity of Lamb Meat Aroma	Grassy Aroma	Aromatic/ Herbal Aroma	Metallic Aroma	Animal/ Farmsmell	Wooly Aroma	Buttery Aroma	Fatty Aroma	Rancid Aroma	Manure Aroma	Sour Aroma	Sweaty Aroma	Soapy Aroma	Earthy Aroma
Intensity of Roast Meat Aroma	1.000														
Intensity of Lamb Meat Aroma	0.232	1.000													
	0.001														
Grassy Aroma	0.087	0.074	1.000												
	0.231	0.305													
Aromatic/Herbal Aroma	0.133	-0.018	0.506	1.000											
	0.065	0.803	**<.0001**												
Metallic Ar	0.133	0.315	-0.045	0.018	1.000										
	0.065	**<.0001**	0.531	0.800											
Animal/Farmsmell	-0.305	0.017	0.070	0.106	-0.064	1.000									
	<.0001	0.813	0.332	0.144	0.374										
Wooly Aroma	-0.431	-0.085	-0.014	0.124	-0.083	0.590	1.000								
	<.0001	0.238	0.842	0.087	0.250	**<.0001**									
Buttery Aroma	0.303	0.106	0.385	0.262	-0.070	-0.069	-0.315	1.000							
	<.0001	0.144	**<.0001**	**0.000**	0.331	0.341	**<.0001**								
Fatty Aroma	0.268	0.208	0.197	0.105	0.301	-0.226	-0.354	0.660	1.000						
	0.000	**0.004**	**0.006**	0.146	**<.0001**	**0.002**	**<.0001**	**<.0001**							
Rancid Aroma	-0.330	-0.073	0.067	0.049	0.036	0.392	0.355	-0.056	-0.054	1.000					
	<.0001	0.316	0.355	0.498	0.618	**<.0001**	**<.0001**	0.439	0.456						
Manure Aroma	-0.358	-0.067	0.063	0.101	-0.016	0.573	0.440	-0.136	-0.170	0.439	1.000				
	<.0001	0.354	0.385	0.162	0.826	**<.0001**	**<.0001**	0.060	**0.018**	**<.0001**					
Sour Aroma	-0.199	-0.063	0.130	0.226	0.164	0.296	0.342	-0.030	-0.041	0.475	0.353	1.000			
	0.006	0.384	0.071	**0.002**	**0.023**	**<.0001**	**<.0001**	0.684	0.575	**<.0001**	**<.0001**				
Sweaty Aroma	-0.388	-0.083	0.020	0.107	-0.103	0.514	0.553	-0.317	-0.369	0.406	0.487	0.358	1.000		
	<.0001	0.253	0.786	0.139	0.153	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**			
Soapy Aroma	-0.114	-0.073	0.171	-0.071	0.067	0.147	0.045	0.142	0.121	0.332	0.213	0.309	0.079	1.000	
	0.116	0.310	**0.018**	0.329	0.355	**0.041**	0.534	**0.050**	0.093	**<.0001**	**0.003**	**<.0001**	0.276		
Earthy Aroma	-0.052	-0.207	0.083	0.172	-0.226	0.343	0.291	-0.050	-0.355	0.173	0.259	0.108	0.249	0.024	1.000
	0.472	**0.004**	0.251	**0.017**	**0.002**	**<.0001**	**<.0001**	0.492	**<.0001**	**0.016**	**0.000**	0.134	**0.001**	0.737	
Intensity of Roast Meat Flavor	0.693	0.037	0.097	0.096	0.031	-0.266	-0.334	0.198	0.089	-0.238	-0.275	-0.170	-0.388	-0.098	0.023

	Intensity of Roast Meat Aroma	Intensity of Lamb Meat Aroma	Grassy Aroma	Aromatic/ Herbal Aroma	Metallic Aroma	Animal/ Farmsmell	Wooly Aroma	Buttery Aroma	Fatty Aroma	Rancid Aroma	Manure Aroma	Sour Aroma	Sweaty Aroma	Soapy Aroma	Earthy Aroma
	<.0001	0.607	0.181	0.184	0.666	**0.000**	**<.0001**	**0.006**	0.217	**0.001**	**0.000**	**0.018**	**<.0001**	0.175	0.748
Intensity of Lamb Flavor	0.207	0.408	0.013	0.039	0.033	-0.016	-0.117	0.090	0.026	-0.147	0.008	-0.140	-0.068	-0.171	0.008
	0.004	**<.0001**	0.858	0.591	0.649	0.829	0.104	0.213	0.719	**0.041**	0.913	0.052	0.348	**0.017**	0.915
Grassy Flavor	0.089	-0.004	0.511	0.426	-0.127	0.143	0.001	0.357	0.208	0.050	0.089	0.110	0.009	-0.012	0.174
	0.219	0.952	**<.0001**	**<.0001**	0.078	**0.047**	0.988	**<.0001**	**0.004**	0.490	0.220	0.130	0.905	0.864	**0.016**
Metallic Flavor	0.207	0.191	0.069	0.043	0.514	-0.111	-0.199	0.280	0.528	-0.050	-0.079	0.077	-0.230	0.056	-0.197
	0.004	**0.008**	0.339	0.551	**<.0001**	0.126	**0.006**	**<.0001**	**<.0001**	0.491	0.275	0.289	**0.001**	0.441	**0.006**
Aromatic Flavor	0.038	-0.101	0.217	0.364	-0.116	0.169	0.181	0.085	-0.061	0.043	0.024	0.088	0.106	0.091	0.245
	0.598	0.161	**0.002**	**<.0001**	0.110	**0.019**	**0.012**	0.238	0.401	0.552	0.740	0.223	0.144	0.207	**0.001**
Soapy Flavor	-0.171	0.041	0.019	0.009	0.109	0.221	0.233	-0.095	0.033	0.227	0.181	0.229	0.201	0.348	0.100
	0.018	0.568	0.796	0.901	0.131	**0.002**	**0.001**	0.187	0.650	**0.002**	**0.012**	**0.001**	**0.005**	**<.0001**	0.167
Rancid Flavor	-0.310	-0.025	-0.034	-0.102	0.020	0.171	0.174	0.052	0.040	0.431	0.181	0.224	0.178	0.307	-0.046
	<.0001	0.732	0.634	0.159	0.780	**0.018**	**0.016**	0.476	0.584	**<.0001**	**0.012**	**0.002**	**0.013**	**<.0001**	0.526
Farmyard Flavor	-0.201	-0.003	0.097	-0.044	-0.048	0.339	0.179	0.168	0.003	0.363	0.284	0.210	0.223	0.214	0.100
	0.005	0.963	0.178	0.548	0.505	**<.0001**	**0.013**	**0.019**	0.966	**<.0001**	**<.0001**	**0.003**	**0.002**	**0.003**	0.167
Sour Flavor	-0.095	-0.073	0.066	0.088	0.215	0.193	0.231	0.043	0.065	0.229	0.251	0.268	0.087	0.234	0.127
	0.191	0.315	0.360	0.225	**0.003**	**0.007**	**0.001**	0.549	0.368	**0.001**	**0.000**	**0.000**	0.229	**0.001**	0.078
Sweet Flavor	-0.058	-0.058	0.001	0.065	-0.152	0.022	0.138	-0.239	-0.299	-0.053	0.116	0.058	0.161	-0.063	0.130
	0.420	0.427	0.994	0.372	**0.035**	0.762	0.055	**0.001**	**<.0001**	0.465	0.110	0.426	**0.026**	0.383	0.071
Off-Flavors	-0.402	-0.190	0.001	0.038	-0.236	0.421	0.447	-0.227	-0.372	0.413	0.387	0.202	0.463	0.163	0.280
	<.0001	**0.008**	0.987	0.598	**0.001**	**<.0001**	**<.0001**	**0.002**	**<.0001**	**<.0001**	**<.0001**	**0.005**	**<.0001**	**0.024**	**<.0001**
Tenderness	0.083	0.088	0.081	-0.019	0.095	-0.016	-0.033	0.074	0.113	0.024	0.022	0.003	-0.049	0.001	-0.036
	0.253	0.223	0.264	0.797	0.189	0.820	0.645	0.307	0.118	0.743	0.763	0.965	0.496	0.991	0.623
Juiciness	-0.065	0.001	0.104	0.168	0.036	-0.059	-0.006	0.034	-0.017	-0.025	0.027	-0.113	-0.045	-0.078	0.007
	0.367	0.986	0.150	**0.019**	0.621	0.419	0.937	0.643	0.812	0.733	0.713	0.116	0.533	0.278	0.918
Chewiness	-0.092	-0.096	-0.100	0.016	-0.168	0.130	0.058	-0.079	-0.157	0.023	0.055	-0.075	0.110	0.024	0.120
	0.205	0.185	0.165	0.825	**0.019**	0.072	0.427	0.277	**0.030**	0.746	0.448	0.300	0.129	0.741	0.098
Fattiness	0.111	0.118	0.165	0.057	0.195	0.090	-0.137	0.254	0.337	0.076	0.000	-0.031	-0.111	0.092	-0.038
	0.123	0.103	**0.022**	0.431	**0.007**	0.214	0.058	**0.000**	**<.0001**	0.292	1.000	0.667	0.124	0.202	0.600
Stringiness	-0.017	-0.173	-0.028	0.048	-0.074	0.119	0.097	-0.112	-0.178	0.013	0.020	0.012	0.079	0.043	0.193
	0.816	**0.016**	0.698	0.507	0.307	0.099	0.178	0.121	**0.013**	0.854	0.787	0.874	0.274	0.551	**0.007**
Stickiness	-0.053	-0.112	-0.116	-0.036	-0.078	0.144	0.099	-0.127	-0.078	-0.004	0.070	-0.075	0.105	-0.073	0.158
	0.465	0.120	0.107	0.618	0.283	**0.046**	0.169	0.077	0.282	0.960	0.333	0.300	0.145	0.312	**0.028**
Intensity of Lamb Afterstaste	0.284	0.393	0.129	0.005	0.218	0.037	-0.140	0.161	0.254	-0.075	-0.018	-0.057	-0.050	-0.044	-0.142
	<.0001	**<.0001**	0.074	0.943	**0.002**	0.614	0.052	**0.025**	**0.000**	0.300	0.800	0.429	0.488	0.544	**0.049**
Soapy Aftertaste	-0.094	-0.082	0.166	0.163	-0.031	0.253	0.177	0.130	0.050	0.202	0.182	0.203	0.216	0.175	0.106
	0.193	0.255	**0.021**	**0.024**	0.665	**0.000**	**0.014**	0.073	0.492	**0.005**	**0.011**	**0.005**	**0.003**	**0.015**	0.144

	Intensity of Roast Meat Aroma	Intensity of Lamb Meat Aroma	Grassy Aroma	Aromatic/ Herbal Aroma	Metallic Aroma	Animal/ Farmsmell	Wooly Aroma	Buttery Aroma	Fatty Aroma	Rancid Aroma	Manure Aroma	Sour Aroma	Sweaty Aroma	Soapy Aroma	Earthy Aroma
Metallic Aftertaste	0.164	0.203	-0.011	0.005	0.537	-0.121	-0.241	0.251	0.577	-0.004	-0.080	0.126	-0.211	0.133	-0.303
	0.023	**0.005**	0.881	0.948	**<.0001**	0.093	**0.001**	**0.000**	**<.0001**	0.960	0.269	0.081	**0.003**	0.065	**<.0001**
Fatty Aftertaste	0.012	0.176	0.209	0.173	0.212	0.054	-0.045	0.225	0.350	0.115	0.058	0.104	-0.010	0.081	-0.079
	0.867	**0.015**	**0.004**	**0.016**	**0.003**	0.454	0.538	**0.002**	**<.0001**	0.110	0.420	0.149	0.889	0.263	0.276
Dry Aftertaste	0.027	-0.202	-0.008	0.049	-0.067	0.084	0.095	0.016	0.019	0.007	0.042	0.148	0.102	-0.020	0.157
	0.711	**0.005**	0.907	0.500	0.356	0.245	0.187	0.820	0.795	0.923	0.561	**0.040**	0.157	0.785	**0.029**
Astringent Aftertaste	0.100	0.071	-0.064	-0.009	0.374	-0.045	0.014	0.146	0.366	0.140	-0.070	0.281	-0.067	0.192	-0.117
	0.166	0.323	0.376	0.903	**<.0001**	0.532	0.851	**0.042**	**<.0001**	0.053	0.333	**<.0001**	0.353	**0.008**	0.105
Dimethyl sulfide	0.022	0.129	-0.084	-0.166	-0.042	-0.138	-0.050	0.068	0.050	-0.137	-0.052	-0.065	-0.028	-0.081	-0.083
	0.765	0.073	0.243	**0.021**	0.562	0.056	0.487	0.349	0.487	0.057	0.471	0.372	0.696	0.261	0.250
Dimethyl disulfide	0.094	-0.052	0.037	0.007	-0.117	-0.023	-0.015	0.007	-0.076	-0.137	-0.048	-0.069	-0.009	-0.143	0.228
	0.194	0.476	0.606	0.921	0.104	0.750	0.839	0.924	0.293	0.058	0.507	0.342	0.903	**0.047**	**0.001**
Dimethyl trisulfide	0.009	-0.088	0.063	-0.013	-0.156	0.100	0.050	-0.057	-0.188	-0.026	0.060	0.008	0.100	-0.050	0.164
	0.902	0.221	0.382	0.861	**0.031**	0.166	0.487	0.430	**0.009**	0.719	0.408	0.908	0.166	0.489	**0.023**
2-methyl butanal	0.209	0.046	0.033	-0.055	0.035	-0.174	-0.216	0.148	0.168	-0.203	-0.123	-0.020	-0.233	-0.056	0.034
	0.004	0.528	0.654	0.452	0.630	**0.015**	**0.003**	**0.039**	**0.019**	**0.005**	0.087	0.779	**0.001**	0.439	0.641
3-methyl butanal	0.168	0.007	-0.003	-0.030	0.026	-0.178	-0.160	0.110	0.091	-0.186	-0.117	-0.047	-0.231	-0.114	0.041
	0.020	0.921	0.962	0.684	0.716	**0.014**	**0.026**	0.128	0.210	**0.010**	0.105	0.513	**0.001**	0.115	0.567
Pentanal	-0.046	-0.066	0.035	0.029	0.135	-0.152	-0.034	0.013	0.072	0.006	0.021	0.073	-0.110	-0.010	0.099
	0.524	0.361	0.633	0.686	0.061	**0.035**	0.641	0.857	0.320	0.932	0.769	0.316	0.129	0.891	0.169
2-Hexenal	0.164	-0.058	0.117	0.020	0.074	-0.117	-0.101	0.192	0.185	0.024	-0.124	0.045	-0.124	0.023	-0.014
	0.022	0.424	0.106	0.781	0.309	0.105	0.162	**0.008**	**0.010**	0.743	0.087	0.531	0.087	0.748	0.852
Hexanal	-0.100	-0.091	-0.069	-0.061	0.053	-0.147	0.018	-0.031	0.054	0.071	-0.035	0.044	-0.083	0.000	0.041
	0.166	0.208	0.341	0.400	0.464	**0.042**	0.809	0.665	0.456	0.330	0.631	0.542	0.249	0.998	0.571
Methional	0.213	-0.019	-0.103	-0.142	0.004	-0.267	-0.157	0.042	0.046	-0.215	-0.164	-0.157	-0.163	-0.073	-0.032
	0.003	0.796	0.155	**0.050**	0.953	**0.000**	**0.030**	0.562	0.528	**0.003**	**0.023**	**0.029**	**0.023**	0.315	0.658
2,4-heptadienal	-0.008	-0.055	-0.021	-0.005	-0.085	0.060	0.140	-0.137	-0.217	0.095	0.000	0.083	0.116	0.009	0.216
	0.914	0.448	0.769	0.950	0.242	0.404	0.052	0.057	**0.003**	0.187	0.995	0.254	0.108	0.899	**0.003**
4-Heptenal	-0.055	0.045	-0.068	-0.013	0.142	-0.097	0.037	-0.112	0.004	0.108	0.015	0.052	0.013	-0.099	-0.045
	0.447	0.535	0.346	0.856	**0.050**	0.180	0.612	0.122	0.956	0.134	0.837	0.475	0.862	0.171	0.532
Heptanal	-0.077	0.034	-0.068	-0.075	0.160	-0.093	0.078	-0.092	0.053	0.143	0.030	0.077	-0.011	-0.039	-0.056
	0.289	0.640	0.346	0.300	**0.026**	0.200	0.281	0.205	0.462	**0.047**	0.680	0.289	0.877	0.590	0.443
2-Octenal	-0.001	-0.105	-0.088	-0.175	-0.088	-0.088	0.076	-0.093	-0.108	0.099	-0.128	-0.005	0.041	0.002	0.059
	0.995	0.148	0.223	**0.015**	0.224	0.223	0.291	0.198	0.136	0.169	0.076	0.941	0.573	0.977	0.415
Octanal	-0.118	0.005	-0.168	0.006	0.161	-0.075	0.150	-0.260	-0.107	0.130	0.034	0.077	0.017	-0.084	-0.037
	0.104	0.942	**0.020**	0.929	**0.025**	0.299	**0.037**	**0.000**	0.139	0.072	0.640	0.286	0.815	0.247	0.610
2,6-nonadienal	-0.003	-0.095	-0.088	-0.050	-0.160	-0.012	0.142	-0.201	-0.250	0.118	-0.002	-0.052	0.104	-0.154	0.148
	0.970	0.191	0.222	0.493	**0.026**	0.871	**0.049**	**0.005**	**0.001**	0.102	0.983	0.474	0.148	**0.033**	**0.040**
2-nonenal	-0.013	0.008	-0.056	-0.094	-0.023	0.004	0.119	-0.130	-0.111	0.201	-0.018	0.051	0.101	-0.088	0.017

