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Aroma profile of dry-aged lamb and bull beef using Real-Time Selected Ion Flow Tube Mass Spectrometry (SIFT-MS) (#282)

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Introduction

Dry-ageing produces meat of superior eating quality and unique flavour [1] compared to that produced from wet-ageing. The distinct flavour and aroma compounds generated from dry-ageing as a result of proteolysis, lipolysis, and oxidation [2] remain relatively unexplored. Some ketones (Diacetyl and acetoin) and aldehydes (2-methylbutanal and 3-methylbutanal) have been reported to be positively associated with the intense dry-aged flavour, for example, buttery, nutty, browned/grilled and sweet [3]. The aim of this study was to investigate the effect of ageing methods and animal species on the aroma profile of lamb and bull beef using real time Selected Ion Flow Tube Mass Spectrometry (SIFT-MS).

Methods

Three biological replicates of lamb (paired legs, bone-in, shank-off) and bull beef striploins were dry-aged in water-permeable ageing bags (TUBLIN® 10, Denmark) at 2 ˚C, 0.5 m/s air velocity and 75% humidity as compared to wet-aged lamb in vacuum barrier bags, for 21 d. The aged lamb (bone-out, untrimmed) and beef (trimmed) samples were minced and analysed for moisture and fat contents and lipid oxidation (Thiobarbituric Acid Reactive Substances; TBARS) using standard methods. The aged sample (5 g) was placed in a sealed reagent bottle and cooked at 75 °C for 30 min. Immediately post-cooking, the sample headspace was extracted into SIFT-MS Voice 200 Ultra (Syft Technologies, Christchurch, NZ) in a positive full scan mode with direct sample inlet. The sample flow rate was 0.3 tls with tube pressure of 0.66 Torr and temperature of 119 °C. The adducts with H_3O^+, NO^+, O_2^+ in the mass range of 15-400 m/z were measured. Identification and quantitation of odorants were performed by Labsyft software (Syft Technologies). Statistical analysis was performed using R (version 3.2.2). Identified odorants were analysed by Principal Component Analysis (PCA) with moisture, fat and TBARS to investigate the differences between ageing methods and animal species and the factors that contributed to the differences. Results of moisture, fat and TBARS were analysed using one-way ANOVA and Tukey's honest significant difference to separate the means at $P<0.05$.

Results

A significantly lower ($P<0.05$) amount of moisture was detected in dry-aged lamb compared to the wet-aged (Table 1). Both dry- and wet-aged lamb had significantly higher ($P<0.05$) fat content compared to the dry-aged beef, with the highest TBARS ($P=0.10$) detected in the dry-aged lamb. A total of 38 odorants were identified, with some unique odorants presented in each sample (Table 1). A clear separation of the three samples was observed by the score plot of PCA (Fig. 1), suggesting that the difference in aroma profiles resulted from both the ageing methods and the animal species. PC1 explained 66.49% of the variation and clearly differentiated the beef samples from the lamb regardless of the ageing methods. PC2 explained 33.51% of the variation which separated the dry-aged lamb from the wet-aged lamb. In the loading plot (Fig. 2), four odorants (2-methyl-2-butanol, 3-methyl pentane, methyl glyoxal, and pentanal) and higher fat content differentiated the lamb aroma from the beef which was dominated by hexanal, propanal and unique odorants in PC1. Increased TBARS level and the unique odorants (Table 1) may have contributed to the distinct aroma profile (e.g. nutty, sweet and buttery) of the dry-aged lamb in PC2. The aroma profile of wet-aged lamb may be associated with the higher moisture content, ethyl mercaptan, dimethyl sulfide and dimethyl amine. Dimethyl sulfide, reported to have bloody/metallic flavour of wet-aged meat [3], was also detected.

Conclusion

A clear differentiation between the aroma profiles of dry- and wet-aged lamb and bull beef was detected by real-time SIFT-MS. The amount of fat and lipid oxidation were the major contributors to the distinct aroma profile of lamb and dry-aged lamb, respectively.

