Effects of Curing Methods on the Quality Characteristics of Pork Jerky

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The purpose of this study was to investigate the quality characteristics of pork jerky prepared under two curing methods (immersion and tumbling). Jerky was dried using cured pork meat immersed for 6, 12, 24, or 48 h, or tumbled for 10, 20, 30, or 60 min. In jerky manufacturing, the tumbling process had a significant influence on increased moisture contents, reduced textural hardness, and improved in sensorial tenderness, juiciness, and overall acceptance compared to immersion. Within the same curing method, longer curing times resulted in an increase in the moisture content, redness, and TBA values. Additionally, the sensorial texture, juiciness, and overall acceptance of pork jerky tumbled for 30 and 60 min had significantly higher sensory scores than other treatments.

Keywords: curing, immersion, quality characteristics, pork jerky, tumbling

Introduction

Immersion in brine, brine-injection or tumbling in the process of curing are techniques used to ensure distribution of curing ingredients, such as salt, nitrite, polyphosphate, acidity regulator, seasoning, and flavoring. Thus, those techniques can reduce the processing time necessary to develop the cured meat color and flavor and to achieve an acceptable and tender meat product (Varnam and Sutherland, 1995; Goodwin and Mannes, 1984; Goutefongea, 1992; Hayes et al., 2007). The enhancement of textural properties of brine-injected or marinated meat products is made possible through tissue structure and the use of water-binding, and myofibril structure modifying ingredients. These ingredients not only improve the water-holding capacity, but can modify flavor, and texture of the meat, and also increase cooking yields (Chen, 1982; Cannon et al., 1993; Xiong, 2005).

Salt, the additive with the longest history of use, is the most important curing ingredient for improving the meat product’s physical and sensory attributes, and acts to inhibit the growth of microorganisms in combination with nitrite, redox potential (Eh), competitive flora, refrigeration, pH, and packaging (Leistner, 1987; Goutefongea, 1992; Torres et al., 1994; Shimokomaki et al., 1998; Tan and Ockerman, 2008). The sugars, including sucrose, lactose, glucose, and starch derivates, often improve the sensory properties of meat products, and are used to retard the growth of micro flora by reducing the water activity of foods. They are also able to play a different role, that of supplementing the dry matter content to avoid excessive moisture content in the products (Kuo and Ockerman, 1985; Goutefongea, 1992). Additionally, of the trace ingredients, erythorbate results in the color enhancement of cured meat, and potassium sorbate aids in inhibiting the growth of bacteria and mold (Defreitas et al., 1988). These ingredients can be applied to the meat through soaking, injection, or tumbling, in order to promote distribution (Smith and Young, 2007). The action of tumbling results in better extraction of meat proteins and improves the speed of curing by increasing the absorption and distribution of curing agents (Pearson and Gillett, 1999). Pietrasik and Shand (2003) reported that the tumbling process serves to extract the salt-soluble proteins to enhance the binding of water within the muscle and thus increase yield. In addition, Pietrasik and Shand (2004) suggested that increasing the tumbling time improves hydration properties of meat products, resulting in improved water holding capacity and lower cooking

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Physicochemical properties

Instrumental color measurements were taken with a color meter (Chroma meter CR-210, Minolta, Tokyo, Japan; illuminate C, calibrated with white standard plate \( L^* = +97.83, a^* = -0.43, b^* = +1.98 \)) by measuring on the surface of samples. The pH of samples was determined in triplicate with a pH meter (Model 340, Mettler-Toledo GmbH, Schwerzenbach, Switzerland). pH values were measured by blending a 5 g sample with 20 ml distilled water for 60 s in a homogenizer (Ultra-Turrax T25, Janke & Kunkel, Staufen, Germany). Samples for water activity were minced into pieces approximately 1 mm\(^3\) in size, and were determined in duplicate with a hygrometer (BT-RS1, Rotronic ag., Bassersdorf, Switzerland). Dry yields were determined by calculating the weight differences of jerky before and after drying (for 60 min at 55\(^\circ\)C, for 60 min at 65\(^\circ\)C, and for 90 min at 76.7\(^\circ\)C) and cooling (for 30 min at 25\(^\circ\)C). Thiobarbituric acid (TBA) values were determined using the distillation method of Tarladgis et al. (1960), and results were expressed as mg of malonaldehyde per kg of sample.