	Intensity of Roast Meat Aroma	Intensity of Lamb Meat Aroma	Grassy Aroma	Aromatic/ Herbal Aroma	Metallic Aroma	Animal/ Farmsmell	Wooly Aroma	Buttery Aroma	Fatty Aroma	Rancid Aroma	Manure Aroma	Sour Aroma	Sweaty Aroma	Soapy Aroma	Earthy Aroma
	0.854	0.908	0.438	0.194	0.754	0.960	0.100	0.072	0.123	**0.005**	0.802	0.480	0.163	0.223	0.812
Nonanal	-0.167	-0.008	-0.089	0.081	0.080	0.120	0.323	-0.287	-0.220	0.145	0.138	0.110	0.215	-0.050	0.049
	0.021	0.914	0.217	0.264	0.271	0.098	**<.0001**	**<.0001**	**0.002**	**0.044**	0.055	0.127	**0.003**	0.489	0.496
2,4-decadienal	0.059	-0.071	-0.039	-0.104	-0.116	-0.050	0.046	-0.042	-0.057	0.107	-0.102	0.001	0.053	0.021	0.017
	0.413	0.325	0.594	0.150	0.108	0.489	0.526	0.564	0.432	0.140	0.157	0.985	0.461	0.771	0.811
2-decenal	0.039	0.078	-0.017	-0.096	0.015	-0.028	0.045	-0.063	-0.038	0.140	-0.083	0.044	0.082	-0.065	-0.023
	0.594	0.283	0.814	0.183	0.836	0.694	0.532	0.387	0.601	0.053	0.250	0.543	0.257	0.369	0.750
Decanal	-0.212	0.113	0.004	0.008	0.115	0.014	0.120	-0.085	-0.013	0.117	0.099	0.164	0.125	0.040	-0.037
	0.003	0.118	0.958	0.910	0.112	0.849	0.097	0.240	0.862	0.106	0.171	**0.023**	0.083	0.579	0.614
Undecanal	0.051	0.209	0.037	-0.043	0.079	0.029	-0.030	0.169	0.227	0.054	-0.005	0.012	-0.040	0.104	-0.034
	0.481	**0.004**	0.606	0.555	0.275	0.688	0.682	**0.019**	**0.002**	0.455	0.945	0.865	0.579	0.151	0.637
Dodecanal	-0.053	0.057	-0.028	-0.093	-0.039	0.128	0.072	-0.040	0.001	0.168	0.097	0.049	0.111	0.117	-0.007
	0.467	0.433	0.699	0.199	0.588	0.076	0.319	0.576	0.984	**0.019**	0.179	0.496	0.124	0.105	0.927
Tridecanal	-0.087	-0.004	0.009	0.015	-0.174	0.208	0.094	-0.074	-0.202	0.136	0.168	0.086	0.211	0.070	0.118
	0.227	0.953	0.899	0.838	**0.015**	**0.004**	0.192	0.303	**0.005**	0.059	**0.019**	0.235	**0.003**	0.336	0.103
Tetradecanal	-0.116	0.036	-0.026	-0.027	-0.198	0.256	0.160	-0.096	-0.235	0.174	0.172	0.058	0.220	0.087	0.128
	0.109	0.619	0.723	0.711	**0.006**	**0.000**	**0.026**	0.186	**0.001**	**0.016**	**0.017**	0.424	**0.002**	0.231	0.075
Pentadecanal	-0.052	-0.018	0.015	-0.024	-0.278	0.209	0.070	-0.042	-0.262	0.072	0.114	-0.024	0.166	0.059	0.148
	0.476	0.802	0.832	0.737	**<.0001**	**0.004**	0.336	0.559	**0.000**	0.321	0.115	0.744	**0.021**	0.413	**0.041**
Hexadecanal	-0.106	-0.003	0.030	-0.026	-0.266	0.204	0.041	-0.018	-0.202	-0.022	0.086	-0.043	0.152	0.069	0.099
	0.143	0.969	0.675	0.720	**0.000**	**0.005**	0.572	0.799	**0.005**	0.763	0.232	0.553	**0.035**	0.344	0.172
Pentanol	-0.018	-0.047	-0.079	-0.064	0.039	-0.199	-0.034	-0.014	0.052	-0.053	-0.063	0.069	-0.126	0.052	0.048
	0.808	0.518	0.274	0.374	0.590	**0.006**	0.642	0.851	0.476	0.461	0.385	0.340	0.081	0.472	0.512
1-Hexanol	-0.074	-0.015	-0.102	-0.082	0.154	-0.135	0.058	-0.092	0.069	0.097	-0.014	0.066	-0.069	-0.010	-0.011
	0.309	0.834	0.159	0.256	**0.032**	0.061	0.422	0.201	0.341	0.178	0.850	0.360	0.337	0.888	0.882
1-Heptanol	-0.062	0.029	-0.135	-0.121	0.153	-0.104	0.092	-0.130	0.021	0.164	0.012	0.120	0.000	0.034	-0.025
	0.393	0.688	0.061	0.095	**0.033**	0.149	0.204	0.071	0.776	**0.023**	0.872	0.097	0.995	0.635	0.728
1-Octen-3-ol	-0.106	-0.154	-0.132	-0.048	-0.060	-0.159	0.058	-0.068	-0.010	0.034	-0.090	0.021	-0.005	0.052	0.031
	0.143	**0.033**	0.067	0.504	0.404	**0.028**	0.425	0.349	0.888	0.637	0.212	0.768	0.951	0.474	0.672
2-Octen-1-ol	-0.156	-0.104	-0.174	-0.102	-0.080	-0.101	0.161	-0.238	-0.185	0.036	-0.064	-0.016	0.121	-0.003	0.049
	0.031	0.150	**0.016**	0.157	0.269	0.163	**0.026**	**0.001**	**0.010**	0.616	0.379	0.829	0.094	0.962	0.497
2-Ethyl-1-hexanol	-0.060	0.077	0.151	0.010	0.004	-0.017	-0.035	0.364	0.329	0.081	0.007	0.005	-0.083	0.120	-0.106
	0.408	0.287	**0.036**	0.887	0.959	0.814	0.632	**<.0001**	**<.0001**	0.266	0.921	0.950	0.252	0.096	0.141
1-Octanol	-0.148	0.017	-0.136	-0.013	0.166	0.024	0.230	-0.235	-0.088	0.156	0.100	0.121	0.117	0.028	-0.043
	0.040	0.812	0.058	0.855	**0.021**	0.736	**0.001**	**0.001**	0.225	**0.031**	0.168	0.095	0.104	0.704	0.556
α-terpineol	0.064	0.193	0.191	-0.031	0.191	-0.028	-0.220	0.439	0.521	-0.016	0.001	0.046	-0.212	0.121	-0.216
	0.376	**0.007**	**0.008**	0.669	**0.008**	0.699	**0.002**	**<.0001**	**<.0001**	0.830	0.984	0.524	**0.003**	0.092	**0.003**
1-Pentadecanol	-0.056	0.113	0.034	0.001	-0.110	0.034	-0.084	0.107	-0.003	0.029	0.048	-0.004	-0.008	-0.052	-0.024
	0.440	0.119	0.636	0.984	0.127	0.634	0.248	0.140	0.964	0.688	0.508	0.952	0.917	0.469	0.738

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2-Pentanone	0.042	0.047	0.175	0.008	0.067	-0.104	-0.125	0.224	0.367	-0.127	-0.007	0.027	-0.218	0.076	-0.128
	0.563	0.520	**0.015**	0.910	0.355	0.150	0.083	**0.002**	**<.0001**	0.079	0.919	0.714	**0.002**	0.293	0.076
2-Heptanone	-0.121	-0.095	-0.051	-0.018	-0.011	-0.079	0.109	-0.050	0.060	0.049	-0.107	0.040	-0.023	-0.023	0.058
	0.095	0.189	0.481	0.808	0.880	0.272	0.133	0.487	0.407	0.497	0.137	0.581	0.754	0.753	0.423
2-Nonanone	-0.177	0.090	-0.041	0.000	0.019	0.141	0.193	-0.031	0.050	0.147	0.013	0.048	0.050	-0.024	0.004
	0.014	0.212	0.568	0.998	0.790	**0.050**	**0.007**	0.672	0.490	**0.041**	0.861	0.511	0.486	0.746	0.961
γ-octalactone	-0.124	0.152	-0.081	-0.246	0.140	0.045	0.126	-0.071	0.068	0.045	0.013	0.009	0.058	-0.040	-0.109
	0.086	**0.035**	0.263	**0.001**	0.052	0.535	0.081	0.324	0.349	0.534	0.858	0.905	0.421	0.578	0.130
γ-nonalactone	0.029	0.156	0.097	-0.077	0.049	-0.038	-0.034	0.118	0.219	0.043	-0.108	-0.060	-0.068	0.026	-0.155
	0.685	**0.030**	0.178	0.285	0.499	0.599	0.638	0.102	**0.002**	0.548	0.134	0.405	0.345	0.723	**0.032**
p-cresol	0.157	0.118	0.089	-0.056	0.100	-0.089	-0.198	0.238	0.292	-0.159	-0.192	-0.043	-0.138	-0.040	-0.143
	0.030	0.101	0.221	0.441	0.167	0.220	**0.006**	**0.001**	**<.0001**	**0.028**	**0.007**	0.557	0.056	0.577	**0.047**
Indole	-0.177	0.100	-0.170	-0.179	-0.102	0.089	0.173	-0.113	-0.102	0.159	0.056	-0.025	0.089	-0.088	0.008
	0.014	0.167	**0.018**	**0.013**	0.157	0.217	**0.016**	0.117	0.160	**0.027**	0.440	0.734	0.217	0.225	0.917
Skatole	-0.156	0.032	-0.086	-0.153	-0.118	0.061	0.067	-0.058	-0.093	0.133	0.037	0.045	0.080	-0.081	0.043
	0.030	0.657	0.234	**0.033**	0.104	0.403	0.358	0.420	0.200	0.066	0.606	0.534	0.266	0.264	0.549
2-Methylpyrazine	0.112	0.005	0.049	0.019	0.067	-0.125	-0.021	0.184	0.239	-0.109	-0.041	0.031	-0.115	-0.066	-0.129
	0.121	0.946	0.497	0.790	0.354	0.082	0.768	**0.011**	**0.001**	0.131	0.569	0.668	0.113	0.363	0.073
2,5-dimethyl pyrazine	0.218	0.022	0.029	-0.020	0.140	-0.129	-0.187	0.177	0.283	-0.115	-0.171	0.026	-0.098	0.013	-0.153
	0.002	0.764	0.693	0.783	0.053	0.075	**0.009**	**0.014**	**<.0001**	0.112	**0.018**	0.719	0.174	0.861	**0.034**
2,6-dimethyl pyrazine	-0.145	0.047	-0.113	-0.064	-0.133	0.091	0.223	-0.138	-0.162	0.077	0.007	0.013	0.090	-0.111	0.046
	0.044	0.514	0.118	0.376	0.065	0.210	**0.002**	0.055	**0.024**	0.290	0.924	0.858	0.215	0.124	0.525
2-ethyl-3,5-dimethyl pyrazine	0.211	0.054	0.033	-0.047	0.101	-0.155	-0.195	0.145	0.223	-0.168	-0.210	-0.001	-0.156	-0.102	-0.114
	0.003	0.457	0.651	0.517	0.162	**0.032**	**0.007**	**0.045**	**0.002**	**0.019**	**0.003**	0.992	**0.031**	0.159	0.115
2-ethyl-3,6-dimethyl pyrazine	0.220	0.077	0.072	-0.077	0.087	-0.136	-0.179	0.173	0.318	-0.226	-0.194	-0.045	-0.229	-0.113	-0.103
	0.002	0.287	0.319	0.286	0.231	0.059	**0.013**	**0.016**	**<.0001**	**0.002**	**0.007**	0.532	**0.001**	0.119	0.153
2-pentylpyridine	-0.062	0.108	-0.037	-0.047	-0.111	0.130	0.250	-0.105	-0.158	0.104	0.064	-0.108	0.112	-0.073	0.098
	0.391	0.136	0.613	0.515	0.123	0.072	**0.001**	0.146	**0.028**	0.152	0.375	0.136	0.122	0.311	0.175
Benzaldehyde	0.059	-0.209	0.057	0.005	-0.159	-0.076	-0.142	0.092	-0.004	-0.125	-0.064	-0.101	-0.065	0.010	0.054
	0.416	**0.004**	0.432	0.943	**0.027**	0.296	**0.049**	0.203	0.961	0.082	0.378	0.161	0.366	0.892	0.454
Phenylacetaldehyde	0.245	0.013	-0.058	-0.073	0.027	-0.166	-0.199	0.108	0.069	-0.120	-0.120	-0.040	-0.149	-0.052	-0.037
	0.001	0.861	0.426	0.310	0.709	**0.021**	**0.006**	0.135	0.342	0.097	0.095	0.579	**0.039**	0.469	0.608
Toluene	0.071	-0.012	0.119	0.020	0.128	-0.158	-0.245	0.291	0.284	-0.154	-0.088	-0.071	-0.171	0.173	-0.105
	0.327	0.865	0.099	0.781	0.076	**0.028**	**0.001**	**<.0001**	**<.0001**	**0.033**	0.226	0.326	**0.018**	**0.016**	0.148
2-pentyl furan	-0.066	-0.160	-0.054	-0.049	-0.088	-0.087	0.023	-0.071	-0.102	-0.028	-0.088	-0.084	-0.009	0.060	0.071
	0.366	**0.026**	0.453	0.500	0.226	0.231	0.754	0.324	0.157	0.703	0.225	0.244	0.896	0.408	0.329
Tridecane	-0.111	-0.097	-0.013	-0.069	-0.141	0.102	0.119	-0.071	-0.112	-0.001	0.077	-0.033	0.144	0.064	-0.018

	Intensity of Roast Meat Aroma	Intensity of Lamb Meat Aroma	Grassy Aroma	Aromatic/ Herbal Aroma	Metallic Aroma	Animal/ Farmsmell	Wooly Aroma	Buttery Aroma	Fatty Aroma	Rancid Aroma	Manure Aroma	Sour Aroma	Sweaty Aroma	Soapy Aroma	Earthy Aroma
	0.123	0.182	0.856	0.337	**0.050**	0.156	0.099	0.329	0.121	0.990	0.288	0.647	**0.045**	0.379	0.808
Tetradecane	-0.160	0.009	0.071	-0.083	-0.166	0.187	0.138	-0.027	-0.010	0.217	0.206	0.048	0.104	0.096	-0.007
	0.026	0.906	0.329	0.248	**0.021**	**0.009**	0.056	0.714	0.886	**0.002**	**0.004**	0.505	0.149	0.182	0.925
Pentadecane	-0.040	0.103	0.135	-0.098	-0.069	0.094	-0.092	0.293	0.270	0.048	0.067	-0.016	-0.042	0.215	-0.100
	0.582	0.152	0.062	0.175	0.341	0.194	0.203	**<.0001**	**0.000**	0.509	0.355	0.830	0.563	**0.003**	0.168
Hexadecane	-0.060	0.113	0.122	-0.073	0.094	0.057	-0.057	0.314	0.368	0.185	0.093	0.100	-0.047	0.181	-0.091
	0.411	0.118	0.092	0.315	0.192	0.432	0.434	**<.0001**	**<.0001**	**0.010**	0.196	0.166	0.514	**0.012**	0.206
Heneicosane	0.067	0.136	0.129	-0.077	0.021	-0.060	-0.240	0.305	0.373	-0.061	-0.039	-0.120	-0.157	0.058	-0.233
	0.351	0.060	0.073	0.285	0.773	0.411	**0.001**	**<.0001**	**<.0001**	0.400	0.592	0.096	**0.029**	0.425	**0.001**
4MOA (Muscle)	-0.168	0.080	-0.120	-0.179	0.052	-0.109	-0.046	0.011	0.062	0.115	0.001	-0.019	-0.043	0.076	-0.138
	0.019	0.267	0.098	**0.013**	0.473	0.131	0.521	0.878	0.388	0.112	0.987	0.795	0.555	0.292	0.055
4EOA (Muscle)	-0.296	0.028	-0.170	-0.186	-0.231	0.135	0.265	-0.269	-0.267	0.206	0.108	-0.004	0.108	-0.128	0.041
	<.0001	0.699	**0.018**	**0.010**	**0.001**	0.061	**0.000**	**0.000**	**0.000**	**0.004**	0.134	0.960	0.134	0.077	0.573
4MNA (Muscle)	-0.277	-0.030	-0.155	-0.130	-0.229	0.172	0.315	-0.250	-0.276	0.212	0.156	0.024	0.176	-0.134	0.105
	<.0001	0.681	**0.031**	0.072	**0.001**	**0.017**	**<.0001**	**0.001**	**0.000**	**0.003**	**0.030**	0.738	**0.014**	0.063	0.148
4MOA (SC Fat)	-0.347	-0.037	-0.064	0.018	-0.025	0.073	0.232	-0.185	-0.216	0.148	0.187	0.167	0.201	-0.012	0.051
	<.0001	0.617	0.391	0.812	0.734	0.326	**0.002**	**0.012**	**0.003**	**0.046**	**0.011**	**0.024**	**0.006**	0.872	0.490
4EOA (SC Fat)	-0.105	0.175	0.077	-0.055	0.039	-0.087	-0.019	-0.033	-0.059	0.064	-0.016	0.103	0.011	0.061	-0.078
	0.186	**0.027**	0.336	0.487	0.621	0.276	0.813	0.681	0.460	0.425	0.845	0.197	0.895	0.444	0.328
4MNA (SC Fat)	-0.244	0.062	0.022	0.041	-0.020	0.082	0.211	-0.032	-0.059	0.187	0.154	0.195	0.155	0.037	-0.001
	0.001	0.423	0.772	0.591	0.798	0.282	**0.006**	0.678	0.444	**0.014**	**0.044**	**0.011**	**0.042**	0.632	0.994
Hexanoic Acid	-0.034	0.015	0.012	-0.167	0.070	-0.161	-0.097	0.121	0.189	0.022	-0.106	0.051	-0.102	0.040	-0.148
	0.643	0.841	0.865	**0.020**	0.335	**0.025**	0.182	0.092	**0.009**	0.759	0.142	0.484	0.160	0.581	**0.040**
Nonanoic Acid	-0.021	0.246	0.041	-0.144	0.073	0.021	-0.062	0.085	0.204	-0.007	0.004	-0.160	-0.058	0.036	-0.267
	0.774	**0.001**	0.574	**0.045**	0.313	0.773	0.393	0.238	**0.005**	0.921	0.955	**0.026**	0.426	0.617	**0.000**
pHu	-0.133	0.071	-0.083	-0.137	0.013	-0.010	-0.008	0.020	0.097	0.129	0.112	0.112	-0.047	0.055	-0.019
	0.065	0.328	0.254	0.057	0.855	0.889	0.912	0.779	0.181	0.073	0.120	0.122	0.521	0.444	0.790
IMF	-0.019	0.000	-0.035	-0.026	0.002	-0.147	-0.039	-0.014	-0.021	0.139	0.011	0.001	0.010	-0.138	-0.033
	0.799	0.998	0.628	0.720	0.983	**0.041**	0.591	0.851	0.770	0.054	0.881	0.989	0.888	0.055	0.652
PUFA proportion	-0.023	-0.111	-0.023	-0.022	0.076	0.004	0.039	-0.045	-0.004	0.023	0.044	0.075	-0.007	0.264	0.065
	0.772	0.167	0.779	0.789	0.347	0.961	0.626	0.577	0.961	0.773	0.584	0.351	0.933	**0.001**	0.415
SFA proportion	-0.040	0.089	0.057	0.018	-0.036	0.220	0.140	-0.006	-0.008	0.113	0.065	-0.040	0.106	-0.083	0.009
	0.621	0.267	0.483	0.819	0.657	**0.006**	0.082	0.946	0.918	0.159	0.418	0.622	0.189	0.303	0.907
PUFA/SFA ratio	-0.015	-0.113	-0.035	-0.017	0.072	-0.032	0.021	-0.040	-0.012	0.006	0.034	0.064	-0.012	0.249	0.057
	0.853	0.161	0.663	0.829	0.372	0.688	0.798	0.616	0.878	0.938	0.669	0.424	0.877	**0.002**	0.477
PUFA mg/100 g muscle	-0.025	-0.036	-0.067	-0.069	0.063	-0.109	-0.087	0.014	0.021	0.133	0.038	0.016	-0.035	0.074	-0.065
	0.757	0.653	0.401	0.392	0.434	0.172	0.277	0.861	0.793	0.096	0.641	0.841	0.665	0.355	0.421
SFA mg/100 g muscle	0.032	0.022	-0.065	-0.088	-0.005	-0.142	-0.118	0.052	0.012	0.128	-0.023	-0.020	-0.049	-0.128	-0.092
	0.688	0.786	0.415	0.275	0.946	0.076	0.141	0.514	0.885	0.111	0.775	0.807	0.541	0.110	0.250

