FLAVOR OF LAMB AND MUTTON

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It has been confirmed that sheep meat (lamb or mutton) possesses distinct strong species-related flavor notes that many regard as not pleasing. The intensity of this flavor can be influenced by various ante-mortem and post-mortem factors such as animal diet, age, sex, meat pH, the type and extent of cooking, and curing. Post-cooking storage and modulation of lipid oxidation in mutton also has effects on flavor characteristics. Various chemical compounds have been implicated as responsible for or contributing to ovine flavor. Of those compounds, medium-length branched-chain fatty acids have been confirmed to be the most important. Definitive generalizations regarding sheep production management practices yielding meat with the most desirable flavor attributes have not yet been made. Meanwhile, processing methods that reduce or modify the species flavor, such as washing and extrusion with nonmeat ingredients, have been evaluated.

1. BACKGROUND

Dislike of the distinct species-related flavor of meat from sheep (Ovis aries) has been cited or implicated as one of the reasons for low sheep meat consumption (Batcher et al., 1969; Cramer, 1983; Sink and Caporaso, 1977; Jones et al., 1988). In 1997, each American consumed only 1 pound of lamb, compared to 67 pounds of beef and 48 pounds of pork (USDA, 1998). On the other side of the spectrum, New Zealand led in per capita annual consumption of lamb and mutton, which, together with goat meat, averaged 70 pounds (USDA, 1997). In Australia, each person consumed around 40 pounds (USDA, 1997). One problem of the sheep industry in the United States is this lack of a consumer base.

The terms lamb and mutton flavor and odor are used interchangeably and refer to the characteristic flavor of all sheep meat, regardless of age (Cramer, 1983). This article uses "ovine flavor" to refer to this characteristic species-related flavor. Extensive reviews on ovine flavor have been provided by Sink and Caporaso (1977), Cramer (1983) and

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Quality Attributes of Muscle Foods, edited by Xiong et al.
Table 1. Percentage of all panelists correctly identifying the species of meat samples

<table>
<thead>
<tr>
<th>Sample</th>
<th>Wasserman and Talley (1968)</th>
<th>Consumer panel</th>
<th>Lab panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef</td>
<td>71.5</td>
<td>49.3</td>
<td>50.0</td>
</tr>
<tr>
<td>Lamb</td>
<td>78.5</td>
<td>59.2</td>
<td>66.7</td>
</tr>
<tr>
<td>Pork</td>
<td>61.0</td>
<td>32.4</td>
<td>33.3</td>
</tr>
</tbody>
</table>

*Ground meat roasts.
*Pan-fried ground meat patties.
*Combined results of both first and second servings.
*Combined results of both first and second servings of the first session.

Young et al. (1994). This article will provide a short review as well as discuss some of the processing methods that can reduce or modify ovine flavor.

1.1. Sensory Characteristics of Ovine Flavor

Many descriptors have been used for the flavors perceived in lamb and mutton. Terms like “lamb” and “wooly” have been used for cooked lamb (Jeremiah, 1988). Fat-rich mutton broths were “lamb-like,” “sweet,” “oily,” and “barny” (Hofstrand and Jacobson, 1960). Special attention has been given by researchers to the odor termed “soo,” the Chinese term for the characteristic flavor of sheep meat meaning “sweaty-sour” (Wong et al., 1975b). “Sheepmeat” flavor note was more intense than “animal,” “poultry,” and “boiled meat” in cooked lamb in a study by Rousset-Akrim et al. (1997).

There have been studies showing that, without fat, identification of lamb is difficult. Lean extracts and lean ground roasts of lamb were difficult to differentiate from beef (Pearson et al., 1973; Wasserman and Talley, 1968). When lamb fat was added to bland products, like turkey (Brennand and Mendenhall, 1981) or veal (Wasserman and Talley, 1968), the tendency to identify them as lamb increased. The results of such studies indicate that ovine flavor is derived from fatty (adipose) tissue and not the lean. Adipose tissue may either contribute flavor-imparting compounds or serve as a storage site for the flavor compounds released upon heating.

Wasserman and Talley (1968) found that, as ground roasts (“roasted” usually meaning oven-baked), lamb was identified correctly more than beef or pork when served to an untrained panel with 28 members as “normal” ground roasts with an unspecified amount of fat (Table 1). They did not indicate the serving of the samples. Rhee and Ziprin (1996) used pan-fried ground meat patties with a raw meat fat content of about 21%. Both a consumer panel (71 members) and an experienced/laboratory sensory panel (12 members) which was not trained for that particular study were used. Serving order for lamb samples was balanced on two sets of servings. Majority of the panelists identified lamb correctly more than beef and pork in blind taste tests (Table 1). They also found that those who could differentiate lamb from beef and pork tended to rate its flavor intensity highest among the three while rating its overall palatability lowest. Thus, results confirmed that ovine flavor is indeed distinct and can decrease the acceptability of sheep meat.

1.2. Chemical Compounds for Ovine Flavor

Among various chemical constituents that have been reported to be associated with ovine flavor, the branched-chain fatty acids with 8–10 carbons have been confirmed to be