As presented at Petfood Forum 2024

Electronic nose detection of aroma profiles of beef liver flavors developed using proteolytic enzymes with different incubation times

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Abstract details:

Proteolytic enzymes are a tool used to alter the sensory profile of meat products towards desired flavors. Liver flavor is often used as a palatant in kibbles to enhance flavor and palatability.

The objective of this experiment was to determine the aroma profile of ground beef liver (GBL) incubated with four different proteolytic enzymes at three different incubation times.

Due to unique incubation conditions of enzyme D compared with enzymes A-C, two control (CTL) treatments were necessary. The study consisted of 19 treatments: Raw GBL (1); GBL incubated for 1, 2 or 3 h at 64 °C (LOW CTL; 2-4); GBL incubated for 1, 2 or 3 h at 74 °C (HIGH CTL; 5-7); GBL incubated with either enzyme A, B or C at 64 °C for 1, 2, or 3 h (8-16); and GBL incubated with enzyme D at 74 °C for 1, 2 or 3 h (17-19). All treatments, except for raw GBL, were incubated in 50-mL conical tubes placed inside a water bath. At the end of the incubation period, temperature was raised by 16 °C and held for 10 min to inactivate the added enzymes. Following incubation, samples were allowed to cool at room temperature and 2 g of sample were used to assess the aroma profile using an electronic nose (Heracles NEO II, Alpha MOS, Toulouse, France); treatments were evaluated in triplicate. Temperature treatment of GBL increased the number of detected volatiles by 3- to 6-fold compared with raw GBL, regardless of enzyme addition. According to the CTL treatments, increasing the incubation temperature of GBL from 64 to 74 °C increased the number of detected volatiles after 1 h (10 vs 18) and 2 h (12 vs 17), mainly from detection of ketones, alkanes and alcohols. At 1 h of 64 °C incubation, GBL incubated with enzymes A-C detected methyl acetate (ester) and acetonitrile (nitrile) after 17 and 20 s of retention time (RT), whereas the LOW CTL samples detected 2-Methyl-2-propanol (alcohol) and 2-mercaptoethanol (alcohol) during those RTs. However, after 2 h of incubation, methyl acetate (17 s), acetonitrile (20 s), dibromochloromethane (44 s) and 1-chloroheptane (60 s) were consistently detected in all treatments, excluding raw GBL. Incubating GBL with enzyme A increased the number of detected ketones and decreased the number of alcohols compared with LOW CTL treatments. On the contrary, incubating GBL with enzyme C for 2 or 3 h increased the number of detected ketones compared with LOW CTL treatments but maintained the number of detected alcohols. Treating GBL with enzyme B not only increased the number of detected ketones compared with LOW CTL

samples but also produced two carboxylic acids at the 2 h incubation time treatment. Incubating GBL with enzyme D for 1 and 2 h decreased the number of detected volatiles compared with equivalent HIGH CTL treatments (18 vs. 13 and 17 vs. 11, respectively); additional volatiles detected in the HIGH CTL treatments included alcohols and alkanes. Meanwhile, incubating GBL with enzyme D for 3 h resulted in the detection of three additional volatiles compared with the equivalent HIGH CTL; an alkene and carboxylic acids were among the extra volatile groups detected. Principal component analysis (PCA) indicates the first two principal components (PC1: 73.25%, PC2: 15.51%) described 88.76% of the variation within data analyzed. The PCA revealed aroma differences between raw GBL vs. LOW/HIGH TEMP vs. enzyme-treated GBL.

In conclusion, incubation temperature, time and proteolytic enzymes alter the aroma profile of beef liver. Alterations in volatiles of GBL produced by each enzymatic treatment are influenced by the incubation time; therefore, a desired aroma profile of GBL can be achieved by optimizing the incubation time for a preferred enzyme.

Biography:

Gerardo Abascal-Ponciano was born and raised in Guatemala. He completed his Master of Science degree at Auburn University and is currently a Ph.D. student under the guidance of Dr. Jessica Starkey. His dissertation research focuses on the effects of coccidiosis challenge on broiler gastrointestinal immune status. Throughout his graduate studies, Gerardo has also been involved in broiler nutrition and growth physiology, feed manufacturing and analysis, and pet food manufacturing experiments. Gerardo has conducted and presented research on pet treat development from several meat animal processing co-products at local and international conferences as well as to pet food industry stakeholders.