	Intensity of Roast Meat Flavor	Intensity of Lamb Flavor	Grassy Flavor	Metallic Flavor	Aromatic Flavor	Soapy Flavor	Rancid Flavor	Farmyard Flavor	Sour Flavor	Sweet Flavor	Off-Flavors	Tenderness	Juiciness	Chewiness	Fattiness
Intensity of Roast Meat Flavor	1.000														
Intensity of Lamb Flavor	0.223	1.000													
	0.002														
Grassy Flavor	0.131	0.085	1.000												
	0.070	0.241													
Metallic Flavor	0.032	0.057	-0.036	1.000											
	0.659	0.433	0.622												
Aromatic Flavor	0.108	0.126	0.447	-0.054	1.000										
	0.134	0.081	**<.0001**	0.460											
Soapy Flavor	-0.222	-0.078	0.031	0.130	0.080	1.000									
	0.002	0.282	0.670	0.072	0.268										
Rancid Flavor	-0.345	-0.225	-0.112	0.018	-0.089	0.315	1.000								
	<.0001	**0.002**	0.121	0.806	0.219	**<.0001**									
Farmyard Flavor	-0.193	-0.039	0.085	-0.080	-0.053	0.287	0.449	1.000							
	0.007	0.589	0.242	0.272	0.468	**<.0001**	**<.0001**								
Sour Flavor	-0.168	-0.189	-0.034	0.268	0.006	0.363	0.346	0.220	1.000						
	0.019	**0.008**	0.643	**0.000**	0.929	**<.0001**	**<.0001**	**0.002**							
Sweet Flavor	-0.090	0.106	0.046	-0.310	0.269	-0.120	-0.186	-0.211	-0.122	1.000					
	0.214	0.143	0.521	**<.0001**	**0.000**	0.096	**0.010**	**0.003**	0.091						
Off-Flavors	-0.338	-0.180	-0.035	-0.248	0.045	0.297	0.385	0.359	0.278	-0.063	1.000				
	<.0001	**0.012**	0.628	**0.001**	0.533	**<.0001**	**<.0001**	**<.0001**	**<.0001**	0.384					
Tenderness	-0.051	0.170	0.017	0.065	0.028	0.009	0.044	-0.064	-0.059	0.045	-0.090	1.000			
	0.485	**0.018**	0.818	0.370	0.695	0.905	0.543	0.375	0.413	0.535	0.214				
Juiciness	-0.108	0.191	0.085	0.133	0.156	0.017	0.018	-0.130	-0.083	0.074	0.001	0.358	1.000		
	0.135	**0.008**	0.241	0.065	**0.030**	0.815	0.803	0.072	0.253	0.310	0.987	**<.0001**			
Chewiness	0.092	-0.017	-0.008	-0.115	0.010	-0.020	-0.057	0.101	-0.005	-0.092	0.226	-0.758	-0.241	1.000	
	0.204	0.815	0.912	0.112	0.885	0.784	0.431	0.161	0.940	0.203	**0.002**	**<.0001**	**0.001**		
Fattiness	0.124	0.046	0.194	0.206	0.002	0.189	0.121	0.138	0.112	-0.172	0.033	0.079	0.256	0.111	1.000
	0.086	0.524	**0.007**	**0.004**	0.982	**0.009**	0.094	0.055	0.120	**0.017**	0.652	0.276	**0.000**	0.124	
Stringiness	0.167	-0.095	0.019	-0.090	0.045	-0.013	-0.089	0.088	0.121	-0.052	0.188	-0.698	-0.245	0.810	0.033
	0.021	0.190	0.791	0.211	0.535	0.853	0.216	0.225	0.093	0.471	**0.009**	**<.0001**	**0.001**	**<.0001**	0.648
Stickiness	0.147	0.091	-0.099	-0.071	0.023	-0.048	-0.088	0.047	0.014	-0.007	0.072	-0.411	-0.246	0.569	0.064
	0.041	0.208	0.170	0.323	0.747	0.504	0.223	0.516	0.851	0.920	0.320	**<.0001**	**0.001**	**<.0001**	0.375
Intensity of Lamb Afterstaste	0.258	0.454	0.042	0.222	-0.037	-0.053	-0.073	-0.025	-0.025	-0.013	-0.189	0.191	0.129	-0.089	0.184

	Intensity of Roast Meat Flavor	Intensity of Lamb Flavor	Grassy Flavor	Metallic Flavor	Aromatic Flavor	Soapy Flavor	Rancid Flavor	Farmyard Flavor	Sour Flavor	Sweet Flavor	Off-Flavors	Tenderness	Juiciness	Chewiness	Fattiness
	0.000	**<.0001**	0.563	**0.002**	0.606	0.465	0.311	0.725	0.734	0.862	**0.009**	**0.008**	0.075	0.219	**0.010**
Soapy Aftertaste	-0.132	-0.067	0.144	0.077	0.081	0.296	0.233	0.228	0.199	-0.042	0.258	-0.039	0.011	-0.004	0.139
	0.066	0.352	**0.046**	0.287	0.263	**<.0001**	**0.001**	**0.001**	**0.006**	0.560	**0.000**	0.593	0.874	0.961	0.055
Metallic Aftertaste	0.026	0.017	-0.081	0.759	-0.094	0.078	0.102	-0.036	0.229	-0.210	-0.256	0.040	0.027	-0.077	0.261
	0.718	0.815	0.262	**<.0001**	0.196	0.282	0.159	0.620	**0.001**	**0.003**	**0.000**	0.584	0.711	0.289	**0.000**
Fatty Aftertaste	-0.063	-0.027	0.079	0.290	0.011	0.165	0.168	0.171	0.209	-0.039	0.053	0.001	0.159	-0.053	0.480
	0.386	0.713	0.274	**<.0001**	0.881	**0.022**	**0.019**	**0.018**	**0.004**	0.592	0.467	0.986	**0.027**	0.464	**<.0001**
Dry Aftertaste	0.171	-0.097	0.004	-0.038	-0.041	-0.134	-0.053	0.077	0.019	-0.010	0.036	-0.285	-0.508	0.252	-0.184
	0.018	0.180	0.960	0.602	0.572	0.063	0.461	0.288	0.797	0.891	0.623	**<.0001**	**<.0001**	**0.000**	**0.011**
Astringent Aftertaste	-0.020	-0.144	-0.079	0.391	-0.042	0.142	0.227	0.114	0.316	-0.263	-0.090	-0.033	-0.181	-0.083	0.055
	0.787	**0.046**	0.277	**<.0001**	0.558	**0.048**	**0.002**	0.116	**<.0001**	**0.000**	0.215	0.652	**0.012**	0.250	0.451
Dimethyl sulfide	-0.003	0.054	-0.127	0.044	-0.152	-0.019	-0.067	-0.043	-0.118	-0.065	-0.051	0.051	0.008	-0.049	-0.163
	0.970	0.456	0.079	0.540	**0.035**	0.798	0.353	0.554	0.103	0.371	0.481	0.479	0.915	0.502	**0.023**
Dimethyl disulfide	0.167	0.197	0.085	-0.033	0.161	-0.035	-0.167	-0.069	-0.032	0.095	0.026	0.010	0.076	0.106	-0.073
	0.020	**0.006**	0.239	0.644	**0.026**	0.633	**0.020**	0.341	0.654	0.188	0.717	0.891	0.294	0.143	0.314
Dimethyl trisulfide	0.085	0.134	0.093	-0.122	0.116	0.044	-0.154	-0.070	0.005	0.072	0.146	-0.008	0.026	0.162	-0.055
	0.241	0.064	0.198	0.092	0.110	0.539	**0.033**	0.331	0.950	0.322	**0.042**	0.914	0.717	**0.024**	0.449
2-methyl butanal	0.170	0.092	-0.005	0.075	-0.127	-0.103	-0.171	-0.057	0.044	-0.041	-0.103	0.254	0.014	-0.126	-0.010
	0.018	0.201	0.940	0.298	0.079	0.154	**0.018**	0.430	0.547	0.574	0.154	**0.000**	0.848	0.081	0.891
3-methyl butanal	0.198	0.151	-0.041	0.058	-0.085	-0.124	-0.201	-0.083	0.084	-0.001	-0.106	0.222	0.044	-0.107	-0.042
	0.006	**0.036**	0.571	0.423	0.239	0.086	**0.005**	0.249	0.247	0.990	0.144	**0.002**	0.548	0.138	0.566
Pentanal	-0.028	0.025	-0.010	0.102	0.001	-0.045	-0.041	0.085	0.015	-0.020	-0.069	-0.004	0.086	0.022	0.028
	0.703	0.734	0.890	0.157	0.990	0.537	0.568	0.239	0.839	0.786	0.338	0.961	0.233	0.764	0.702
2-Hexenal	0.067	0.028	0.087	0.135	0.074	-0.041	0.056	0.060	-0.014	-0.098	-0.124	0.005	-0.087	-0.061	-0.039
	0.357	0.697	0.227	0.062	0.307	0.570	0.437	0.409	0.847	0.174	0.085	0.947	0.227	0.398	0.595
Hexanal	-0.091	-0.073	-0.101	0.113	-0.067	-0.064	0.034	0.080	-0.010	-0.083	-0.010	-0.119	0.018	0.057	-0.027
	0.209	0.311	0.163	0.117	0.356	0.373	0.643	0.270	0.889	0.250	0.892	0.101	0.804	0.432	0.710
Methional	0.218	0.143	-0.071	0.018	-0.039	-0.101	-0.132	-0.135	-0.017	0.038	-0.169	0.186	0.005	-0.106	-0.134
	0.002	**0.047**	0.326	0.807	0.587	0.162	0.068	0.061	0.812	0.597	**0.019**	**0.010**	0.942	0.143	0.063
2,4-heptadienal	0.111	0.048	0.008	-0.067	0.131	0.088	0.092	-0.017	0.016	-0.012	0.224	0.010	0.019	0.073	-0.040
	0.124	0.503	0.910	0.355	0.069	0.226	0.205	0.816	0.823	0.869	**0.002**	0.893	0.795	0.312	0.578
4-Heptenal	-0.111	0.085	-0.136	-0.090	-0.059	-0.096	0.102	0.047	-0.061	0.019	-0.042	0.152	0.092	-0.150	-0.070
	0.123	0.241	0.060	0.213	0.416	0.187	0.158	0.515	0.402	0.790	0.559	**0.035**	0.206	**0.038**	0.332
Heptanal	-0.117	-0.025	-0.202	0.000	-0.122	-0.105	0.099	0.068	-0.070	-0.038	-0.087	0.060	-0.024	-0.148	-0.108
	0.104	0.728	**0.005**	0.998	0.090	0.147	0.169	0.347	0.337	0.604	0.227	0.408	0.739	**0.039**	0.136
2-Octenal	-0.001	0.043	-0.029	0.019	0.085	0.018	0.044	-0.008	-0.097	-0.037	0.129	-0.066	-0.088	0.071	-0.067
	0.992	0.548	0.690	0.789	0.239	0.801	0.547	0.913	0.181	0.608	0.075	0.363	0.222	0.327	0.352
Octanal	-0.113	-0.066	-0.150	-0.023	-0.065	-0.030	0.033	0.033	-0.100	-0.041	-0.009	-0.060	0.050	-0.044	-0.050
	0.118	0.364	**0.037**	0.747	0.368	0.680	0.653	0.646	0.168	0.568	0.906	0.407	0.493	0.548	0.494

	Intensity of Roast Meat Flavor	Intensity of Lamb Flavor	Grassy Flavor	Metallic Flavor	Aromatic Flavor	Soapy Flavor	Rancid Flavor	Farmyard Flavor	Sour Flavor	Sweet Flavor	Off-Flavors	Tenderness	Juiciness	Chewiness	Fattiness
2,6-nonadienal	0.092	0.122	0.037	-0.217	0.157	0.028	0.057	-0.029	-0.030	0.094	0.220	0.072	0.087	0.017	-0.122
	0.206	0.092	0.606	**0.003**	**0.029**	0.702	0.427	0.691	0.679	0.195	**0.002**	0.318	0.228	0.817	0.092
2-nonenal	0.016	0.069	-0.116	-0.109	-0.003	-0.053	0.120	0.001	-0.100	-0.042	0.076	0.149	-0.067	-0.143	-0.071
	0.829	0.337	0.109	0.132	0.970	0.462	0.097	0.990	0.165	0.562	0.290	**0.039**	0.355	**0.047**	0.325
Nonanal	-0.119	-0.075	-0.096	-0.090	0.054	0.059	0.041	0.027	-0.017	0.019	0.156	-0.109	0.064	0.031	-0.057
	0.100	0.299	0.184	0.212	0.453	0.414	0.570	0.713	0.813	0.795	**0.031**	0.133	0.378	0.673	0.434
2,4-decadienal	0.059	0.032	0.024	0.078	0.125	0.025	0.036	-0.028	0.001	-0.019	0.154	-0.062	-0.115	0.094	-0.021
	0.415	0.656	0.741	0.280	0.084	0.728	0.624	0.703	0.985	0.795	**0.032**	0.394	0.112	0.195	0.771
2-decenal	0.019	0.127	-0.037	-0.018	0.025	-0.022	0.092	0.038	-0.097	-0.074	0.048	0.186	-0.060	-0.198	-0.039
	0.796	0.078	0.605	0.801	0.729	0.765	0.203	0.603	0.180	0.307	0.511	**0.009**	0.407	**0.006**	0.594
Decanal	-0.264	-0.143	-0.065	0.073	-0.064	0.076	0.136	0.124	0.117	-0.082	0.170	-0.053	0.079	-0.074	-0.009
	0.000	**0.048**	0.371	0.312	0.373	0.293	0.059	0.086	0.106	0.257	**0.018**	0.465	0.275	0.303	0.899
Undecanal	-0.015	-0.043	0.036	0.160	-0.139	0.121	0.083	0.124	0.082	-0.258	0.029	-0.003	-0.088	-0.071	0.105
	0.837	0.548	0.624	**0.026**	0.054	0.094	0.252	0.087	0.256	**0.000**	0.687	0.970	0.226	0.327	0.146
Dodecanal	-0.082	-0.099	0.010	-0.009	-0.039	0.131	0.171	0.089	0.029	-0.082	0.200	-0.025	-0.027	0.053	0.190
	0.257	0.173	0.894	0.900	0.586	0.070	**0.017**	0.221	0.685	0.259	**0.005**	0.728	0.711	0.463	**0.008**
Tridecanal	-0.047	-0.113	-0.002	-0.047	-0.046	0.138	0.110	0.103	0.053	-0.022	0.275	-0.171	-0.016	0.202	0.091
	0.515	0.117	0.983	0.520	0.527	0.057	0.127	0.154	0.468	0.757	**0.000**	**0.017**	0.828	**0.005**	0.210
Tetradecanal	-0.127	-0.188	0.005	-0.193	-0.052	0.165	0.131	0.029	0.037	0.031	0.283	-0.127	-0.031	0.165	0.051
	0.079	**0.009**	0.943	**0.007**	0.476	**0.022**	0.070	0.688	0.607	0.665	**<.0001**	0.078	0.668	**0.022**	0.481
Pentadecanal	-0.010	-0.114	0.021	-0.172	-0.045	0.101	0.046	0.008	0.019	0.022	0.236	-0.180	-0.041	0.245	0.027
	0.885	0.114	0.767	**0.017**	0.539	0.163	0.522	0.910	0.796	0.756	**0.001**	**0.012**	0.574	**0.001**	0.711
Hexadecanal	0.015	-0.083	0.032	-0.153	-0.040	0.088	0.056	-0.021	-0.003	0.021	0.218	-0.222	-0.014	0.277	0.064
	0.835	0.253	0.658	**0.033**	0.577	0.225	0.439	0.769	0.970	0.769	**0.002**	**0.002**	0.851	**<.0001**	0.374
Pentanol	-0.052	-0.005	-0.077	0.117	-0.013	-0.001	-0.039	-0.013	0.027	-0.047	-0.006	-0.048	-0.059	0.027	-0.124
	0.473	0.949	0.287	0.106	0.853	0.984	0.586	0.858	0.713	0.512	0.929	0.506	0.412	0.714	0.086
1-Hexanol	-0.189	-0.086	-0.228	0.072	-0.147	-0.077	0.102	0.054	0.043	-0.052	-0.052	0.023	-0.021	-0.098	-0.130
	0.008	0.236	**0.001**	0.317	**0.042**	0.290	0.158	0.455	0.553	0.475	0.474	0.750	0.768	0.173	0.072
1-Heptanol	-0.120	0.033	-0.139	0.002	-0.044	-0.042	0.092	0.105	0.011	-0.054	0.016	0.062	-0.118	-0.130	-0.102
	0.096	0.650	0.054	0.973	0.543	0.559	0.202	0.147	0.877	0.457	0.826	0.393	0.103	0.071	0.160
1-Octen-3-ol	-0.115	-0.075	-0.075	0.120	0.027	-0.012	-0.003	-0.004	0.013	-0.015	0.066	-0.236	0.020	0.179	-0.051
	0.112	0.299	0.298	0.095	0.713	0.871	0.964	0.955	0.857	0.840	0.362	**0.001**	0.779	**0.013**	0.483
2-Octen-1-ol	-0.214	-0.095	-0.164	-0.020	-0.040	0.034	0.038	-0.065	-0.046	0.052	0.187	-0.150	0.025	0.141	-0.122
	0.003	0.190	**0.023**	0.781	0.579	0.634	0.605	0.370	0.525	0.469	**0.009**	**0.037**	0.734	**0.050**	0.091
2-Ethyl-1-hexanol	-0.164	-0.080	0.045	0.229	-0.181	-0.051	0.060	0.280	0.076	-0.207	0.026	-0.039	-0.027	0.053	0.151
	0.022	0.272	0.534	**0.001**	**0.012**	0.484	0.410	**<.0001**	0.294	**0.004**	0.719	0.593	0.713	0.467	**0.036**
1-Octanol	-0.182	-0.116	-0.164	0.012	-0.040	0.052	0.103	0.050	-0.003	-0.052	0.086	-0.013	0.031	-0.062	-0.047
	0.011	0.109	**0.023**	0.873	0.580	0.469	0.153	0.492	0.965	0.472	0.235	0.855	0.668	0.391	0.512
α-terpineol	-0.051	-0.040	0.102	0.377	-0.241	-0.012	0.037	0.120	0.039	-0.355	-0.194	0.102	0.029	-0.134	0.201