Instrumental texture measurement

The textural properties of jerky samples (thickness 4.02 ± 0.26 mm) were measured by a cylinder probe (5 mm diameter) attached to a texture analyzer (TA-XT2i, Stable Micro Systems Ltd., Surrey, U. K.). The test conditions were as follows: stroke, 20 g; test speed, 2 mm/s; distance, 10.0 mm. Data were collected and analyzed regarding the hardness (N), springiness, cohesiveness, gumminess (N), and chewiness (N) values (Han et al., 2007).

Sensory evaluation

The sensory evaluations were performed in triplicate on each jerky treatment by trained raters. So far, limited research has been conducted on improving and maximizing production process in pork jerky. Therefore, the objective of this study was to evaluate the quality properties of pork jerky prepared under various curing conditions for improved texture modification.

Materials and Methods

Meat and curing solution preparation

\( M. \) biceps femoris, \( M. \) semitendinosus, \( M. \) semimembranosus in frozen pork (Landrace × Yorkshire × Duroc; 5 months old) were purchased from a local processor at 48 h post-mortem. The frozen meat was thawed at 4\(^\circ\)C until a core temperature of −1\(^\circ\)C was reached, then sliced into 7 to 8 mm thick sections parallel to the muscle fiber. The meat was trimmed of all visible subcutaneous fat before use for jerky processing. After thawing, the properties of trimmed pork samples (45 samples per sampling point, the average initial weight: 33.25 g) were pH 5.56 ± 0.03, moisture 62.84 ± 0.73%, protein 19.04 ± 0.42%, fat 16.30 ± 1.08%, and ash 1.07 ± 0.06%. The curing solution was prepared to improve the recipe for Korean-type curing solution as reported by Song (1997). Jerky was manufactured with the following formulation; 74.65% lean pork meat, 7.47% water, 6.71% soy sauce, 0.523% salt, 3.75% starch syrup, 1.5% sucrose, 4.46% D-sorbitol, 0.373% black pepper powder, 0.075% ginger powder, 0.15% garlic powder, 0.15% onion powder, 0.005% sodium nitrite, 0.007% sodium citrate, 0.075% potassium sorbate, 0.027% sodium erythorbate, and 0.075% soup stock powder. The pH of curing solution was 5.45 ± 0.06.

Preparation of jerky

Sliced pork was mixed with stirred curing solution by hand for 3 min. The meat was then continuously immersed at 1\(^\circ\)C for 6, 12, 24, and 48 h or individually tumbled in a tumbler (MGH-20, Vackona, Liesen, Germany) at 25 rpm for 10, 20, 30, and 60 min using the curing method of Kim et al. (2003). According to the commercial drying practices of jerky manufacturing in Korea, cured meat was dried in a convection oven (Enex-CO-600, Enex, Yon-gin, Korea) for 60 min at 55\(^\circ\)C, for 60 min at 65\(^\circ\)C, and for 90 min at 76.7\(^\circ\)C and cooling (for 30 min at 25\(^\circ\)C).

Compositional properties

Moisture content was determined by weight loss after 12 h of drying at 105\(^\circ\)C in a drying oven (SW-90D, Sang Woo Scientific Co., Bucheon, South Korea) as recommended by AOAC (1995). Fat content was determined by using a ether solvent extraction system (Soxtec® Avanti 2050 Auto System, Foss Tecator AB, Höganäs, Sweden) and protein was determined by the Kjeldahl method with an automatic nitrogen analyzer (Kjeltec® 2300 Analyzer Unit, Foss Tecator AB, Höganäs, Sweden). Ash was determined according to AOAC method 923.03.