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REFERENCES

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Notes

	Wet-aged lamb	Dry-aged lamb	Dry-aged beef	SED	P-values
% Moisture	73.15	67.98	74.68	0.99	0.001
% Fat	5.64	6.20	0.71	0.70	<0.001
TBARS (mg MDA/kg meat)	0.30	1.44	0.38	0.48	0.102
Unique odorants	1-methylpyrrolidine allyl methyl sulfide carbon disulfide formic acid ammonia trimethylamine	2-methyl-2-propanol 3-methylbutanal	acrolein carbonyl sulphide ethanol octanoic acid methyl mercaptan diethyl amine ethanolamine 2-methyl-1-butanamine 2-methyl naphthalene		

Table 1. Moisture, fat and TBARS and the unique odorants of aged meat samples

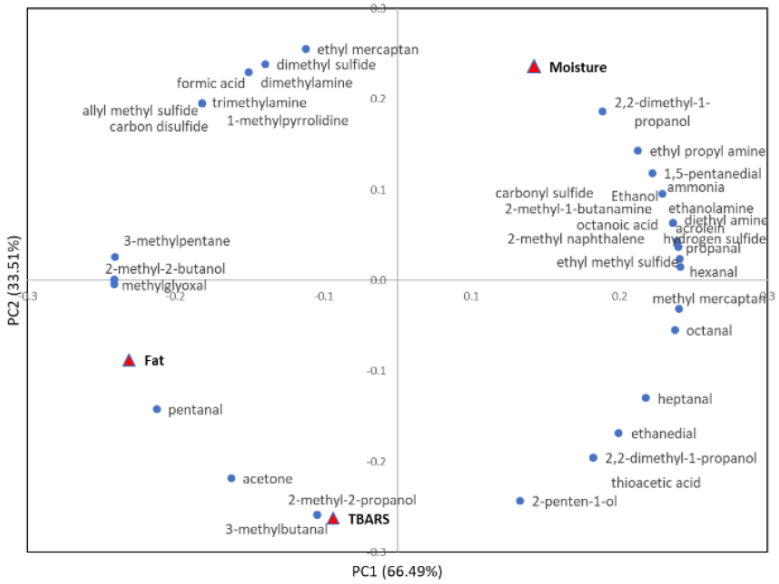

Fig 2 Loading plot of PCA analysis of odorants, moisture, fat and TBARS of aged meat samples.

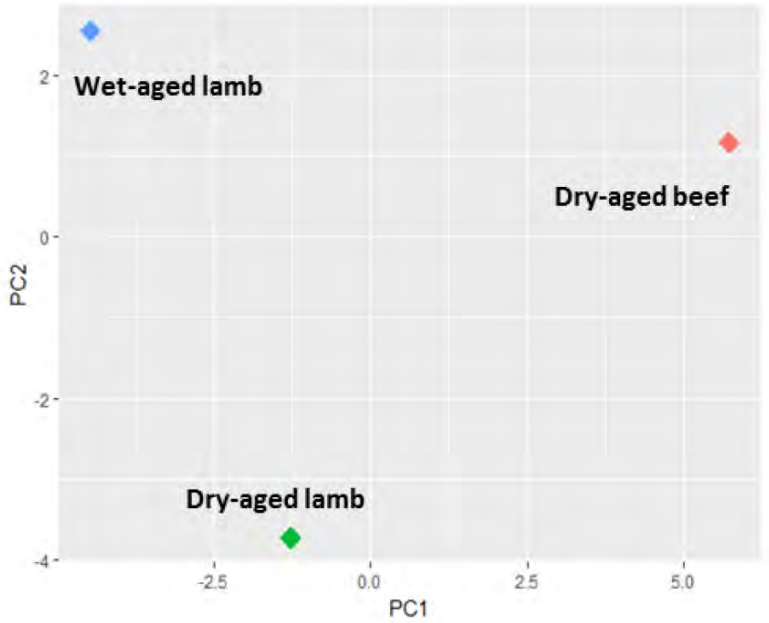

Fig 1. Score plot of PCA analysis of dry- and wet aged lamb and bull beef

Notes