	Intensity of Roast Meat Flavor	Intensity of Lamb Flavor	Grassy Flavor	Metallic Flavor	Aromatic Flavor	Soapy Flavor	Rancid Flavor	Farmyard Flavor	Sour Flavor	Sweet Flavor	Off-Flavors	Tenderness	Juiciness	Chewiness	Fattiness
	0.479	0.582	0.160	**<.0001**	**0.001**	0.872	0.611	0.098	0.589	**<.0001**	**0.007**	0.156	0.694	0.063	**0.005**
1-Pentadecanol	-0.053	0.016	-0.002	-0.022	-0.078	0.048	0.074	0.100	-0.086	-0.071	0.146	0.051	0.042	0.091	0.094
	0.464	0.826	0.976	0.766	0.284	0.510	0.308	0.166	0.236	0.330	**0.043**	0.484	0.559	0.207	0.193
2-Pentanone	-0.043	0.046	0.082	0.230	-0.122	-0.023	-0.069	0.016	-0.039	-0.133	-0.115	0.069	0.069	-0.101	0.014
	0.557	0.525	0.258	**0.001**	0.091	0.752	0.342	0.821	0.592	0.066	0.110	0.339	0.344	0.161	0.842
2-Heptanone	-0.164	-0.105	-0.052	0.064	-0.011	-0.033	0.020	0.015	0.000	-0.072	0.067	-0.087	0.025	0.074	-0.035
	0.022	0.147	0.470	0.378	0.876	0.653	0.785	0.834	0.999	0.320	0.358	0.229	0.730	0.306	0.625
2-Nonanone	-0.211	-0.107	-0.064	-0.017	-0.012	0.003	0.143	0.056	0.043	-0.146	0.209	0.096	-0.011	-0.021	0.051
	0.003	0.139	0.376	0.810	0.871	0.972	**0.047**	0.440	0.551	**0.043**	**0.004**	0.186	0.876	0.777	0.480
γ-octalactone	-0.144	-0.002	-0.140	0.149	-0.179	0.043	0.090	0.081	-0.009	-0.246	0.037	0.093	-0.116	-0.098	-0.092
	0.045	0.973	0.053	**0.038**	**0.013**	0.549	0.215	0.264	0.906	**0.001**	0.610	0.201	0.109	0.177	0.204
γ-nonalactone	0.043	0.086	0.078	0.144	-0.097	0.081	0.058	0.067	-0.127	-0.294	-0.067	0.145	0.038	-0.081	0.139
	0.548	0.234	0.282	**0.046**	0.181	0.262	0.424	0.357	0.077	**<.0001**	0.354	**0.044**	0.603	0.265	0.054
p-cresol	0.112	0.168	0.057	0.144	-0.033	-0.071	-0.022	-0.010	-0.003	-0.107	-0.173	0.263	-0.047	-0.226	0.010
	0.120	**0.019**	0.428	**0.046**	0.647	0.326	0.762	0.892	0.964	0.139	**0.016**	**0.000**	0.515	**0.002**	0.886
Indole	-0.184	0.000	-0.080	-0.070	-0.056	-0.083	0.064	0.110	-0.073	-0.069	0.195	0.088	0.065	-0.032	-0.086
	0.010	0.996	0.267	0.334	0.439	0.249	0.375	0.126	0.312	0.341	**0.007**	0.221	0.371	0.657	0.234
Skatole	-0.146	0.003	-0.080	-0.096	-0.028	-0.033	0.070	0.036	-0.093	0.028	0.148	0.093	-0.052	-0.032	-0.089
	0.043	0.965	0.267	0.182	0.701	0.648	0.332	0.617	0.198	0.700	**0.040**	0.199	0.477	0.660	0.221
2-Methylpyrazine	0.013	0.012	-0.051	0.190	-0.116	-0.034	-0.008	-0.031	0.018	-0.090	-0.107	0.147	0.086	-0.189	-0.124
	0.858	0.871	0.481	**0.008**	0.108	0.641	0.918	0.673	0.805	0.213	0.140	**0.041**	0.235	**0.009**	0.087
2,5-dimethyl pyrazine	0.184	0.128	0.031	0.163	0.040	-0.013	-0.074	-0.023	-0.008	-0.038	-0.231	0.161	-0.094	-0.140	0.004
	0.010	0.075	0.669	**0.023**	0.577	0.856	0.307	0.752	0.908	0.602	**0.001**	**0.026**	0.192	0.052	0.953
2,6-dimethyl pyrazine	-0.160	-0.049	-0.091	-0.137	-0.021	-0.024	0.078	0.106	-0.083	0.017	0.209	0.094	0.069	-0.058	-0.109
	0.026	0.495	0.206	0.058	0.767	0.746	0.284	0.142	0.253	0.817	**0.004**	0.195	0.342	0.422	0.132
2-ethyl-3,5-dimethyl pyrazine	0.201	0.170	0.019	0.103	-0.019	-0.101	-0.087	-0.065	-0.004	-0.067	-0.205	0.223	-0.036	-0.192	0.003
	0.005	**0.018**	0.793	0.156	0.792	0.162	0.231	0.373	0.955	0.356	**0.004**	**0.002**	0.621	**0.008**	0.962
2-ethyl-3,6-dimethyl pyrazine	0.177	0.195	-0.024	0.225	-0.154	-0.080	-0.168	-0.031	0.014	-0.150	-0.225	0.159	0.016	-0.061	0.087
	0.014	**0.007**	0.735	**0.002**	**0.033**	0.269	**0.020**	0.671	0.846	**0.037**	**0.002**	**0.027**	0.821	0.401	0.230
2-pentylpyridine	-0.080	0.007	-0.011	-0.222	-0.017	0.049	0.128	-0.022	0.046	0.155	0.270	0.031	0.082	0.054	0.000
	0.267	0.926	0.877	**0.002**	0.817	0.501	0.077	0.761	0.522	**0.032**	**0.000**	0.667	0.256	0.457	0.996
Benzaldehyde	0.091	0.018	0.085	-0.065	0.083	-0.036	-0.091	-0.093	0.019	0.135	-0.121	-0.078	-0.015	0.070	-0.050
	0.207	0.806	0.241	0.369	0.253	0.619	0.207	0.199	0.790	0.061	0.094	0.284	0.833	0.331	0.493
Phenylacetaldehyde	0.214	0.120	0.028	-0.030	0.053	-0.135	-0.049	-0.123	0.051	0.065	-0.147	0.293	-0.023	-0.248	-0.080
	0.003	0.095	0.695	0.683	0.462	0.061	0.495	0.087	0.485	0.368	**0.041**	**<.0001**	0.748	**0.001**	0.269
Toluene	0.005	-0.014	0.034	0.205	-0.059	-0.042	-0.047	-0.027	0.144	-0.007	-0.276	-0.079	0.001	0.021	0.034
	0.948	0.842	0.643	**0.004**	0.413	0.563	0.518	0.710	**0.046**	0.922	**0.000**	0.276	0.991	0.769	0.641

	Intensity of Roast Meat Flavor	Intensity of Lamb Flavor	Grassy Flavor	Metallic Flavor	Aromatic Flavor	Soapy Flavor	Rancid Flavor	Farmyard Flavor	Sour Flavor	Sweet Flavor	Off-Flavors	Tenderness	Juiciness	Chewiness	Fattiness
2-pentyl furan	0.037	-0.002	-0.062	-0.008	0.030	0.014	-0.049	-0.033	-0.030	-0.022	0.023	-0.198	-0.081	0.208	-0.075
	0.605	0.979	0.395	0.908	0.681	0.845	0.501	0.645	0.681	0.766	0.754	**0.006**	0.265	**0.004**	0.302
Tridecane	-0.026	-0.034	0.013	-0.090	0.066	0.010	0.043	-0.095	0.114	0.044	0.094	-0.136	-0.052	0.209	0.040
	0.719	0.642	0.855	0.211	0.365	0.887	0.549	0.189	0.115	0.541	0.192	0.059	0.476	**0.004**	0.576
Tetradecane	-0.087	-0.031	0.032	-0.085	-0.015	0.047	0.156	0.077	0.010	-0.048	0.091	-0.052	-0.047	0.111	0.135
	0.228	0.665	0.654	0.240	0.840	0.515	**0.031**	0.289	0.885	0.509	0.210	0.470	0.514	0.124	0.061
Pentadecane	-0.050	-0.047	0.038	0.184	-0.112	0.106	0.164	0.109	0.077	-0.197	-0.089	0.053	-0.071	0.019	0.164
	0.489	0.520	0.595	**0.011**	0.123	0.142	**0.023**	0.131	0.286	**0.006**	0.218	0.466	0.327	0.790	**0.023**
Hexadecane	-0.105	-0.094	0.008	0.196	-0.140	0.098	0.213	0.193	0.072	-0.206	-0.080	0.111	-0.046	-0.086	0.243
	0.145	0.195	0.909	**0.006**	0.052	0.175	**0.003**	**0.007**	0.319	**0.004**	0.271	0.126	0.527	0.232	**0.001**
Heneicosane	0.016	-0.108	0.073	0.188	-0.239	-0.085	0.120	0.041	0.085	-0.231	-0.058	-0.006	-0.103	0.030	0.150
	0.820	0.135	0.311	**0.009**	**0.001**	0.242	0.096	0.575	0.240	**0.001**	0.426	0.932	0.154	0.681	**0.038**
4MOA (Muscle)	-0.110	-0.127	-0.097	-0.111	-0.162	-0.039	0.116	0.094	-0.035	-0.100	0.041	-0.032	-0.110	-0.069	-0.074
	0.128	0.080	0.180	0.123	**0.025**	0.595	0.107	0.192	0.633	0.167	0.570	0.658	0.127	0.338	0.309
4EOA (Muscle)	-0.213	-0.043	-0.139	-0.257	-0.015	-0.047	0.109	0.059	-0.154	0.059	0.241	0.039	0.034	-0.003	-0.151
	0.003	0.557	0.053	**0.000**	0.838	0.517	0.132	0.416	**0.033**	0.417	**0.001**	0.593	0.642	0.969	**0.037**
4MNA (Muscle)	-0.241	-0.049	-0.122	-0.295	-0.031	-0.004	0.091	0.125	-0.117	0.037	0.338	0.028	0.021	0.042	-0.102
	0.001	0.496	0.091	**<.0001**	0.667	0.955	0.207	0.084	0.104	0.610	**<.0001**	0.699	0.767	0.563	0.158
4MOA (SC Fat)	-0.289	-0.094	-0.044	-0.082	0.051	0.198	0.128	0.121	0.015	0.155	0.185	-0.086	0.069	0.078	0.005
	<.0001	0.207	0.555	0.267	0.491	**0.007**	0.085	0.103	0.838	**0.036**	**0.012**	0.248	0.350	0.291	0.942
4EOA (SC Fat)	-0.067	0.000	-0.010	-0.035	0.054	0.049	0.076	0.033	-0.035	0.017	0.011	0.011	0.032	-0.055	-0.009
	0.400	0.995	0.901	0.663	0.494	0.535	0.338	0.682	0.657	0.832	0.893	0.886	0.688	0.492	0.911
4MNA (SC Fat)	-0.309	-0.120	-0.091	0.053	-0.023	0.111	0.132	0.233	0.001	0.079	0.110	-0.159	-0.031	0.078	0.016
	<.0001	0.117	0.235	0.490	0.760	0.146	0.084	**0.002**	0.986	0.301	0.152	**0.037**	0.690	0.312	0.837
Hexanoic Acid	-0.051	-0.052	-0.011	0.169	-0.157	0.047	0.017	0.048	-0.143	-0.235	-0.073	0.111	-0.049	-0.122	0.029
	0.483	0.477	0.878	**0.019**	**0.030**	0.516	0.817	0.506	**0.048**	**0.001**	0.314	0.124	0.499	0.091	0.692
Nonanoic Acid	-0.046	0.035	-0.095	0.071	-0.248	0.052	0.161	0.002	-0.097	-0.195	-0.046	0.212	0.079	-0.149	0.168
	0.526	0.631	0.191	0.330	**0.001**	0.473	**0.026**	0.979	0.180	**0.007**	0.526	**0.003**	0.276	**0.039**	**0.020**
pHu	-0.139	-0.060	-0.063	0.134	-0.095	-0.014	0.084	0.110	-0.014	-0.125	0.164	0.052	0.079	-0.033	0.168
	0.055	0.407	0.382	0.063	0.190	0.847	0.247	0.127	0.842	0.084	**0.023**	0.471	0.275	0.648	**0.019**
IMF	0.013	0.205	-0.048	0.048	-0.024	0.020	0.072	-0.006	-0.036	0.005	-0.005	0.229	0.183	-0.170	-0.040
	0.852	**0.004**	0.509	0.506	0.736	0.779	0.320	0.932	0.620	0.942	0.944	**0.001**	**0.011**	**0.018**	0.576
PUFA proportion	-0.096	-0.240	-0.183	0.151	-0.160	0.060	0.063	0.088	0.178	-0.137	0.043	-0.312	-0.274	0.199	-0.091
	0.230	**0.003**	**0.022**	0.058	**0.046**	0.454	0.430	0.273	**0.026**	0.086	0.593	**<.0001**	**0.001**	**0.013**	0.255
SFA proportion	-0.115	0.022	0.111	-0.180	0.112	0.096	0.129	-0.048	0.031	0.081	0.189	0.221	0.144	-0.140	0.117
	0.154	0.783	0.168	**0.024**	0.165	0.235	0.109	0.555	0.703	0.313	**0.018**	**0.006**	0.073	0.080	0.147
PUFA/SFA ratio	-0.067	-0.200	-0.186	0.162	-0.148	0.049	0.043	0.105	0.151	-0.132	0.005	-0.325	-0.273	0.207	-0.107
	0.403	**0.012**	**0.020**	**0.043**	0.064	0.541	0.592	0.191	0.059	0.099	0.954	**<.0001**	**0.001**	**0.009**	0.182
PUFA mg/100 g muscle	-0.023	0.028	-0.184	0.193	-0.129	0.020	0.123	0.071	0.099	-0.089	0.029	-0.003	-0.058	-0.032	-0.043

	Intensity of Roast Meat Flavor	Intensity of Lamb Flavor	Grassy Flavor	Metallic Flavor	Aromatic Flavor	Soapy Flavor	Rancid Flavor	Farmyard Flavor	Sour Flavor	Sweet Flavor	Off-Flavors	Tenderness	Juiciness	Chewiness	Fattiness
	0.777	0.725	**0.021**	**0.015**	0.108	0.801	0.124	0.374	0.216	0.268	0.717	0.971	0.473	0.692	0.596
SFA mg/100 g muscle	0.051	0.146	-0.076	0.077	-0.045	-0.013	0.073	-0.021	-0.028	0.008	0.047	0.255	0.130	-0.203	-0.003
	0.528	0.067	0.341	0.337	0.580	0.876	0.365	0.795	0.724	0.919	0.562	**0.001**	0.104	**0.011**	0.967

	Stringiness	Stickiness	Intensity of Lamb After taste	Soapy Aftertaste	Metallic After taste	Fatty Aftertaste	Dry Aftertaste	Astringent Aftertaste	Dimethyl sulfide	Dimethyl disulfide	Dimethyl trisulfide	2-methyl butanal	3-methyl butanal	Pentanal
Stringiness	1.000													
Stickiness	0.634	1.000												
	<.0001													
Intensity of Lamb Afterstaste	-0.122	0.083	1.000											
	0.092	0.249												
Soapy Aftertaste	0.011	-0.047	-0.058	1.000										
	0.881	0.518	0.424											
Metallic Aftertaste	-0.105	-0.045	0.213	0.033	1.000									
	0.145	0.539	**0.003**	0.645										
Fatty Aftertaste	-0.025	-0.068	0.223	0.295	0.308	1.000								
	0.726	0.347	**0.002**	**<.0001**	**<.0001**									
Dry Aftertaste	0.325	0.360	-0.079	0.087	-0.007	-0.162	1.000							
	<.0001	**<.0001**	0.275	0.229	0.927	**0.024**								
Astringent Aftertaste	-0.008	0.024	-0.001	0.152	0.390	0.181	0.286	1.000						
	0.912	0.737	0.987	**0.034**	**<.0001**	**0.012**	**<.0001**							
Dimethyl sulfide	-0.069	-0.074	0.026	-0.121	-0.061	-0.121	-0.053	-0.068	1.000					
	0.344	0.308	0.723	0.094	0.397	0.093	0.466	0.351						
Dimethyl disulfide	0.138	0.154	0.005	-0.087	-0.054	-0.099	-0.040	-0.141	0.106	1.000				
	0.056	**0.033**	0.943	0.231	0.453	0.173	0.578	0.051	0.138					
Dimethyl trisulfide	0.129	0.176	-0.003	-0.074	-0.182	-0.092	-0.036	-0.203	0.046	0.663	1.000			
	0.074	**0.015**	0.962	0.310	**0.011**	0.202	0.618	**0.005**	0.521	**<.0001**				
2-methyl	-0.049	0.008	0.215	-0.145	0.035	0.010	0.001	0.027	0.187	0.377	0.300	1.000		

	Stringiness	Stickiness	Intensity of Lamb After taste	Soapy Aftertaste	Metallic After taste	Fatty Aftertaste	Dry Aftertaste	Astringent Aftertaste	Dimethyl sulfide	Dimethyl disulfide	Dimethyl trisulfide	2-methyl butanal	3-methyl butanal	Pentanal
butanal														
	0.498	0.908	**0.003**	**0.044**	0.625	0.889	0.994	0.709	**0.009**	**<.0001**	**<.0001**			
3-methyl butanal	0.010	0.078	0.135	-0.123	0.028	-0.049	-0.003	-0.011	0.321	0.363	0.256	0.804	1.000	
	0.885	0.284	0.061	0.088	0.698	0.495	0.963	0.877	**<.0001**	**<.0001**	**0.000**	**<.0001**		
Pentanal	0.036	-0.025	-0.061	0.066	0.056	0.024	0.034	0.150	0.067	0.235	0.032	0.053	0.113	1.000
	0.620	0.728	0.399	0.358	0.440	0.742	0.638	**0.037**	0.347	**0.001**	0.655	0.457	0.113	
2-Hexenal	-0.022	-0.009	-0.038	0.047	0.098	-0.053	0.107	0.142	-0.143	0.112	0.074	-0.091	-0.067	0.445
	0.756	0.901	0.600	0.518	0.177	0.468	0.138	**0.050**	**0.044**	0.116	0.302	0.203	0.348	**<.0001**
Hexanal	0.070	0.002	-0.163	0.062	0.055	0.069	0.067	0.161	0.035	0.114	-0.025	-0.045	0.017	0.784
	0.336	0.979	**0.024**	0.391	0.449	0.342	0.351	**0.026**	0.623	0.108	0.731	0.526	0.813	**<.0001**
Methional	-0.009	0.043	0.185	-0.155	0.029	-0.163	0.047	0.048	0.300	0.224	0.142	0.466	0.574	-0.062
	0.902	0.554	**0.010**	**0.031**	0.693	**0.023**	0.514	0.506	**<.0001**	**0.002**	**0.046**	**<.0001**	**<.0001**	0.387
2,4-heptadienal	0.102	0.133	-0.109	-0.067	-0.121	-0.097	0.095	0.060	-0.071	0.243	0.206	-0.008	0.031	0.279
	0.160	0.066	0.130	0.357	0.094	0.179	0.189	0.406	0.323	**0.001**	**0.004**	0.915	0.664	**<.0001**
4-Heptenal	-0.128	-0.095	-0.103	0.034	-0.077	-0.069	-0.037	0.073	-0.054	0.028	-0.150	-0.015	0.048	0.471
	0.075	0.190	0.155	0.640	0.289	0.341	0.610	0.311	0.453	0.698	**0.035**	0.830	0.503	**<.0001**
Heptanal	-0.124	-0.120	-0.129	0.050	0.003	-0.055	0.028	0.143	-0.019	-0.151	-0.262	-0.161	-0.110	0.531
	0.086	0.097	0.073	0.493	0.966	0.447	0.695	**0.047**	0.786	**0.034**	**0.000**	**0.024**	0.123	**<.0001**
2-Octenal	0.070	0.024	-0.130	0.045	-0.080	-0.065	0.084	0.041	-0.094	0.094	0.107	-0.276	-0.218	0.366
	0.334	0.736	0.071	0.530	0.270	0.366	0.244	0.574	0.188	0.187	0.135	**<.0001**	**0.002**	**<.0001**
Octanal	-0.054	-0.120	-0.209	0.092	-0.026	-0.077	-0.048	0.138	-0.103	-0.290	-0.371	-0.368	-0.337	0.344
	0.458	0.096	**0.004**	0.201	0.718	0.286	0.507	0.056	0.150	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**
2,6-nonadienal	0.033	0.116	-0.031	-0.028	-0.294	-0.146	-0.015	-0.134	-0.068	0.182	0.182	-0.058	0.047	0.118
	0.645	0.108	0.671	0.696	**<.0001**	**0.042**	0.839	0.064	0.342	**0.010**	**0.010**	0.413	0.514	0.098
2-nonenal	-0.119	-0.026	-0.054	0.034	-0.128	-0.140	0.027	-0.017	-0.109	-0.043	-0.038	-0.271	-0.213	0.196
	0.098	0.721	0.453	0.637	0.076	0.053	0.707	0.819	0.128	0.546	0.597	**0.000**	**0.003**	**0.006**
Nonanal	0.033	-0.066	-0.151	0.091	-0.104	-0.080	-0.084	0.046	-0.065	-0.292	-0.312	-0.411	-0.387	0.016
	0.644	0.360	**0.036**	0.210	0.151	0.270	0.245	0.527	0.361	**<.0001**	**<.0001**	**<.0001**	**<.0001**	0.825
2,4-decadienal	0.113	0.118	-0.018	0.015	-0.031	-0.017	0.139	0.050	-0.181	0.042	0.127	-0.253	-0.234	0.172
	0.119	0.101	0.807	0.834	0.668	0.809	0.054	0.488	**0.011**	0.560	0.075	**0.000**	**0.001**	**0.016**
2-decenal	-0.188	-0.118	0.020	0.059	-0.067	-0.065	0.004	0.041	-0.129	-0.144	-0.136	-0.311	-0.274	0.081
	0.009	0.102	0.787	0.415	0.353	0.372	0.953	0.575	0.070	**0.044**	0.056	**<.0001**	**<.0001**	0.255
Decanal	-0.029	-0.148	-0.207	0.082	0.080	0.109	-0.037	0.118	-0.072	-0.346	-0.327	-0.262	-0.230	-0.110
	0.685	**0.040**	**0.004**	0.259	0.270	0.132	0.605	0.104	0.312	**<.0001**	**<.0001**	**0.000**	**0.001**	0.124
Undecanal	-0.043	-0.074	-0.044	0.058	0.150	0.158	0.071	0.082	0.038	-0.291	-0.200	-0.184	-0.211	-0.223
	0.552	0.303	0.547	0.426	**0.038**	**0.029**	0.324	0.255	0.591	**<.0001**	**0.005**	**0.010**	**0.003**	**0.002**
Dodecanal	0.045	-0.005	-0.115	0.097	-0.049	0.137	-0.050	-0.027	-0.144	-0.238	-0.116	-0.375	-0.397	-0.198
	0.534	0.949	0.112	0.180	0.497	0.058	0.493	0.710	**0.043**	**0.001**	0.103	**<.0001**	**<.0001**	**0.005**