Fig. 1. The diagram of pork jerky manufacturing.
The effects of curing methods and time on the compositional properties of pork jerky are shown in Table 1. Regardless of the curing method, longer curing times resulted in a significant increase in the moisture content of pork jerky. Pork jerky immersed for 24 and 48 h had significantly higher moisture content than those tumbled for 6 and 12 h, and samples tumbled for 30 and 60 min had higher moisture content than for 10 min. Also, jerky tumbled for 60 min had significantly higher moisture contents than immersion treatments, except for those immersed for 48 h. However, neither curing method nor time had significant effect on the protein, fat and ash contents of pork jerky (\( p > 0.05 \)).

Hullberg and Lundström (2004) demonstrated that tumbled cured-smoked loins contained higher moisture content than non-tumbled cured-smoked loins, and Dzudie and Okubanjo (1999) reported that the moisture content of raw and cooked goat hams increased with increased tumbling time. Motycka and Betchel (1983) also reported that the moisture content increased due to salt accumulation in the meat with increased curing time, and Pietrasik and Shand (2003) demonstrated that the quality attributes of tenderness, texture, and flavor were negatively affected by the loss of moisture from beef rolls during and after thermal processing.

### Table 1. Effect of curing methods and time on compositional properties of pork jerky.

<table>
<thead>
<tr>
<th>Traits</th>
<th>Compositional properties (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Moisture</td>
</tr>
<tr>
<td>Immersion time (h)</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>48</td>
</tr>
<tr>
<td>Tumbling time (min)</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>60</td>
</tr>
</tbody>
</table>

1 Each pork jerky treatment was dried after being cured by immersing for 6, 12, 24, and 48 h.
2 Each pork jerky treatment was dried after being cured by tumbling for 10, 20, 30, and 60 min.
All values are mean ± standard deviations.
<sup>a-c</sup> Means with different superscripts within each treatment are significantly different (\( P < 0.05 \)).
<sup>a, b</sup> Means with different superscripts within the same curing method are significantly different (\( P < 0.05 \)).
of the cooked beef roasts. Also, Han et al. (2007) reported that the water activity of pork jerky was 0.59-0.69, and Jung et al. (1994) found that the water activity of commercial beef jerky ranged from 0.58 to 0.70.

The dry yields of pork jerky in this study increased with curing time (Table 2). With immersion treatment, the dry yields for 48 h were significantly higher than for 6 h, but there was no difference in dry yields among jerky samples cured by tumbling, and especially, samples tumbled for 60 min had higher dry yields than those immersed for 6 h. This finding is consistent with that of Krause et al. (1978) in that tumbling process increased the extraction of salt-soluble proteins and had an effect on product yield, and Motyca and Betchel (1983) also reported that the exudates from mechanically tenderized ham consistently exhibited increased protein levels which positively correlated with cooking yields. Additionally, Hullberg and Lundström (2004) indicated the great difference in yield between tumbled and non-tumbled loins was caused during thermal process, and tumbling also tended to diminish the fluid loss during tumbling phase, and Cheng and Ockerman (2003) also found that tumbled roast beef had a significantly higher cooking yield than the non-tumbled control, and tumbling did effectively function to increase product yield of roast beef, and Pietrasik and Shand (2004) found that increased tumbling time improved the hydration properties of cooked roast beef, resulting in improved water holding capacity and significantly lower cooking loss.

