Effects of electric, microwave and superheated steam methods of cooking on non- and volatile compounds of roasted mutton

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Introduction: Roasted lamb leg is a traditional roasted meat product and is popular among consumers in China due to its unique taste and volatile compounds profile. However, this method has the disadvantage of smoky emissions that pollute the environment. Several new roasting methods have been developed to avoid the drawbacks of high pollution from traditional burning charcoal (BCC) and still generate a comparable aroma of meat products such as electrically heated air (EHA), microwave heat (MWH) and superheated steam (SHS) (Domínguez, Gómez, Fonseca, & Lorenzo, 2014; Zzaman, Bhat, Yang, & Easa, 2017; Farhadian, Jinap, Abas, & Sakar, 2010; Farhadian, Jinap, Hanifah, & Zaidul, 2011). The objective of the present study was to explore the effects of roasting by EHA, MWH and SHS on (non)volatile compounds in comparison with BCC.

Materials and methods: The lamb legs were cured by a 16% salt solution at 4°C for 6 h without other additives. The lamb legs were then roasted by the 3 new roasting methods (EHA, MWH and SHS) and compared with lamb legs roasted over BCC as the control group. The core temperature in oyster cuts of roasted lamb was 78–82°C when the cooking ended. For each roasting method, the roasted oyster cuts from 6 forelegs of lambs were selected as 6 batches. The left forelegs were used for analysis of contents of (non)volatile compounds, moisture, protein and fat. The sensory evaluation was implemented as described by the previous literatures (Petričević et al., 2018). The 5 traits of taste sensory evaluation in the samples were as follows: sourness, sweetness, bitterness, saltiness and umami. Furthermore, the 7 descriptors of sensory evaluation were fat, roast, smoke, fermentation, grass flavours and less taint, along with acceptability.

Results: The BCC resulted in the highest umami sensory taste (8.67 ± 0.19 out of 10 points), followed by the EHA (8.07 ± 0.19) ($P > 0.05$), while the MWH (6.83 ± 0.20) and SHS (6.72 ± 0.18) generated the lowest umami sensory taste ($P < 0.05$). The acceptability, fat and roast flavours in samples from the EHA and SHS did not present significant differences ($P > 0.05$) with those from the BCC. The grass flavour in samples among the BCC, EHA and MWH were not different ($P > 0.05$).

The ratio of glutamic acid (umami ingredients) to glutamine (no taste) in samples from BCC (0.37) was not different ($P > 0.05$) with that from EHA (0.22), whereas their ratios were both significantly higher ($P < 0.05$) than those in samples from MWH (0.02) and SHS (0.05). The taste active values (TAVs) of 5′-IMP in samples from the BCC (2.16) were the highest, followed by the EHA (1.19) and MWH (0.99). The EHA (5.01 g MSG/100 g) could be more than capable of the generation of the umami tastes ($P < 0.05$) compared with the MWH and SHS. The EHA generated richer (E)-2-octenal, (E, E)-2,4-nonadienal, 1-nonanol and 2-pentylfuran ($P < 0.05$) than the BCC in terms of higher OAVs. In addition, several volatile compounds from the EHA and SHS were not different ($P > 0.05$) from those from the BCC, such as (E)-2-nonenal and (E)-2-octene-1-ol.

Conclusions: The EHA, MWH and SHS methods all generated rich flavour compounds and contributed to high sensory scores of roasted oyster cuts that were similar to those from the BCC. The roasted oyster cuts from the EHA had a better umami taste resulting from higher levels of glutamic acid and 5′-IMP than the MWH and SHS. The roasted oyster cuts from the EHA and SHS had richer roast and fat flavours than the MWH due to characteristics of volatile compounds. The EHA might be a potential method to replace the BCC.

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