	Stringiness	Stickiness	Intensity of Lamb After taste	Soapy Aftertaste	Metallic After taste	Fatty Aftertaste	Dry Aftertaste	Astringent Aftertaste	Dimethyl sulfide	Dimethyl disulfide	Dimethyl trisulfide	2-methyl butanal	3-methyl butanal	Pentanal
Tridecanal	0.198	0.125	-0.078	0.048	-0.123	0.067	0.056	-0.141	0.019	-0.095	0.053	-0.354	-0.307	-0.176
	0.006	0.084	0.278	0.504	0.087	0.356	0.440	0.051	0.795	0.181	0.457	**<.0001**	**<.0001**	**0.013**
Tetradecanal	0.141	0.116	-0.161	0.016	-0.177	0.031	0.008	-0.181	-0.037	-0.127	0.113	-0.345	-0.359	-0.338
	0.050	0.107	**0.025**	0.828	**0.014**	0.671	0.913	**0.012**	0.604	0.074	0.113	**<.0001**	**<.0001**	**<.0001**
Pentadecanal	0.250	0.217	-0.087	-0.040	-0.197	0.011	0.069	-0.215	0.027	0.013	0.261	-0.204	-0.171	-0.345
	0.000	**0.003**	0.227	0.581	**0.006**	0.882	0.342	**0.003**	0.705	0.852	**0.000**	**0.004**	**0.016**	**<.0001**
Hexadecanal	0.288	0.183	0.006	-0.064	-0.166	0.091	0.088	-0.180	0.058	0.001	0.196	-0.069	-0.076	-0.355
	<.0001	**0.011**	0.939	0.373	**0.021**	0.209	0.224	**0.012**	0.421	0.989	**0.006**	0.331	0.285	**<.0001**
Pentanol	0.067	0.000	-0.158	0.018	0.041	-0.074	0.067	0.157	0.167	0.183	-0.002	0.143	0.174	0.648
	0.354	0.998	**0.028**	0.806	0.570	0.307	0.354	**0.030**	**0.019**	**0.010**	0.974	**0.045**	**0.014**	**<.0001**
1-Hexanol	-0.069	-0.059	-0.113	0.049	0.077	-0.029	0.061	0.211	0.039	-0.047	-0.202	-0.018	0.017	0.612
	0.338	0.417	0.116	0.498	0.286	0.687	0.402	**0.003**	0.590	0.507	**0.004**	0.799	0.808	**<.0001**
1-Heptanol	-0.108	-0.102	-0.122	0.073	0.028	-0.061	0.079	0.231	-0.055	-0.135	-0.213	-0.125	-0.054	0.404
	0.135	0.159	0.091	0.312	0.701	0.402	0.273	**0.001**	0.439	0.058	**0.003**	0.078	0.454	**<.0001**
1-Octen-3-ol	0.170	0.110	-0.185	0.001	0.087	0.033	0.085	0.153	-0.061	0.165	0.096	-0.042	-0.034	0.438
	0.018	0.127	**0.010**	0.991	0.231	0.650	0.240	**0.033**	0.397	**0.020**	0.180	0.558	0.630	**<.0001**
2-Octen-1-ol	0.127	0.130	-0.188	-0.035	-0.069	-0.016	0.040	0.066	-0.013	0.051	0.096	-0.116	-0.120	0.232
	0.079	0.071	**0.009**	0.626	0.343	0.827	0.576	0.358	0.856	0.476	0.180	0.103	0.093	**0.001**
2-Ethyl-1-hexanol	-0.019	-0.054	0.018	0.154	0.177	0.197	0.021	0.155	0.174	-0.150	-0.152	0.118	0.150	0.057
	0.794	0.459	0.804	**0.033**	**0.014**	**0.006**	0.770	**0.031**	**0.014**	**0.035**	**0.032**	0.097	**0.035**	0.421
1-Octanol	-0.082	-0.119	-0.118	0.108	0.000	-0.034	-0.041	0.193	-0.069	-0.381	-0.384	-0.368	-0.379	0.096
	0.256	0.099	0.101	0.133	0.997	0.640	0.574	**0.007**	0.336	**<.0001**	**<.0001**	**<.0001**	**<.0001**	0.180
α-terpineol	-0.153	-0.151	0.124	0.105	0.357	0.232	0.019	0.215	0.148	-0.310	-0.248	0.020	0.005	-0.064
	0.034	**0.036**	0.087	0.145	**<.0001**	**0.001**	0.797	**0.003**	**0.037**	**<.0001**	**0.000**	0.777	0.948	0.370
1-Pentadecanol	0.000	0.071	0.030	0.127	-0.080	0.075	-0.065	-0.064	0.108	-0.109	0.071	-0.047	0.023	-0.129
	0.998	0.327	0.674	0.078	0.270	0.303	0.366	0.374	0.130	0.125	0.318	0.514	0.749	0.071
2-Pentanone	-0.114	-0.160	0.072	0.042	0.156	0.122	0.002	0.133	0.256	-0.012	-0.063	0.252	0.206	0.157
	0.114	**0.026**	0.323	0.562	**0.031**	0.090	0.977	0.066	**0.000**	0.865	0.378	**0.000**	**0.004**	**0.027**
2-Heptanone	0.073	-0.015	-0.226	0.022	0.031	0.056	-0.001	0.137	-0.023	0.246	0.098	0.107	0.048	0.565
	0.311	0.836	**0.002**	0.761	0.671	0.439	0.986	0.057	0.747	**0.001**	0.169	0.135	0.502	**<.0001**
2-Nonanone	-0.068	-0.020	-0.070	0.033	0.000	0.043	-0.121	0.063	0.042	-0.092	-0.081	0.090	-0.010	0.037
	0.349	0.783	0.334	0.644	0.995	0.551	0.094	0.381	0.555	0.199	0.254	0.208	0.893	0.607
γ-octalactone	-0.091	0.040	0.065	0.098	0.134	0.061	-0.019	0.131	0.284	-0.090	-0.108	-0.052	0.046	-0.050
	0.207	0.580	0.371	0.175	0.064	0.398	0.792	0.069	**<.0001**	0.205	0.130	0.470	0.521	0.482
γ-nonalactone	-0.129	-0.052	0.087	0.047	0.154	0.067	0.005	0.061	0.240	-0.083	-0.071	-0.078	-0.016	-0.055
	0.075	0.477	0.232	0.516	**0.033**	0.357	0.948	0.399	**0.001**	0.247	0.318	0.272	0.824	0.441
p-cresol	-0.177	-0.025	0.348	-0.080	0.174	0.082	-0.014	0.038	-0.011	0.290	0.194	0.522	0.352	-0.179
	0.014	0.728	**<.0001**	0.268	**0.016**	0.259	0.851	0.605	0.882	**<.0001**	**0.006**	**<.0001**	**<.0001**	**0.012**

	Stringiness	Stickiness	Intensity of Lamb After taste	Soapy Aftertaste	Metallic After taste	Fatty Aftertaste	Dry Aftertaste	Astringent Aftertaste	Dimethyl sulfide	Dimethyl disulfide	Dimethyl trisulfide	2-methyl butanal	3-methyl butanal	Pentanal
Indole	-0.031	0.034	-0.045	-0.001	-0.098	0.002	-0.107	-0.026	0.233	-0.106	-0.055	-0.005	0.131	-0.136
	0.664	0.639	0.536	0.991	0.177	0.973	0.138	0.719	**0.001**	0.136	0.446	0.945	0.066	0.057
Skatole	-0.073	0.061	-0.018	-0.065	-0.127	-0.041	-0.020	-0.088	0.254	0.059	0.100	0.019	0.077	-0.069
	0.311	0.396	0.801	0.371	0.079	0.569	0.784	0.226	**0.000**	0.406	0.163	0.793	0.279	0.335
2-Methylpyrazine	-0.164	-0.105	0.188	-0.084	0.179	-0.004	-0.060	0.049	0.336	0.213	0.113	0.392	0.394	0.012
	0.022	0.147	**0.009**	0.245	**0.013**	0.953	0.407	0.499	**<.0001**	**0.003**	0.114	**<.0001**	**<.0001**	0.870
2,5-dimethyl pyrazine	-0.106	0.030	0.321	-0.111	0.211	0.058	0.109	0.128	0.048	0.201	0.161	0.525	0.388	-0.155
	0.142	0.684	**<.0001**	0.125	**0.003**	0.424	0.130	0.075	0.498	**0.005**	**0.023**	**<.0001**	**<.0001**	**0.029**
2,6-dimethyl pyrazine	-0.052	0.029	-0.109	-0.012	-0.195	-0.064	-0.051	-0.082	0.207	-0.039	-0.042	-0.017	0.095	-0.094
	0.477	0.688	0.130	0.869	**0.007**	0.376	0.481	0.258	**0.003**	0.581	0.556	0.807	0.183	0.189
2-ethyl-3,5-dimethyl pyrazine	-0.129	-0.001	0.357	-0.135	0.128	0.078	0.013	0.060	-0.072	0.251	0.177	0.637	0.436	-0.136
	0.074	0.985	**<.0001**	0.061	0.076	0.282	0.854	0.410	0.313	**0.000**	**0.013**	**<.0001**	**<.0001**	0.057
2-ethyl-3,6-dimethyl pyrazine	-0.030	0.120	0.323	-0.123	0.227	0.064	0.109	0.066	0.160	0.224	0.198	0.629	0.529	-0.074
	0.684	0.096	**<.0001**	0.088	**0.002**	0.374	0.132	0.359	**0.025**	**0.002**	**0.005**	**<.0001**	**<.0001**	0.300
2-pentylpyridine	0.090	0.114	0.010	0.045	-0.215	-0.007	-0.140	-0.180	0.079	-0.071	-0.017	-0.079	-0.009	-0.151
	0.215	0.114	0.889	0.534	**0.003**	0.925	0.052	**0.012**	0.266	0.319	0.815	0.270	0.904	**0.033**
Benzaldehyde	0.075	0.150	-0.043	-0.095	-0.007	-0.061	-0.007	-0.124	0.064	0.385	0.387	0.177	0.222	-0.130
	0.297	**0.038**	0.552	0.189	0.919	0.403	0.925	0.086	0.371	**<.0001**	**<.0001**	**0.013**	**0.002**	0.067
Phenylacetaldehyde	-0.152	-0.055	0.220	-0.090	0.026	-0.042	-0.045	0.022	-0.040	0.067	0.084	0.506	0.481	-0.305
	0.035	0.444	**0.002**	0.212	0.718	0.561	0.536	0.767	0.580	0.349	0.240	**<.0001**	**<.0001**	**<.0001**
Toluene	0.028	-0.049	0.021	-0.021	0.263	0.127	-0.044	0.090	-0.016	0.182	0.112	0.250	0.206	-0.011
	0.695	0.499	0.777	0.777	**0.000**	0.079	0.548	0.213	0.821	**0.010**	0.115	**0.000**	**0.004**	0.878
2-pentyl furan	0.211	0.115	-0.209	0.008	-0.093	-0.112	0.074	-0.024	-0.034	0.268	0.243	-0.046	-0.078	0.491
	0.003	0.112	**0.004**	0.914	0.201	0.121	0.308	0.745	0.632	**0.000**	**0.001**	0.522	0.274	**<.0001**
Tridecane	0.180	0.087	-0.064	-0.040	-0.079	0.010	-0.003	-0.030	-0.108	0.054	0.108	-0.048	-0.114	-0.025
	0.013	0.231	0.374	0.585	0.273	0.888	0.964	0.678	0.132	0.452	0.128	0.500	0.109	0.723
Tetradecane	0.062	0.065	-0.042	0.035	-0.057	0.132	-0.038	-0.110	0.013	-0.243	-0.118	-0.350	-0.294	-0.134
	0.394	0.369	0.562	0.626	0.431	0.068	0.595	0.129	0.860	**0.001**	0.099	**<.0001**	**<.0001**	0.060
Pentadecane	-0.034	-0.003	0.118	-0.001	0.133	0.182	0.011	0.022	0.188	-0.108	0.008	-0.038	-0.024	-0.132
	0.636	0.971	0.103	0.992	0.065	**0.011**	0.878	0.759	**0.008**	0.130	0.916	0.597	0.738	0.064

	Stringiness	Stickiness	Intensity of Lamb After taste	Soapy Aftertaste	Metallic After taste	Fatty Aftertaste	Dry Aftertaste	Astringent Aftertaste	Dimethyl sulfide	Dimethyl disulfide	Dimethyl trisulfide	2-methyl butanal	3-methyl butanal	Pentanal
Hexadecane	-0.120	-0.003	0.083	0.092	0.225	0.280	0.023	0.167	0.036	-0.280	-0.135	-0.112	-0.088	-0.064
	0.096	0.972	0.252	0.202	**0.002**	**<.0001**	0.749	**0.020**	0.613	**<.0001**	0.058	0.117	0.217	0.374
Heneicosane	-0.021	-0.033	0.158	0.066	0.161	0.184	0.102	0.108	0.201	-0.239	-0.126	0.052	0.056	-0.188
	0.775	0.648	**0.028**	0.364	**0.026**	**0.010**	0.158	0.135	**0.005**	**0.001**	0.077	0.469	0.432	**0.008**
4MOA (Muscle)	-0.120	-0.086	0.001	0.050	-0.020	-0.001	-0.002	0.050	0.105	-0.182	-0.207	0.005	0.037	-0.016
	0.096	0.236	0.993	0.491	0.786	0.989	0.982	0.487	0.141	**0.010**	**0.003**	0.941	0.604	0.821
4EOA (Muscle)	-0.051	0.038	-0.115	-0.084	-0.246	-0.084	-0.066	-0.105	0.224	-0.085	-0.038	-0.137	-0.019	-0.107
	0.478	0.598	0.113	0.246	**0.001**	0.243	0.359	0.147	**0.002**	0.233	0.591	0.055	0.794	0.132
4MNA (Muscle)	-0.008	0.053	-0.146	0.031	-0.324	-0.101	-0.051	-0.121	0.178	-0.054	0.012	-0.100	0.023	-0.100
	0.911	0.462	**0.043**	0.668	**<.0001**	0.161	0.479	0.095	**0.012**	0.450	0.862	0.160	0.746	0.161
4MOA (SC Fat)	0.049	-0.023	-0.149	0.105	-0.116	0.109	-0.026	0.033	-0.145	0.014	-0.011	-0.195	-0.237	0.078
	0.507	0.761	**0.045**	0.159	0.118	0.142	0.729	0.660	**0.047**	0.847	0.880	**0.007**	**0.001**	0.284
4EOA (SC Fat)	-0.011	-0.076	0.043	0.046	-0.054	-0.001	-0.062	-0.145	0.029	0.024	0.048	0.063	0.029	-0.016
	0.885	0.340	0.593	0.565	0.497	0.992	0.435	0.066	0.715	0.758	0.544	0.427	0.712	0.839
4MNA (SC Fat)	0.065	0.012	-0.126	0.112	-0.036	0.144	0.091	0.059	-0.067	-0.221	-0.052	-0.169	-0.166	-0.021
	0.400	0.871	0.099	0.144	0.637	0.060	0.233	0.441	0.374	**0.003**	0.489	**0.024**	**0.028**	0.783
Hexanoic Acid	-0.132	-0.152	-0.057	0.061	0.102	0.012	0.018	0.093	0.392	-0.016	0.001	0.113	0.227	-0.010
	0.067	**0.035**	0.429	0.403	0.156	0.873	0.799	0.199	**<.0001**	0.819	0.986	0.111	**0.001**	0.892
Nonanoic Acid	-0.281	-0.136	0.213	0.046	0.142	0.051	-0.161	-0.027	0.137	-0.152	-0.084	-0.050	0.041	-0.056
	<.0001	0.060	**0.003**	0.524	**0.049**	0.481	**0.025**	0.712	0.054	**0.032**	0.239	0.486	0.562	0.433
pHu	-0.030	-0.022	-0.058	0.066	0.124	0.147	-0.091	0.091	0.140	-0.111	-0.059	-0.038	-0.031	0.059
	0.675	0.761	0.421	0.365	0.087	**0.041**	0.210	0.207	0.050	0.118	0.411	0.598	0.663	0.407
IMF	-0.206	-0.099	0.004	0.011	-0.062	-0.046	-0.190	-0.037	0.064	0.088	0.051	0.013	0.013	0.116
	0.004	0.170	0.953	0.882	0.388	0.526	**0.008**	0.608	0.369	0.218	0.472	0.856	0.857	0.103
PUFA proportion	0.207	0.008	-0.187	0.032	0.144	-0.089	0.236	0.171	-0.086	-0.160	-0.165	-0.210	-0.211	0.160
	0.009	0.918	**0.019**	0.688	0.072	0.268	**0.003**	**0.032**	0.281	**0.043**	**0.036**	**0.008**	**0.007**	**0.042**
SFA proportion	-0.129	-0.037	0.159	0.119	-0.119	0.122	-0.180	-0.136	-0.076	0.145	0.073	0.095	0.052	-0.051
	0.108	0.645	**0.048**	0.140	0.137	0.130	**0.025**	0.090	0.340	0.068	0.360	0.233	0.515	0.521
PUFA/SFA ratio	0.206	0.010	-0.195	0.019	0.141	-0.097	0.234	0.173	-0.059	-0.168	-0.166	-0.223	-0.210	0.143
	0.010	0.905	**0.015**	0.814	0.077	0.225	**0.003**	**0.030**	0.455	**0.033**	**0.035**	**0.004**	**0.008**	0.070
PUFA mg/100 g muscle	-0.065	-0.072	-0.087	0.069	0.094	-0.029	-0.013	0.088	0.023	-0.045	-0.080	-0.101	-0.093	0.223
	0.416	0.371	0.278	0.387	0.239	0.719	0.872	0.274	0.775	0.575	0.313	0.200	0.240	**0.005**
SFA mg/100 g muscle	-0.215	-0.075	0.040	0.018	-0.036	0.032	-0.204	-0.036	0.064	0.065	0.042	0.073	0.045	0.060
	0.007	0.352	0.623	0.828	0.657	0.687	**0.010**	0.650	0.418	0.409	0.596	0.358	0.571	0.446