With the extension of curing time, significant changes

<table>
<thead>
<tr>
<th>Traits</th>
<th>CIE color</th>
<th>pH</th>
<th>Water activity</th>
<th>Dry yields (%)</th>
<th>TBA (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$L^*$-value</td>
<td>$a'$-value</td>
<td>$b'$-value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immersion 6</td>
<td>44.70 ± 0.74$^{ab}$</td>
<td>7.71 ± 0.39$^{bc}$</td>
<td>2.75 ± 0.21$^{ab}$</td>
<td>5.73 ± 0.14</td>
<td>0.69 ± 0.02</td>
</tr>
<tr>
<td>Time (h)$^1$</td>
<td>12</td>
<td>44.55 ± 1.91$^{ab}$</td>
<td>7.90 ± 0.46$^{bc}$</td>
<td>2.51 ± 0.19$^{ab}$</td>
<td>5.73 ± 0.08</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>43.72 ± 0.64$^{bc}$</td>
<td>8.20 ± 0.44$^{bc}$</td>
<td>2.29 ± 0.20$^{b}$</td>
<td>5.71 ± 0.10</td>
</tr>
<tr>
<td></td>
<td>48</td>
<td>43.02 ± 1.93$^{bc}$</td>
<td>8.64 ± 0.29$^{bc}$</td>
<td>1.82 ± 0.11$^{bc}$</td>
<td>5.72 ± 0.09</td>
</tr>
<tr>
<td>Tumbling 10</td>
<td>44.48 ± 0.95$^{ab}$</td>
<td>7.88 ± 0.34$^{ab}$</td>
<td>3.08 ± 0.28$^{a}$</td>
<td>5.75 ± 0.10</td>
<td>0.69 ± 0.01</td>
</tr>
<tr>
<td>Time (min)$^2$</td>
<td>20</td>
<td>44.04 ± 1.00$^{ab}$</td>
<td>8.05 ± 0.42$^{bc}$</td>
<td>2.78 ± 0.23$^{b}$</td>
<td>5.75 ± 0.08</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>43.92 ± 0.52$^{ab}$</td>
<td>8.26 ± 0.34$^{ab}$</td>
<td>2.73 ± 0.24$^{b}$</td>
<td>5.74 ± 0.09</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>43.87 ± 0.73$^{ab}$</td>
<td>8.34 ± 0.35$^{a}$</td>
<td>2.58 ± 0.26$^{c}$</td>
<td>5.74 ± 0.08</td>
</tr>
</tbody>
</table>

1 Each pork jerky treatment was dried after being cured by immersing for 6, 12, 24, and 48 h.
2 Each pork jerky treatment was dried after being cured by tumbling for 10, 20, 30, and 60 min.

All values are mean ± standard deviations.

$^a$, $^b$, $^c$, $^d$ Means with different superscripts within each treatment are significantly different ($P < 0.05$).

$^{a-d}$ Means with different superscripts within the same curing method are significantly different ($P < 0.05$).
Effect of Curing Methods on the Pork Jerky

Differences were significant up to 24 h (p < 0.05) among the various immersion treatments, and these differences (Table 2). Differences in TBA values were found were observed in the TBA values of the pork jerky treatments had higher than immersed for 6, 12, 24, and 48 h. The springiness, gumminess, and chewiness values of samples treated with tumbling for 30 and 60 min were higher than those for 10 min, and cohesiveness values of product tumbled for 30 min were the highest. Pietrasik and Shand suggested that different quantities of salt soluble proteins might have been extracted during the different brine addition and tumbling regimes which influenced cross-linkage formation. Carballo et al. (1995) reported that an increase in protein content, and hence in extracted protein, generally causes an increase in the number of locations in the polypeptide chains capable of interacting.

In this study, hardness decreased and springiness, cohesiveness, gumminess, and chewiness in jerky immersed for 6 h were significantly lower than other treatments; there were no differences (p > 0.05) in 12 h to 48 h. The springiness, gumminess, and chewiness values of samples treated with tumbling for 30 and 60 min were higher than those for 10 min, and cohesiveness values of product tumbled for 30 min were the highest.

Table 3 shows the effects of various curing methods and time on textural properties of pork jerky. With immersion treatments, cohesiveness, gumminess, and chewiness increased, which resulted in TBA.