	2-Hexenal	Hexanal	Methional	2,4-heptadienal	4-Heptenal	Heptanal	2-Octenal	Octanal	2,6-nonadienal	2-nonenal	Nonanal	2,4-decadienal	2-decenal	Decanal	Undecanal
2-Hexenal	1.000														
Hexanal	0.457	1.000													
	<.0001														
Methional	0.055	-0.218	1.000												
	0.445	**0.002**													
2,4-heptadienal	0.363	0.269	0.058	1.000											
	<.0001	**0.000**	0.417												
4-Heptenal	0.535	0.456	-0.072	0.268	1.000										
	<.0001	**<.0001**	0.314	**0.000**											
Heptanal	0.545	0.591	-0.178	0.173	0.787	1.000									
	<.0001	**<.0001**	**0.012**	**0.015**	**<.0001**										
2-Octenal	0.550	0.515	-0.150	0.523	0.309	0.354	1.000								
	<.0001	**<.0001**	**0.035**	**<.0001**	**<.0001**	**<.0001**									
Octanal	0.092	0.393	-0.393	-0.002	0.449	0.633	0.217	1.000							
	0.199	**<.0001**	**<.0001**	0.980	**<.0001**	**<.0001**	**0.002**								
2,6-nonadienal	0.322	0.097	0.098	0.584	0.383	0.181	0.552	0.073	1.000						
	<.0001	0.173	0.169	**<.0001**	**<.0001**	**0.011**	**<.0001**	0.306							
2-nonenal	0.546	0.207	-0.116	0.406	0.576	0.660	0.604	0.356	0.562	1.000					
	<.0001	**0.004**	0.105	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**						
Nonanal	-0.187	0.054	-0.353	-0.058	0.131	0.289	0.079	0.766	0.090	0.219	1.000				
	0.008	0.447	**<.0001**	0.420	0.067	**<.0001**	0.271	**<.0001**	0.208	**0.002**					
2,4-decadienal	0.364	0.291	-0.188	0.543	0.065	0.094	0.811	0.060	0.589	0.478	0.068	1.000			
	<.0001	**<.0001**	**0.008**	**<.0001**	0.365	0.190	**<.0001**	0.404	**<.0001**	**<.0001**	0.339				
2-decenal	0.430	0.082	-0.149	0.367	0.430	0.481	0.578	0.360	0.527	0.871	0.259	0.544	1.000		
	<.0001	0.248	**0.036**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**0.000**	**<.0001**			
Decanal	-0.162	-0.033	-0.339	-0.107	0.072	0.176	-0.020	0.425	-0.039	0.119	0.503	0.045	0.221	1.000	
	0.023	0.641	**<.0001**	0.132	0.313	**0.013**	0.778	**<.0001**	0.589	0.096	**<.0001**	0.526	**0.002**		
Undecanal	-0.104	-0.108	-0.157	-0.067	-0.157	-0.074	0.024	0.038	-0.073	0.024	0.117	0.197	0.197	0.537	1.000
	0.146	0.130	**0.027**	0.350	**0.028**	0.298	0.741	0.597	0.309	0.734	0.100	**0.006**	**0.005**	**<.0001**	
Dodecanal	-0.109	-0.064	-0.339	0.079	-0.107	-0.074	0.200	0.129	0.101	0.138	0.242	0.375	0.325	0.434	0.590
	0.128	0.367	**<.0001**	0.269	0.134	0.298	**0.005**	0.070	0.158	0.053	**0.001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**
Tridecanal	-0.132	-0.032	-0.270	0.110	-0.238	-0.218	0.151	-0.109	0.134	0.033	0.016	0.365	0.112	0.145	0.365
	0.063	0.659	**0.000**	0.124	**0.001**	**0.002**	**0.034**	0.127	0.059	0.646	0.821	**<.0001**	0.118	**0.041**	**<.0001**
Tetradecanal	-0.243	-0.233	-0.280	0.044	-0.296	-0.309	0.033	-0.162	0.108	0.008	0.064	0.258	0.039	0.161	0.338
	0.001	**0.001**	**<.0001**	0.542	**<.0001**	**<.0001**	0.644	**0.022**	0.131	0.911	0.369	**0.000**	0.585	**0.023**	**<.0001**
Pentadecanal	-0.257	-0.274	-0.096	0.066	-0.402	-0.473	-0.053	-0.384	0.067	-0.136	-0.145	0.195	-0.098	-0.047	0.218
	0.000	**<.0001**	0.177	0.355	**<.0001**	**<.0001**	0.461	**<.0001**	0.346	0.057	**0.041**	**0.006**	0.169	0.509	**0.002**
Hexadecanal	-0.343	-0.300	-0.004	-0.013	-0.452	-0.564	-0.212	-0.524	-0.086	-0.342	-0.272	0.013	-0.284	-0.137	0.119
	<.0001	**<.0001**	0.959	0.853	**<.0001**	**<.0001**	**0.003**	**<.0001**	0.228	**<.0001**	**0.000**	0.861	**<.0001**	0.054	0.095
Pentanol	0.446	0.748	-0.022	0.311	0.399	0.423	0.448	0.215	0.134	0.168	-0.003	0.301	0.084	-0.034	-0.127

	2-Hexenal	Hexanal	Methional	2,4-heptadienal	4-Heptenal	Heptanal	2-Octenal	Octanal	2,6-nonadienal	2-nonenal	Nonanal	2,4-decadienal	2-decenal	Decanal	Undecanal
	<.0001	**<.0001**	0.756	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**0.002**	0.060	**0.018**	0.965	**<.0001**	0.237	0.633	0.076
1-Hexanol	0.518	0.714	-0.116	0.202	0.682	0.844	0.421	0.522	0.162	0.499	0.148	0.182	0.323	0.073	-0.097
	<.0001	**<.0001**	0.104	**0.004**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**0.023**	**<.0001**	**0.037**	**0.010**	**<.0001**	0.305	0.174
1-Heptanol	0.419	0.472	-0.149	0.265	0.633	0.751	0.450	0.591	0.300	0.604	0.277	0.289	0.598	0.237	0.053
	<.0001	**<.0001**	**0.036**	**0.000**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**0.001**	0.462
1-Octen-3-ol	0.200	0.718	-0.199	0.279	0.082	0.155	0.514	0.132	0.162	-0.001	0.020	0.484	-0.061	-0.012	-0.037
	0.005	**<.0001**	**0.005**	**<.0001**	0.253	**0.029**	**<.0001**	0.064	**0.023**	0.993	0.779	**<.0001**	0.390	0.866	0.601
2-Octen-1-ol	0.183	0.472	-0.103	0.397	0.111	0.162	0.576	0.190	0.413	0.214	0.162	0.605	0.195	0.068	0.002
	0.010	**<.0001**	0.148	**<.0001**	0.120	**0.022**	**<.0001**	**0.008**	**<.0001**	**0.002**	**0.022**	**<.0001**	**0.006**	0.338	0.975
2-Ethyl-1-hexanol	-0.002	0.203	-0.057	-0.223	-0.061	0.069	-0.126	-0.079	-0.309	-0.197	-0.179	-0.141	-0.198	0.178	0.210
	0.977	**0.004**	0.424	**0.002**	0.391	0.337	0.077	0.267	**<.0001**	**0.005**	**0.012**	**0.048**	**0.005**	**0.012**	**0.003**
1-Octanol	-0.041	0.140	-0.367	-0.016	0.258	0.436	0.168	0.810	0.118	0.336	0.832	0.153	0.409	0.542	0.199
	0.563	**0.049**	**<.0001**	0.818	**0.000**	**<.0001**	**0.018**	**<.0001**	0.099	**<.0001**	**<.0001**	**0.032**	**<.0001**	**<.0001**	**0.005**
α-terpineol	0.023	-0.010	-0.085	-0.329	-0.118	0.011	-0.274	-0.079	-0.472	-0.198	-0.181	-0.228	-0.118	0.293	0.464
	0.748	0.892	0.232	**<.0001**	0.098	0.873	**<.0001**	0.268	**<.0001**	**0.005**	**0.011**	**0.001**	0.099	**<.0001**	**<.0001**
1-Pentadecanol	-0.075	-0.117	-0.074	0.038	-0.020	-0.062	0.051	-0.032	0.092	0.108	-0.055	0.065	0.163	0.151	0.138
	0.291	0.101	0.300	0.595	0.777	0.386	0.472	0.654	0.195	0.130	0.445	0.365	**0.022**	**0.033**	0.052
2-Pentanone	0.003	0.152	0.019	-0.062	-0.012	0.083	-0.114	-0.028	-0.184	-0.146	-0.153	-0.096	-0.126	0.211	0.219
	0.968	**0.033**	0.788	0.382	0.872	0.245	0.109	0.699	**0.010**	**0.040**	**0.031**	0.177	0.078	**0.003**	**0.002**
2-Heptanone	0.310	0.768	-0.193	0.252	0.299	0.394	0.391	0.256	0.101	0.130	0.062	0.240	0.036	-0.011	-0.129
	<.0001	**<.0001**	**0.007**	**0.000**	**<.0001**	**<.0001**	**<.0001**	**0.000**	0.155	0.069	0.387	**0.001**	0.615	0.881	0.071
2-Nonanone	-0.021	0.176	-0.191	0.040	0.123	0.152	0.021	0.127	-0.007	0.106	0.148	0.021	0.064	0.241	0.096
	0.771	**0.013**	**0.007**	0.580	0.084	**0.033**	0.770	0.074	0.927	0.139	**0.038**	0.774	0.372	**0.001**	0.180
γ-octalactone	0.043	0.005	0.050	0.070	0.064	0.139	0.158	0.087	0.157	0.256	0.045	0.179	0.364	0.204	0.259
	0.549	0.948	0.487	0.327	0.371	0.051	**0.026**	0.223	**0.027**	**0.000**	0.530	**0.012**	**<.0001**	**0.004**	**0.000**
γ-nonalactone	0.070	-0.021	-0.023	0.036	0.000	0.030	0.033	0.049	0.040	0.130	0.017	0.097	0.279	0.165	0.386
	0.326	0.766	0.745	0.617	0.995	0.672	0.640	0.495	0.580	0.069	0.815	0.173	**<.0001**	**0.020**	**<.0001**
p-cresol	0.077	-0.252	0.288	-0.088	-0.164	-0.214	-0.203	-0.459	-0.098	-0.123	-0.480	-0.121	-0.081	-0.249	-0.064
	0.280	**0.000**	**<.0001**	0.215	**0.021**	**0.003**	**0.004**	**<.0001**	0.168	0.084	**<.0001**	0.088	0.258	**0.000**	0.368
Indole	-0.126	-0.010	0.025	0.053	0.022	0.070	0.043	0.053	0.168	0.145	0.038	0.065	0.160	0.298	0.173
	0.076	0.891	0.732	0.456	0.760	0.326	0.547	0.455	**0.018**	**0.042**	0.597	0.363	**0.024**	**<.0001**	**0.015**
Skatole	-0.041	-0.024	0.071	0.136	-0.015	-0.018	0.107	-0.070	0.173	0.161	-0.052	0.099	0.164	0.061	0.055
	0.567	0.734	0.320	0.057	0.833	0.799	0.134	0.325	**0.015**	**0.023**	0.464	0.165	**0.021**	0.392	0.439
2-Methylpyrazine	-0.045	-0.062	0.349	-0.062	-0.131	-0.141	-0.208	-0.307	-0.175	-0.210	-0.307	-0.218	-0.225	-0.099	-0.048
	0.529	0.389	**<.0001**	0.383	0.066	**0.048**	**0.003**	**<.0001**	**0.014**	**0.003**	**<.0001**	**0.002**	**0.001**	0.164	0.503
2,5-dimethyl pyrazine	-0.005	-0.289	0.425	-0.019	-0.181	-0.249	-0.244	-0.475	-0.124	-0.197	-0.495	-0.164	-0.168	-0.312	-0.084
	0.940	**<.0001**	**<.0001**	0.791	**0.011**	**0.000**	**0.001**	**<.0001**	0.081	**0.006**	**<.0001**	**0.021**	**0.018**	**<.0001**	0.239
2,6-dimethyl pyrazine	-0.075	-0.023	0.030	0.170	0.019	0.048	0.086	0.081	0.229	0.174	0.084	0.084	0.212	0.245	0.100
	0.297	0.750	0.678	**0.017**	0.791	0.504	0.227	0.257	**0.001**	**0.014**	0.238	0.240	**0.003**	**0.001**	0.161

	2-Hexenal	Hexanal	Methional	2,4-heptadienal	4-Heptenal	Heptanal	2-Octenal	Octanal	2,6-nonadienal	2-nonenal	Nonanal	2,4-decadienal	2-decenal	Decanal	Undecanal
2-ethyl-3,5-dimethyl pyrazine	-0.048	-0.248	0.312	-0.069	-0.119	-0.210	-0.237	-0.417	-0.066	-0.148	-0.427	-0.155	-0.135	-0.213	-0.108
	0.505	**0.000**	**<.0001**	0.333	0.094	**0.003**	**0.001**	**<.0001**	0.356	**0.037**	**<.0001**	**0.030**	0.058	**0.003**	0.131
2-ethyl-3,6-dimethyl pyrazine	-0.078	-0.138	0.359	-0.039	-0.154	-0.193	-0.249	-0.352	-0.144	-0.229	-0.373	-0.148	-0.201	-0.156	0.015
	0.274	0.053	**<.0001**	0.583	**0.031**	**0.006**	**0.000**	**<.0001**	**0.043**	**0.001**	**<.0001**	**0.038**	**0.005**	**0.028**	0.837
2-pentylpyridine	-0.129	-0.150	0.042	0.125	-0.034	-0.109	0.091	0.014	0.215	0.082	0.136	0.097	0.103	0.093	0.026
	0.069	**0.034**	0.561	0.079	0.631	0.127	0.201	0.847	**0.002**	0.249	0.056	0.173	0.147	0.191	0.711
Benzaldehyde	0.029	-0.130	0.300	-0.021	-0.227	-0.368	-0.164	-0.597	-0.073	-0.309	-0.614	-0.207	-0.417	-0.505	-0.336
	0.680	0.069	**<.0001**	0.769	**0.001**	**<.0001**	**0.021**	**<.0001**	0.307	**<.0001**	**<.0001**	**0.004**	**<.0001**	**<.0001**	**<.0001**
Phenylacetaldehyde	0.018	-0.391	0.563	-0.048	-0.016	-0.169	-0.167	-0.401	0.109	-0.019	-0.414	-0.176	-0.023	-0.242	-0.169
	0.798	**<.0001**	**<.0001**	0.498	0.828	**0.017**	**0.019**	**<.0001**	0.125	0.790	**<.0001**	**0.013**	0.744	**0.001**	**0.018**
Toluene	-0.009	0.009	0.189	-0.335	-0.200	-0.231	-0.334	-0.425	-0.496	-0.547	-0.523	-0.401	-0.598	-0.284	-0.141
	0.899	0.902	**0.008**	**<.0001**	**0.005**	**0.001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**0.048**
2-pentyl furan	0.329	0.625	-0.194	0.367	0.127	0.140	0.502	0.055	0.159	0.080	-0.050	0.425	-0.033	-0.212	-0.154
	<.0001	**<.0001**	**0.006**	**<.0001**	0.075	**0.049**	**<.0001**	0.439	**0.025**	0.263	0.481	**<.0001**	0.643	**0.003**	**0.031**
Tridecane	0.010	0.011	-0.011	0.079	-0.073	-0.147	0.014	-0.235	-0.021	-0.105	-0.162	0.107	-0.122	-0.106	-0.024
	0.893	0.881	0.874	0.270	0.304	**0.039**	0.850	**0.001**	0.768	0.140	**0.022**	0.133	0.088	0.136	0.733
Tetradecane	-0.077	0.007	-0.316	-0.049	-0.032	0.026	0.074	0.040	0.000	0.126	0.055	0.132	0.175	0.311	0.352
	0.281	0.921	**<.0001**	0.490	0.655	0.715	0.299	0.579	0.996	0.076	0.439	0.063	**0.014**	**<.0001**	**<.0001**
Pentadecane	0.022	-0.098	0.057	-0.099	-0.153	-0.136	-0.140	-0.367	-0.207	-0.119	-0.354	-0.037	-0.080	0.025	0.332
	0.756	0.170	0.425	0.164	**0.031**	0.056	**0.049**	**<.0001**	**0.003**	0.095	**<.0001**	0.609	0.262	0.725	**<.0001**
Hexadecane	0.127	-0.016	-0.112	-0.078	-0.003	0.088	-0.016	-0.116	-0.165	0.104	-0.242	0.032	0.131	0.259	0.358
	0.075	0.821	0.115	0.274	0.962	0.217	0.828	0.103	**0.020**	0.146	**0.001**	0.654	0.066	**0.000**	**<.0001**
Heneicosane	-0.174	-0.129	-0.078	-0.281	-0.229	-0.157	-0.232	-0.149	-0.232	-0.189	-0.134	-0.052	-0.108	0.226	0.373
	0.014	0.071	0.274	**<.0001**	**0.001**	**0.028**	**0.001**	**0.036**	**0.001**	**0.008**	0.060	0.466	0.129	**0.001**	**<.0001**
4MOA (Muscle)	-0.119	0.082	-0.051	-0.178	0.016	0.123	-0.079	0.126	-0.040	0.000	0.085	-0.069	0.012	0.265	0.094
	0.096	0.250	0.477	**0.012**	0.828	0.084	0.269	0.077	0.574	0.998	0.232	0.332	0.863	**0.000**	0.187
4EOA (Muscle)	-0.131	0.019	0.004	0.114	0.084	0.124	0.088	0.199	0.205	0.220	0.228	0.044	0.208	0.274	0.074
	0.065	0.788	0.953	0.109	0.242	0.083	0.219	**0.005**	**0.004**	**0.002**	**0.001**	0.540	**0.003**	**<.0001**	0.301
4MNA (Muscle)	-0.093	0.038	-0.034	0.154	0.107	0.133	0.136	0.174	0.280	0.261	0.199	0.111	0.233	0.286	0.056
	0.193	0.597	0.639	**0.030**	0.135	0.062	0.056	**0.014**	**<.0001**	**0.000**	**0.005**	0.121	**0.001**	**<.0001**	0.430
4MOA (SC Fat)	-0.116	0.073	-0.210	0.116	0.061	0.023	0.146	0.203	0.054	0.036	0.194	0.068	0.067	0.115	-0.036
	0.114	0.317	**0.004**	0.114	0.407	0.751	**0.045**	**0.005**	0.465	0.619	**0.008**	0.351	0.358	0.116	0.620
4EOA (SC Fat)	-0.157	-0.016	-0.158	-0.122	-0.058	0.018	-0.101	0.076	-0.089	-0.057	0.092	-0.050	0.003	0.243	0.099
	0.046	0.835	**0.044**	0.119	0.463	0.820	0.200	0.337	0.256	0.472	0.244	0.527	0.970	**0.002**	0.207
4MNA (SC Fat)	-0.096	0.085	-0.274	-0.011	-0.056	0.062	0.095	0.123	-0.093	-0.009	0.090	0.098	0.027	0.237	0.147
	0.205	0.263	**0.000**	0.882	0.461	0.412	0.208	0.102	0.220	0.910	0.235	0.194	0.725	**0.002**	0.051
Hexanoic Acid	0.135	0.039	0.130	-0.071	0.076	0.133	0.013	-0.024	-0.058	0.107	-0.141	-0.078	0.095	0.066	0.078
	0.058	0.585	0.067	0.323	0.287	0.063	0.856	0.735	0.414	0.134	**0.047**	0.278	0.181	0.358	0.275

	2-Hexenal	Hexanal	Methional	2,4-heptadienal	4-Heptenal	Heptanal	2-Octenal	Octanal	2,6-nonadienal	2-nonenal	Nonanal	2,4-decadienal	2-decenal	Decanal	Undecanal
Nonanoic Acid	0.014	-0.124	0.049	-0.086	-0.010	0.062	-0.128	-0.010	-0.021	0.113	0.014	-0.045	0.135	0.026	0.079
	0.843	0.081	0.496	0.226	0.892	0.387	0.072	0.884	0.769	0.112	0.846	0.532	0.059	0.711	0.271
pHu	-0.125	0.117	-0.170	0.060	0.018	0.068	0.031	0.232	-0.066	0.010	0.154	0.078	0.062	0.296	0.184
	0.078	0.101	**0.017**	0.400	0.802	0.344	0.666	**0.001**	0.355	0.885	**0.030**	0.277	0.386	**<.0001**	**0.009**
IMF	0.173	0.109	0.017	0.061	0.185	0.165	0.161	0.059	0.168	0.191	-0.004	0.109	0.162	0.006	-0.018
	0.015	0.126	0.813	0.394	**0.009**	**0.020**	**0.024**	0.406	**0.018**	**0.007**	0.961	0.125	**0.022**	0.928	0.804
PUFA proportion	0.056	0.237	-0.222	-0.013	-0.030	0.105	0.049	0.152	-0.210	-0.053	0.116	0.122	-0.058	0.233	0.210
	0.482	**0.002**	**0.005**	0.868	0.702	0.186	0.539	0.055	**0.007**	0.504	0.144	0.122	0.465	**0.003**	**0.007**
SFA proportion	0.069	-0.180	0.106	0.055	0.052	-0.082	-0.031	-0.167	0.212	0.130	-0.087	-0.050	0.134	-0.174	-0.086
	0.389	**0.022**	0.183	0.487	0.515	0.305	0.702	**0.035**	**0.007**	0.101	0.276	0.532	0.091	**0.027**	0.280
PUFA/SFA ratio	0.042	0.243	-0.214	-0.018	-0.027	0.110	0.056	0.165	-0.218	-0.066	0.121	0.123	-0.067	0.227	0.199
	0.596	**0.002**	**0.006**	0.825	0.730	0.167	0.478	**0.037**	**0.006**	0.408	0.127	0.120	0.398	**0.004**	**0.012**
PUFA mg/100 g muscle	0.200	0.284	-0.176	0.011	0.136	0.206	0.187	0.135	-0.004	0.121	0.019	0.186	0.110	0.113	0.078
	0.011	**0.000**	**0.026**	0.886	0.086	**0.009**	**0.018**	0.088	0.964	0.125	0.809	**0.018**	0.167	0.155	0.326
SFA mg/100 g muscle	0.152	0.065	0.012	0.033	0.129	0.100	0.149	-0.004	0.159	0.152	-0.065	0.097	0.138	-0.058	-0.052
	0.054	0.413	0.879	0.679	0.103	0.206	0.060	0.962	**0.044**	0.055	0.413	0.221	0.080	0.467	0.512

	Dodecanal	Tridecanal	Tetradecanal	Pentadecanal	Hexadecanal	Pentanol	1-Hexanol	1-Heptanol	1-Octen-3-ol	2-Octen-1-ol	2-Ethyl-1-hexanol	1-Octanol	α-terpineol	1-Pentadecanol	2-Pentanone
Dodecanal	1.000														
Tridecanal	0.570	1.000													
	<.0001														
Tetradecanal	0.583	0.793	1.000												
	<.0001	**<.0001**													
Pentadecanal	0.374	0.746	0.890	1.000											
	<.0001	**<.0001**	**<.0001**												
Hexadecanal	0.192	0.549	0.638	0.833	1.000										
	0.007	**<.0001**	**<.0001**	**<.0001**											
Pentanol	-0.106	-0.088	-0.232	-0.248	-0.251	1.000									
	0.139	0.220	**0.001**	**0.000**	**0.000**										
1-Hexanol	-0.154	-0.181	-0.304	-0.435	-0.529	0.587	1.000								
	0.030	**0.011**	**<.0001**	**<.0001**	**<.0001**	**<.0001**									
1-Heptanol	0.095	-0.151	-0.257	-0.413	-0.549	0.372	0.746	1.000							
	0.182	**0.034**	**0.000**	**<.0001**	**<.0001**	**<.0001**	**<.0001**								
1-Octen-3-ol	0.076	0.121	-0.001	-0.031	-0.070	0.563	0.393	0.239	1.000						
	0.288	0.088	0.987	0.661	0.324	**<.0001**	**<.0001**	**0.001**							

	Dodecanal	Tridecanal	Tetradecanal	Pentadecanal	Hexadecanal	Pentanol	1-Hexanol	1-Heptanol	1-Octen-3-ol	2-Octen-1-ol	2-Ethyl-1-hexanol	1-Octanol	α-terpineol	1-Pentadecanol	2-Pentanone
2-Octen-1-ol	0.189	0.254	0.224	0.136	0.012	0.418	0.336	0.300	0.717	1.000					
	0.008	**0.000**	**0.002**	0.055	0.868	**<.0001**	**<.0001**	**<.0001**	**<.0001**						
2-Ethyl-1-hexanol	-0.010	-0.020	-0.127	-0.114	-0.088	0.161	0.161	0.087	0.170	-0.017	1.000				
	0.892	0.784	0.076	0.109	0.220	**0.024**	**0.024**	0.224	**0.017**	0.815					
1-Octanol	0.294	0.011	0.012	-0.236	-0.409	0.053	0.388	0.568	0.080	0.265	-0.034	1.000			
	<.0001	0.874	0.862	**0.001**	**<.0001**	0.456	**<.0001**	**<.0001**	0.263	**0.000**	0.635				
α-terpineol	0.152	-0.018	-0.045	-0.059	-0.021	0.006	0.000	-0.022	-0.125	-0.311	0.625	-0.023	1.000		
	0.033	0.798	0.528	0.408	0.767	0.932	1.000	0.760	0.080	**<.0001**	**<.0001**	0.744			
1-Pentadecanol	0.211	0.141	0.138	0.150	0.041	-0.087	-0.091	0.049	-0.111	-0.019	0.252	0.089	0.248	1.000	
	0.003	**0.048**	0.053	**0.035**	0.567	0.224	0.203	0.492	0.119	0.794	**0.000**	0.212	**0.000**		
2-Pentanone	0.004	-0.032	-0.138	-0.122	-0.074	0.195	0.123	0.010	0.038	-0.035	0.381	-0.036	0.479	0.089	1.000
	0.951	0.657	0.052	0.088	0.302	**0.006**	0.084	0.889	0.598	0.628	**<.0001**	0.610	**<.0001**	0.214	
2-Heptanone	-0.008	-0.063	-0.133	-0.199	-0.199	0.627	0.520	0.311	0.726	0.569	0.147	0.095	-0.087	-0.154	0.162
	0.910	0.379	0.062	**0.005**	**0.005**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**0.038**	0.182	0.221	**0.031**	**0.022**
2-Nonanone	0.157	0.041	0.116	-0.034	-0.018	0.222	0.185	0.157	0.198	0.209	0.210	0.151	0.175	0.034	0.171
	0.027	0.570	0.104	0.636	0.796	**0.002**	**0.009**	**0.027**	**0.005**	**0.003**	**0.003**	**0.034**	**0.014**	0.630	**0.016**
γ-octalactone	0.180	0.095	0.018	-0.026	-0.097	0.110	0.192	0.324	-0.046	0.124	0.181	0.241	0.269	0.319	0.239
	0.011	0.181	0.801	0.712	0.174	0.122	**0.007**	**<.0001**	0.521	0.083	**0.011**	**0.001**	**0.000**	**<.0001**	**0.001**
γ-nonalactone	0.323	0.162	0.104	0.080	0.011	0.056	0.002	0.135	-0.068	-0.004	0.211	0.153	0.389	0.306	0.278
	<.0001	**0.022**	0.144	0.262	0.881	0.430	0.975	0.057	0.341	0.958	**0.003**	**0.032**	**<.0001**	**<.0001**	**<.0001**
p-cresol	-0.244	-0.283	-0.282	-0.199	-0.063	-0.088	-0.184	-0.176	-0.207	-0.181	0.092	-0.404	0.161	-0.117	0.147
	0.001	**<.0001**	**<.0001**	**0.005**	0.381	0.220	**0.009**	**0.013**	**0.004**	**0.011**	0.199	**<.0001**	**0.023**	0.102	**0.039**
Indole	0.156	0.072	0.128	0.102	-0.003	-0.061	0.081	0.210	0.022	0.167	0.295	0.189	0.170	0.402	0.247
	0.028	0.316	0.073	0.153	0.968	0.391	0.254	**0.003**	0.763	**0.019**	**<.0001**	**0.008**	**0.017**	**<.0001**	**0.000**
Skatole	0.059	0.058	0.122	0.135	0.045	-0.004	0.048	0.130	0.037	0.197	0.188	0.067	0.097	0.329	0.165
	0.412	0.421	0.087	0.058	0.527	0.951	0.500	0.068	0.609	**0.005**	**0.008**	0.352	0.175	**<.0001**	**0.020**
2-Methylpyrazine	-0.306	-0.177	-0.247	-0.123	-0.037	0.044	-0.045	-0.203	-0.103	-0.184	0.148	-0.288	0.249	0.068	0.337
	<.0001	**0.013**	**0.001**	0.085	0.601	0.537	0.528	**0.004**	0.147	**0.009**	**0.037**	**<.0001**	**0.000**	0.344	**<.0001**
2,5-dimethyl pyrazine	-0.348	-0.322	-0.350	-0.218	-0.053	-0.151	-0.220	-0.224	-0.245	-0.255	0.039	-0.449	0.095	-0.131	0.129
	<.0001	**<.0001**	**<.0001**	**0.002**	0.455	**0.033**	**0.002**	**0.002**	**0.001**	**0.000**	0.587	**<.0001**	0.183	0.066	0.071
2,6-dimethyl pyrazine	0.146	0.086	0.069	0.024	-0.069	-0.003	0.061	0.196	0.016	0.196	0.196	0.194	0.056	0.398	0.186
	0.040	0.228	0.334	0.738	0.336	0.967	0.397	**0.006**	0.819	**0.006**	**0.006**	**0.006**	0.435	**<.0001**	**0.009**

	Dodecanal	Tridecanal	Tetradecanal	Pentadecanal	Hexadecanal	Pentanol	1-Hexanol	1-Heptanol	1-Octen-3-ol	2-Octen-1-ol	2-Ethyl-1-hexanol	1-Octanol	α-terpineol	1-Pentadecanol	2-Pentanone
2-ethyl-3,5-dimethyl pyrazine	-0.279	-0.335	-0.319	-0.246	-0.104	-0.145	-0.181	-0.174	-0.169	-0.180	0.004	-0.386	0.037	-0.158	0.122
	<.0001	**<.0001**	**<.0001**	**0.001**	0.146	**0.041**	**0.011**	**0.014**	**0.017**	**0.011**	0.952	**<.0001**	0.609	**0.026**	0.088
2-ethyl-3,6-dimethyl pyrazine	-0.299	-0.241	-0.262	-0.134	-0.032	-0.025	-0.097	-0.158	-0.128	-0.139	0.135	-0.334	0.212	-0.002	0.359
	<.0001	**0.001**	**0.000**	0.059	0.659	0.726	0.174	**0.026**	0.072	0.051	0.058	**<.0001**	**0.003**	0.982	**<.0001**
2-pentylpyridine	0.144	0.144	0.230	0.182	0.131	-0.023	-0.089	-0.024	-0.089	0.155	-0.001	0.077	-0.093	0.163	-0.038
	0.043	**0.043**	**0.001**	**0.010**	0.065	0.743	0.214	0.739	0.211	**0.029**	0.991	0.281	0.191	**0.022**	0.595
Benzaldehyde	-0.375	-0.174	-0.152	0.049	0.137	-0.154	-0.290	-0.370	0.043	-0.147	0.021	-0.637	-0.091	-0.076	-0.148
	<.0001	**0.014**	**0.033**	0.497	0.054	**0.031**	**<.0001**	**<.0001**	0.544	**0.039**	0.771	**<.0001**	0.202	0.290	**0.037**
Phenylacetaldehyde	-0.289	-0.376	-0.304	-0.223	-0.131	-0.223	-0.181	-0.046	-0.317	-0.225	-0.062	-0.329	-0.046	0.048	-0.067
	<.0001	**<.0001**	**<.0001**	**0.002**	0.066	**0.002**	**0.011**	0.522	**<.0001**	**0.001**	0.386	**<.0001**	0.521	0.499	0.347
Toluene	-0.337	-0.287	-0.290	-0.132	0.084	-0.031	-0.130	-0.284	0.067	-0.257	0.241	-0.506	0.263	-0.205	0.096
	<.0001	**<.0001**	**<.0001**	0.064	0.240	0.664	0.067	**<.0001**	0.350	**0.000**	**0.001**	**<.0001**	**0.000**	**0.004**	0.176
2-pentyl furan	-0.015	0.105	0.009	0.052	0.053	0.554	0.254	0.085	0.674	0.466	-0.050	-0.104	-0.223	-0.154	-0.036
	0.836	0.142	0.896	0.467	0.456	**<.0001**	**0.000**	0.235	**<.0001**	**<.0001**	0.481	0.147	**0.002**	**0.031**	0.615
Tridecane	0.137	0.199	0.163	0.198	0.369	0.038	-0.140	-0.158	0.118	0.010	-0.115	-0.273	-0.077	-0.313	-0.038
	0.055	**0.005**	**0.022**	**0.005**	**<.0001**	0.595	**0.049**	**0.027**	0.098	0.888	0.108	**<.0001**	0.279	**<.0001**	0.591
Tetradecane	0.524	0.346	0.370	0.274	0.200	-0.048	-0.080	0.068	-0.003	-0.003	0.102	0.090	0.285	0.275	0.135
	<.0001	**<.0001**	**<.0001**	**<.0001**	**0.005**	0.500	0.263	0.344	0.966	0.969	0.154	0.209	**<.0001**	**<.0001**	0.058
Pentadecane	0.275	0.293	0.269	0.317	0.374	-0.049	-0.156	-0.128	-0.128	-0.181	0.290	-0.258	0.501	0.146	0.242
	<.0001	**<.0001**	**0.000**	**<.0001**	**<.0001**	0.492	**0.029**	0.072	0.072	**0.011**	**<.0001**	**0.000**	**<.0001**	**0.040**	**0.001**
Hexadecane	0.293	0.181	0.170	0.125	0.056	-0.008	0.044	0.136	-0.150	-0.150	0.383	-0.009	0.643	0.426	0.330
	<.0001	**0.011**	**0.017**	0.079	0.436	0.909	0.542	0.055	**0.035**	**0.035**	**<.0001**	0.900	**<.0001**	**<.0001**	**<.0001**
Heneicosane	0.205	0.188	0.174	0.169	0.165	-0.074	-0.123	-0.088	-0.148	-0.212	0.451	0.001	0.629	0.270	0.397
	0.004	**0.008**	**0.014**	**0.018**	**0.020**	0.301	0.084	0.219	**0.038**	**0.003**	**<.0001**	0.993	**<.0001**	**0.000**	**<.0001**
4MOA (Muscle)	0.052	0.007	0.020	-0.076	-0.101	0.054	0.080	0.113	0.033	0.025	0.169	0.133	0.213	-0.017	0.137
	0.469	0.918	0.781	0.288	0.155	0.453	0.264	0.112	0.647	0.724	**0.018**	0.061	**0.003**	0.810	0.054
4EOA (Muscle)	0.164	0.091	0.142	0.096	-0.003	-0.059	0.060	0.193	0.020	0.199	0.160	0.271	0.015	0.315	0.126
	0.021	0.203	**0.046**	0.180	0.971	0.405	0.398	**0.006**	0.776	**0.005**	**0.025**	**0.000**	0.829	**<.0001**	0.076
4MNA (Muscle)	0.182	0.115	0.171	0.108	-0.017	0.007	0.127	0.271	0.084	0.287	0.195	0.298	0.012	0.365	0.167
	0.010	0.107	**0.016**	0.130	0.815	0.922	0.074	**0.000**	0.241	**<.000**	**0.006**	**<.000**	0.870	**<.0001**	**0.019**

	Dodecanal	Tridecanal	Tetradecanal	Pentadecanal	Hexadecanal	Pentanol	1-Hexanol	1-Heptanol	1-Octen-3-ol	2-Octen-1-ol	2-Ethyl-1-hexanol	1-Octanol	α-terpineol	1-Pentadecanol	2-Pentanone
										1		1			
4MOA (SC Fat)	0.168	0.169	0.186	0.091	0.024	-0.028	0.071	0.176	0.129	0.221	-0.066	0.260	-0.229	0.119	-0.160
	0.021	**0.021**	**0.010**	0.213	0.748	0.702	0.335	**0.016**	0.077	**0.002**	0.366	**0.000**	**0.002**	0.103	**0.029**
4EOA (SC Fat)	0.103	0.080	0.065	0.008	-0.030	-0.040	-0.058	0.047	0.006	-0.061	0.031	0.067	0.008	0.035	0.047
	0.192	0.308	0.406	0.924	0.700	0.611	0.463	0.552	0.942	0.441	0.693	0.392	0.921	0.659	0.552
4MNA (SC Fat)	0.189	0.152	0.168	0.081	0.006	-0.024	0.026	0.118	0.110	0.119	0.243	0.163	0.129	0.240	-0.007
	0.012	**0.043**	**0.025**	0.285	0.933	0.748	0.731	0.119	0.143	0.116	**0.001**	**0.031**	0.086	**0.001**	0.930
Hexanoic Acid	-0.095	-0.017	-0.102	-0.041	-0.067	0.108	0.085	0.123	-0.148	-0.110	0.335	-0.006	0.431	0.223	0.308
	0.182	0.817	0.154	0.567	0.351	0.131	0.234	0.085	**0.038**	0.124	**<.0001**	0.933	**<.0001**	**0.002**	**<.0001**
Nonanoic Acid	0.044	0.037	0.053	0.050	0.045	-0.105	-0.015	-0.001	-0.292	-0.169	0.166	0.080	0.322	0.193	0.199
	0.537	0.608	0.461	0.487	0.528	0.140	0.832	0.990	**<.0001**	**0.018**	**0.020**	0.260	**<.0001**	**0.007**	**0.005**
pHu	0.227	0.088	0.065	-0.030	-0.153	0.120	0.048	0.148	0.082	0.058	0.288	0.279	0.276	0.392	0.208
	0.001	0.217	0.362	0.674	**0.031**	0.091	0.499	**0.037**	0.253	0.420	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**0.003**
IMF	0.021	-0.034	-0.097	-0.124	-0.163	0.139	0.120	0.098	0.015	0.098	-0.033	0.015	-0.019	-0.033	0.043
	0.765	0.635	0.174	0.082	**0.022**	0.051	0.093	0.171	0.830	0.168	0.647	0.834	0.789	0.646	0.549
PUFA proportion	0.262	0.231	0.227	0.161	0.114	0.138	0.184	0.092	0.313	0.194	0.073	0.154	0.129	-0.147	0.059
	0.001	**0.003**	**0.004**	**0.041**	0.150	0.081	**0.019**	0.248	**<.0001**	**0.014**	0.355	0.052	0.102	0.063	0.461
SFA proportion	-0.001	-0.049	0.008	-0.038	-0.040	-0.169	-0.075	-0.077	-0.217	-0.093	-0.161	-0.129	-0.154	-0.019	-0.176
	0.987	0.542	0.920	0.630	0.618	**0.033**	0.348	0.331	**0.006**	0.244	**0.042**	0.104	0.052	0.807	**0.026**
PUFA/SFA ratio	0.244	0.222	0.209	0.154	0.108	0.153	0.179	0.101	0.322	0.195	0.079	0.163	0.123	-0.118	0.061
	0.002	**0.005**	**0.008**	0.051	0.174	0.053	**0.023**	0.203	**<.0001**	**0.013**	0.316	**0.038**	0.120	0.135	0.439
PUFA mg/100 g muscle	0.128	0.086	-0.009	-0.034	-0.046	0.244	0.216	0.166	0.205	0.173	0.058	0.079	0.092	-0.105	0.076
	0.105	0.276	0.915	0.669	0.559	**0.002**	**0.006**	**0.036**	**0.009**	**0.028**	0.462	0.321	0.245	0.185	0.341
SFA mg/100 g muscle	-0.020	-0.079	-0.127	-0.110	-0.112	0.092	0.053	0.054	-0.026	0.038	0.013	-0.051	0.000	0.001	-0.014
	0.804	0.317	0.107	0.163	0.157	0.244	0.506	0.493	0.739	0.632	0.869	0.518	0.999	0.987	0.857