### Table 3. Effect of curing methods and time on textural properties of pork jerky.

<table>
<thead>
<tr>
<th>Traits</th>
<th>Hardness (N)</th>
<th>Springiness</th>
<th>Cohesiveness</th>
<th>Gumminess (N)</th>
<th>Chewiness (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immersion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>time (h)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>56.01 ± 5.52A</td>
<td>0.89 ± 0.04B</td>
<td>0.14 ± 0.02\textsuperscript{Db}</td>
<td>7.96 ± 0.85\textsuperscript{ABCb}</td>
<td>7.09 ± 0.85\textsuperscript{BCDb}</td>
</tr>
<tr>
<td>12</td>
<td>55.32 ± 4.96A</td>
<td>0.91 ± 0.04\textsuperscript{ABb}</td>
<td>0.16 ± 0.02\textsuperscript{CDb}</td>
<td>8.89 ± 0.88\textsuperscript{Aa}</td>
<td>8.11 ± 0.87\textsuperscript{Ab}</td>
</tr>
<tr>
<td>24</td>
<td>54.60 ± 5.00A</td>
<td>0.91 ± 0.03\textsuperscript{ABb}</td>
<td>0.16 ± 0.01\textsuperscript{BCa}</td>
<td>8.93 ± 0.88\textsuperscript{Aa}</td>
<td>8.12 ± 0.90\textsuperscript{Ab}</td>
</tr>
<tr>
<td>48</td>
<td>54.41 ± 4.75A</td>
<td>0.92 ± 0.03\textsuperscript{ABb}</td>
<td>0.17 ± 0.01\textsuperscript{BCa}</td>
<td>9.01 ± 0.92\textsuperscript{Aa}</td>
<td>8.25 ± 0.78\textsuperscript{Ab}</td>
</tr>
<tr>
<td>Tumbling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>time (min)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>43.41 ± 4.10B</td>
<td>0.89 ± 0.04\textsuperscript{ABb}</td>
<td>0.16 ± 0.02\textsuperscript{BCc}</td>
<td>7.09 ± 0.75\textsuperscript{Cc}</td>
<td>6.30 ± 0.72\textsuperscript{Db}</td>
</tr>
<tr>
<td>20</td>
<td>42.55 ± 3.56B</td>
<td>0.92 ± 0.05\textsuperscript{ABbc}</td>
<td>0.17 ± 0.02\textsuperscript{BCc}</td>
<td>7.18 ± 0.79\textsuperscript{Bc}</td>
<td>6.57 ± 0.79\textsuperscript{CDb}</td>
</tr>
<tr>
<td>30</td>
<td>41.55 ± 3.13B</td>
<td>0.93 ± 0.04\textsuperscript{ABbc}</td>
<td>0.20 ± 0.01\textsuperscript{Aa}</td>
<td>8.18 ± 0.85\textsuperscript{Ab}</td>
<td>7.58 ± 0.79\textsuperscript{ABCa}</td>
</tr>
<tr>
<td>60</td>
<td>41.87 ± 2.84B</td>
<td>0.94 ± 0.03\textsuperscript{ABbc}</td>
<td>0.18 ± 0.02\textsuperscript{ABCb}</td>
<td>7.72 ± 0.70\textsuperscript{BCab}</td>
<td>7.21 ± 0.60\textsuperscript{ACDa}</td>
</tr>
</tbody>
</table>

1 Each pork jerky treatment was dried after being cured by immersing for 6, 12, 24, and 48 h.
2 Each pork jerky treatment was dried after being cured by tumbling for 10, 20, 30, and 60 min.
All values are mean ± standard deviations.
\textsuperscript{A–D} Means with different superscripts within each treatment are significantly different (p < 0.05).
\textsuperscript{a–c} Means with different superscripts within the same curing method are significantly different (p < 0.05).
shown in Table 4. Curing time did not have a significant influence on the sensory characteristics of pork jerky, and the overall acceptance of jerky immersed for 48 h had significantly higher scores than for 6 h. Samples cured by tumbling for 30 and 60 min had similar scores for all sensorial traits. Also, tumbling generally improved sensorial texture, juiciness, and overall acceptance as compared with immersion treatments. The sensorial properties of pork jerky improved for both immersion and tumbling treatments with increased curing time and this may be due to the increase in moisture content (Motycka and Betchel, 1983). The improvement of color, taste, flavor, tenderness, protein extractability and water holding capacity was attributed to the curing agents (Ockerman et al., 1978; Babdji et al., 1982; Ockerman and Kuo, 1982; Kuo and Ockerman, 1985). Pietrasik and Shand (2004) also suggested that a longer tumbling time assured higher quality product attributes.