	2-Heptanone	2-Nonanone	γ-octa lactone	γ-nona lactone	p-cresol	Indole	Skatole	2-Methyl pyrazine	2,5-dimethyl pyrazine	2,6-dimethyl pyrazine	2-ethyl-3,5-dimethyl pyrazine	2-ethyl-3,6-dimethyl pyrazine	2-pentylpyridine	Benzaldehyde	Phenylacetaldehyde
2-Heptanone	1.000														
2-Nonanone	0.489	1.000													

	2-Heptanone	2-Nonanone	γ-octalactone	γ-nonalactone	p-cresol	Indole	Skatole	2-Methylpyrazine	2,5-dimethylpyrazine	2,6-dimethylpyrazine	2-ethyl-3,5-dimethylpyrazine	2-ethyl-3,6-dimethylpyrazine	2-pentylpyridine	Benzaldehyde	Phenylacetaldehyde
	<.0001														
γ-octalactone	-0.034	0.153	1.000												
	0.632	**0.031**													
γ-nonalactone	-0.029	0.048	0.474	1.000											
	0.683	0.501	**<.0001**												
p-cresol	-0.026	0.119	0.065	0.012	1.000										
	0.711	0.095	0.360	0.870											
Indole	0.031	0.261	0.498	0.258	-0.048	1.000									
	0.663	**0.000**	**<.0001**	**0.000**	0.503										
Skatole	-0.012	0.140	0.400	0.177	0.008	0.625	1.000								
	0.868	**0.049**	**<.0001**	**0.013**	0.911	**<.0001**									
2-Methylpyrazine	-0.034	0.001	0.158	0.099	0.381	0.133	0.107	1.000							
	0.631	0.985	**0.026**	0.165	**<.0001**	0.063	0.133								
2,5-dimethyl pyrazine	-0.125	-0.046	-0.006	-0.066	0.717	-0.117	-0.056	0.488	1.000						
	0.081	0.516	0.935	0.353	**<.0001**	0.102	0.432	**<.0001**							
2,6-dimethyl pyrazine	0.017	0.189	0.443	0.268	-0.069	0.661	0.552	0.148	-0.090	1.000					
	0.808	**0.008**	**<.0001**	**0.000**	0.333	**<.0001**	**<.0001**	**0.038**	0.205						
2-ethyl-3,5-dimethyl pyrazine	0.002	0.112	-0.078	-0.122	0.835	-0.092	-0.070	0.391	0.789	-0.112	1.000				
	0.977	0.117	0.276	0.087	**<.0001**	0.199	0.327	**<.0001**	**<.0001**	0.116					
2-ethyl-3,6-dimethyl pyrazine	0.041	0.115	0.129	0.070	0.622	0.065	0.019	0.518	0.690	-0.028	0.695	1.000			
	0.569	0.106	0.071	0.324	**<.0001**	0.363	0.795	**<.0001**	**<.0001**	0.696	**<.0001**				
2-pentylpyridine	-0.069	0.268	0.112	0.003	-0.143	0.230	0.168	-0.099	-0.207	0.252	-0.154	-0.068	1.000		
	0.333	**0.000**	0.115	0.963	**0.045**	**0.001**	**0.018**	0.167	**0.004**	**0.000**	**0.030**	0.345			
Benzaldehyde	-0.138	-0.329	-0.178	-0.188	0.219	-0.077	0.069	0.165	0.243	-0.102	0.153	0.078	-0.175	1.000	
	0.052	**<.0001**	**0.012**	**0.008**	**0.002**	0.283	0.337	**0.020**	**0.001**	0.153	**0.031**	0.277	**0.014**		
Phenylacetaldehyde	-0.337	-0.127	-0.003	-0.124	0.484	0.083	0.093	0.207	0.445	0.075	0.525	0.283	0.015	0.318	1.000
	<.0001	0.075	0.963	0.082	**<.0001**	0.245	0.195	**0.004**	**<.0001**	0.297	**<.0001**	**<.0001**	0.839	**<.0001**	
Toluene	0.000	-0.120	-0.259	-0.245	0.320	-0.230	-0.198	0.235	0.287	-0.339	0.249	0.188	-0.243	0.573	0.248
	0.995	0.091	**0.000**	**0.001**	**<.0001**	**0.001**	**0.005**	**0.001**	**<.0001**	**<.0001**	**0.000**	**0.008**	**0.001**	**<.0001**	**0.000**
2-pentyl furan	0.602	0.129	-0.171	-0.086	-0.169	-0.227	-0.122	-0.181	-0.229	-0.161	-0.190	-0.149	-0.047	0.101	-0.353
	<.0001	0.070	**0.016**	0.228	**0.018**	**0.001**	0.087	**0.011**	**0.001**	**0.024**	**0.007**	**0.037**	0.513	0.157	**<.0001**
Tridecane	0.107	0.198	-0.218	-0.201	-0.046	-0.191	-0.217	-0.106	-0.050	-0.310	-0.018	-0.110	0.045	0.106	-0.004

	2-Heptanone	2-Nonanone	γ-octalactone	γ-nonalactone	p-cresol	Indole	Skatole	2-Methylpyrazine	2,5-dimethylpyrazine	2,6-dimethylpyrazine	2-ethyl-3,5-dimethylpyrazine	2-ethyl-3,6-dimethylpyrazine	2-pentylpyridine	Benzaldehyde	Phenylacetaldehyde
	0.134	**0.005**	**0.002**	**0.004**	0.521	**0.007**	**0.002**	0.137	0.481	**<.0001**	0.796	0.122	0.534	0.135	0.956
Tetradecane	-0.001	0.251	0.167	0.241	-0.251	0.289	0.147	-0.159	-0.293	0.156	-0.266	-0.193	0.204	-0.146	-0.164
	0.994	**0.000**	**0.019**	**0.001**	**0.000**	**<.0001**	**0.039**	**0.025**	**<.0001**	**0.028**	**0.000**	**0.006**	**0.004**	**0.040**	**0.021**
Pentadecane	-0.135	0.086	0.159	0.222	0.104	0.072	0.123	0.080	0.018	0.013	-0.094	0.023	-0.033	0.114	0.007
	0.058	0.227	**0.025**	**0.002**	0.145	0.316	0.083	0.261	0.799	0.861	0.190	0.746	0.643	0.110	0.926
Hexadecane	-0.153	0.153	0.358	0.324	0.053	0.271	0.198	0.149	0.008	0.216	-0.066	0.075	0.050	-0.098	0.048
	0.031	**0.031**	**<.0001**	**<.0001**	0.457	**0.000**	**0.005**	**0.036**	0.914	**0.002**	0.358	0.295	0.481	0.171	0.501
Heneicosane	-0.196	0.098	0.237	0.322	0.121	0.127	0.133	0.104	0.032	0.063	0.008	0.176	0.038	-0.092	-0.037
	0.006	0.169	**0.001**	**<.0001**	0.089	0.076	0.062	0.144	0.653	0.378	0.915	**0.013**	0.598	0.196	0.609
4MOA (Muscle)	0.032	0.209	0.169	0.073	0.076	0.242	0.115	0.102	-0.005	0.229	0.034	0.007	-0.045	-0.091	0.064
	0.657	**0.003**	**0.017**	0.309	0.285	**0.001**	0.108	0.152	0.945	**0.001**	0.632	0.917	0.527	0.202	0.372
4EOA (Muscle)	0.047	0.247	0.341	0.199	-0.209	0.703	0.653	0.021	-0.263	0.673	-0.241	-0.104	0.298	-0.104	-0.025
	0.515	**0.000**	**<.0001**	**0.005**	**0.003**	**<.0001**	**<.0001**	0.766	**0.000**	**<.0001**	**0.001**	0.144	**<.0001**	0.144	0.725
4MNA (Muscle)	0.105	0.348	0.404	0.195	-0.186	0.776	0.665	0.016	-0.283	0.764	-0.217	-0.084	0.357	-0.133	-0.001
	0.141	**<.0001**	**<.0001**	**0.006**	**0.009**	**<.0001**	**<.0001**	0.824	**<.0001**	**<.0001**	**0.002**	0.238	**<.0001**	0.061	0.988
4MOA (SC Fat)	0.095	0.041	0.009	-0.119	-0.172	0.075	0.068	-0.185	-0.220	0.076	-0.141	-0.222	0.175	-0.112	-0.132
	0.196	0.577	0.901	0.105	**0.018**	0.304	0.355	**0.011**	**0.003**	0.303	0.053	**0.002**	**0.016**	0.127	0.072
4EOA (SC Fat)	0.037	0.141	0.057	0.053	0.147	0.025	0.028	0.047	0.084	0.060	0.166	0.102	0.017	-0.167	-0.034
	0.643	0.073	0.474	0.500	0.060	0.749	0.723	0.554	0.285	0.449	**0.034**	0.193	0.833	**0.033**	0.666
4MNA (SC Fat)	0.031	0.122	0.022	0.006	-0.060	0.153	0.029	-0.028	-0.074	0.108	-0.057	-0.073	0.040	-0.114	-0.123
	0.685	0.106	0.767	0.941	0.429	**0.043**	0.698	0.711	0.331	0.151	0.455	0.336	0.600	0.131	0.102
Hexanoic Acid	-0.093	0.015	0.433	0.398	0.100	0.296	0.331	0.293	0.108	0.143	-0.011	0.187	-0.098	0.014	0.068
	0.190	0.834	**<.0001**	**<.0001**	0.159	**<.0001**	**<.0001**	**<.0001**	0.129	**0.044**	0.876	**0.008**	0.170	0.841	0.344
Nonanoic Acid	-0.207	0.022	0.300	0.453	0.062	0.164	0.183	0.208	-0.014	0.182	-0.080	0.105	0.031	-0.164	-0.022
	0.003	0.758	**<.0001**	**<.0001**	0.386	**0.021**	**0.010**	**0.003**	0.844	**0.010**	0.263	0.141	0.665	**0.021**	0.762
pHu	0.046	0.103	0.232	0.228	-0.112	0.354	0.196	0.065	-0.107	0.242	-0.100	0.025	0.074	-0.201	-0.128
	0.519	0.147	**0.001**	**0.001**	0.115	**<.0001**	**0.006**	0.365	0.132	**0.001**	0.159	0.727	0.302	**0.005**	0.073
IMF	0.107	-0.008	0.017	0.053	0.130	-0.054	0.073	0.093	0.033	-0.025	0.088	0.018	-0.018	-0.032	0.060
	0.133	0.906	0.809	0.459	0.069	0.450	0.310	0.191	0.644	0.728	0.216	0.803	0.798	0.655	0.402
PUFA proportion	0.226	0.036	-0.001	-0.058	-0.247	-0.109	-0.179	-0.048	-0.211	-0.154	-0.229	-0.139	-0.198	-0.167	-0.400
	0.004	0.648	0.988	0.464	**0.002**	0.168	**0.023**	0.544	**0.007**	0.052	**0.004**	0.079	**0.012**	**0.034**	**<.0001**
SFA proportion	0.019	0.205	-0.008	0.029	0.198	-0.026	0.113	-0.028	0.154	0.058	0.151	0.014	0.214	0.035	0.157
	0.808	**0.009**	0.918	0.715	**0.012**	0.744	0.156	0.726	0.052	0.466	0.057	0.862	**0.007**	0.665	**0.047**
PUFA/SFA ratio	0.196	-0.015	-0.002	-0.053	-0.269	-0.095	-0.189	-0.032	-0.214	-0.142	-0.239	-0.136	-0.211	-0.156	-0.390

	2-Heptanone	2-Nonanone	γ-octa lactone	γ-nona lactone	p-cresol	Indole	Skatole	2-Methyl pyrazine	2,5-dimethyl pyrazine	2,6-dimethyl pyrazine	2-ethyl-3,5-dimethyl pyrazine	2-ethyl-3,6-dimethyl pyrazine	2-pentylpyridine	Benzaldehyde	Phenylacetaldehyde
	0.013	0.850	0.983	0.506	**0.001**	0.230	**0.016**	0.689	**0.006**	0.073	**0.002**	0.086	**0.007**	**0.049**	**<.0001**
PUFA mg/100 g muscle	0.219	0.003	0.019	0.031	-0.017	-0.162	-0.040	0.018	-0.112	-0.106	-0.081	-0.097	-0.108	-0.154	-0.158
	0.005	0.968	0.810	0.693	0.835	**0.040**	0.616	0.820	0.156	0.180	0.305	0.220	0.173	0.052	**0.045**
SFA mg/100 g muscle	0.051	-0.003	-0.023	0.031	0.178	-0.080	0.104	0.067	0.064	0.018	0.110	-0.004	0.036	0.001	0.149
	0.518	0.969	0.776	0.699	**0.024**	0.311	0.189	0.395	0.421	0.824	0.166	0.956	0.654	0.991	0.059

	Toluene	2-pentyl furan	Tridecane	Tetradecane	Pentadecane	Hexadecane	Heneicosane	4MOA (Muscle)	4EOA (Muscle)	4MNA (Muscle)	4MOA (SC Fat)	4EOA (SC Fat)	4MNA (SC Fat)	Hexanoic Acid	Nonanoic Acid
Toluene	1.000														
2-pentyl furan	0.065	1.000													
	0.365														
Tridecane	0.278	0.284	1.000												
	<.0001	**<.0001**													
Tetradecane	-0.080	-0.010	0.353	1.000											
	0.260	0.891	**<.0001**												
Pentadecane	0.311	-0.057	0.373	0.527	1.000										
	<.0001	0.422	**<.0001**	**<.0001**											
Hexadecane	0.109	-0.187	0.035	0.526	0.630	1.000									
	0.125	**0.008**	0.629	**<.0001**	**<.0001**										
Heneicosane	0.083	-0.212	-0.026	0.301	0.518	0.527	1.000								
	0.247	**0.003**	0.716	**<.0001**	**<.0001**	**<.0001**									
4MOA (Muscle)	-0.053	-0.078	-0.077	0.123	0.090	0.238	0.238	1.000							
	0.460	0.275	0.281	0.085	0.206	**0.001**	**0.001**								
4EOA (Muscle)	-0.370	-0.153	-0.206	0.277	0.020	0.146	0.035	0.283	1.000						
	<.0001	**0.031**	**0.004**	**<.0001**	0.778	**0.041**	0.627	**<.0001**							
4MNA (Muscle)	-0.383	-0.098	-0.190	0.262	-0.023	0.180	0.041	0.299	0.830	1.000					
	<.0001	0.169	**0.008**	**0.000**	0.745	**0.011**	0.571	**<.0001**	**<.0001**						
4MOA (SC Fat)	-0.121	0.045	-0.001	0.096	-0.107	-0.031	-0.219	-0.094	0.102	0.178	1.000				
	0.099	0.537	0.992	0.191	0.145	0.670	**0.003**	0.198	0.166	**0.015**					

4EOA (SC Fat)	-0.081	-0.074	-0.184	-0.070	-0.083	-0.008	0.070	0.205	0.029	0.050	0.170	1.000			
	0.307	0.348	**0.019**	0.375	0.295	0.919	0.377	**0.009**	0.714	0.523	**0.030**				
4MNA (SC Fat)	-0.048	0.031	-0.100	0.119	0.021	0.269	0.088	0.118	0.107	0.183	0.481	0.255	1.000		
	0.524	0.683	0.186	0.114	0.786	**0.000**	0.243	0.117	0.155	**0.015**	**<.0001**	**0.001**			
Hexanoic Acid	-0.025	-0.126	-0.233	0.017	0.190	0.342	0.313	0.211	0.223	0.254	-0.114	-0.007	0.059	1.000	
	0.727	0.077	**0.001**	0.813	**0.007**	**<.0001**	**<.0001**	**0.003**	**0.002**	**0.000**	0.118	0.927	0.433		
Nonanoic Acid	-0.146	-0.199	-0.108	0.065	0.237	0.354	0.405	0.247	0.175	0.182	-0.197	-0.046	-0.034	0.422	1.000
	0.041	**0.005**	0.130	0.366	**0.001**	**<.0001**	**<.0001**	**0.001**	**0.014**	**0.010**	**0.007**	0.558	0.652	**<.0001**	
pHu	-0.207	-0.095	-0.295	0.203	0.011	0.250	0.215	0.134	0.301	0.274	0.142	0.189	0.278	0.223	0.059
	0.004	0.182	**<.0001**	**0.004**	0.877	**0.000**	**0.002**	0.061	**<.0001**	**<.0001**	0.052	**0.016**	**0.000**	**0.002**	0.411
IMF	-0.024	0.067	0.029	0.025	0.037	0.056	-0.048	0.005	-0.007	-0.028	0.039	0.016	-0.091	0.047	0.075
	0.742	0.346	0.681	0.722	0.605	0.431	0.505	0.941	0.923	0.700	0.595	0.843	0.228	0.509	0.297
PUFA proportion	0.051	0.276	0.129	0.153	0.130	0.076	0.110	0.033	-0.131	-0.113	0.010	0.057	0.093	-0.019	-0.091
	0.517	**0.000**	0.102	0.052	0.099	0.341	0.166	0.675	0.099	0.153	0.901	0.513	0.266	0.808	0.249
SFA proportion	-0.164	-0.157	0.077	-0.080	-0.033	-0.073	-0.129	-0.009	0.076	0.025	-0.049	0.018	-0.218	-0.086	0.112
	0.038	**0.047**	0.331	0.316	0.680	0.357	0.103	0.911	0.338	0.751	0.550	0.833	**0.009**	0.277	0.160
PUFA/SFA ratio	0.073	0.279	0.102	0.167	0.123	0.082	0.106	0.021	-0.134	-0.102	0.040	0.040	0.134	-0.016	-0.115
	0.354	**0.000**	0.199	**0.034**	0.122	0.299	0.179	0.790	0.090	0.200	0.621	0.649	0.109	0.839	0.145
PUFA mg/100 g muscle	0.024	0.253	0.112	0.118	0.156	0.136	0.096	0.103	-0.104	-0.122	-0.004	0.033	-0.071	0.066	0.062
	0.763	**0.001**	0.158	0.137	**0.048**	0.086	0.225	0.194	0.187	0.124	0.958	0.705	0.398	0.408	0.432
SFA mg/100 g muscle	-0.004	0.032	0.016	-0.036	0.045	0.049	-0.022	0.080	-0.003	-0.032	-0.006	0.028	-0.163	0.051	0.099
	0.960	0.684	0.837	0.648	0.570	0.538	0.778	0.316	0.972	0.685	0.937	0.748	0.051	0.524	0.210

	pHu	**IMF**	**PUFA proportion**	**SFA proportion**	**PUFA/SFA ratio**	**PUFA mg/100 g muscle**	**SFA mg/100 g muscle**
pHu	1.000						
IMF	-0.012	1.000					
	0.866						
PUFA proportion	-0.021	-0.201	1.000				
	0.788	**0.011**					
SFA proportion	-0.246	0.016	-0.417	1.000			
	0.002	0.839	**<.0001**				
PUFA/SFA ratio	0.017	-0.179	0.979	-0.569	1.000		
	0.829	**0.023**	**<.0001**	**<.0001**			

PUFA mg/100 g muscle	0.002	0.748	0.451	-0.229	0.455	1.000	
	0.979	**<.0001**	**<.0001**	**0.004**	**<.0001**		
SFA mg/100 g muscle	0.017	0.953	-0.281	0.159	-0.286	0.666	1.000
	0.834	**<.0001**	**0.000**	**0.045**	**0.000**	**<.0001**	