This study was carried out to compare curing methods and find the relationship between curing time and the quality characteristics of pork jerky prepared under various curing methods. The increase in curing time correlated positively with moisture content and product yield, enhanced tenderness of pork jerky. In addition, tumbling reduced the processing time and improved the quality characteristics of jerky compared to immersion, and especially, 30 min tumbling was the most effective curing condition since it resulted in similar properties to 60 min tumbling.

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Table 4. Effect of curing methods and time on sensorial properties of pork jerky.

<table>
<thead>
<tr>
<th>Traits</th>
<th>Color</th>
<th>Flavor</th>
<th>Tenderness</th>
<th>Juiciness</th>
<th>Overall acceptance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immersion</td>
<td>6</td>
<td>6.92 ± 0.51</td>
<td>7.33 ± 0.49</td>
<td>6.75 ± 0.62&lt;sup&gt;C&lt;/sup&gt;</td>
<td>6.67 ± 0.49&lt;sup&gt;D&lt;/sup&gt;</td>
</tr>
<tr>
<td>time (h)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>12</td>
<td>7.17 ± 0.72</td>
<td>7.33 ± 0.49</td>
<td>6.83 ± 0.72&lt;sup&gt;C&lt;/sup&gt;</td>
<td>6.75 ± 0.62&lt;sup&gt;CD&lt;/sup&gt;</td>
</tr>
<tr>
<td>24</td>
<td>7.33 ± 0.65</td>
<td>7.58 ± 0.67</td>
<td>7.08 ± 0.67&lt;sup&gt;BC&lt;/sup&gt;</td>
<td>6.92 ± 0.67&lt;sup&gt;BDC&lt;/sup&gt;</td>
<td>7.50 ± 0.52&lt;sup&gt;BDCab&lt;/sup&gt;</td>
</tr>
<tr>
<td>48</td>
<td>7.33 ± 0.49</td>
<td>7.67 ± 0.78</td>
<td>7.17 ± 0.83&lt;sup&gt;BC&lt;/sup&gt;</td>
<td>7.17 ± 0.58&lt;sup&gt;BCD&lt;/sup&gt;</td>
<td>7.67 ± 0.65&lt;sup&gt;BCa&lt;/sup&gt;</td>
</tr>
<tr>
<td>Tumbling</td>
<td>10</td>
<td>7.17 ± 0.58</td>
<td>7.33 ± 0.49</td>
<td>7.58 ± 0.51&lt;sup&gt;AB&lt;/sup&gt;</td>
<td>7.25 ± 0.62&lt;sup&gt;B&lt;/sup&gt;</td>
</tr>
<tr>
<td>time (min)&lt;sup&gt;2&lt;/sup&gt;</td>
<td>20</td>
<td>7.25 ± 0.62</td>
<td>7.33 ± 0.78</td>
<td>7.83 ± 0.58&lt;sup&gt;A&lt;/sup&gt;</td>
<td>7.42 ± 0.51&lt;sup&gt;AB&lt;/sup&gt;</td>
</tr>
<tr>
<td>30</td>
<td>7.33 ± 0.78</td>
<td>7.50 ± 0.67</td>
<td>8.00 ± 0.60&lt;sup&gt;A&lt;/sup&gt;</td>
<td>7.67 ± 0.65&lt;sup&gt;A&lt;/sup&gt;</td>
<td>8.33 ± 0.78&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
<tr>
<td>60</td>
<td>7.25 ± 0.62</td>
<td>7.50 ± 0.52</td>
<td>8.08 ± 0.67&lt;sup&gt;A&lt;/sup&gt;</td>
<td>7.67 ± 0.49&lt;sup&gt;A&lt;/sup&gt;</td>
<td>8.33 ± 0.65&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

1 Each pork jerky treatment was dried after being cured by immersing for 6, 12, 24, and 48 h.
2 Each pork jerky treatment was dried after being cured by tumbling for 10, 20, 30, and 60 min.
All values are mean ± standard deviations.
A-D Means with different superscripts within each treatment are significantly different (P < 0.05).
a, b Means with different superscripts within the same curing method are significantly different (P < 0.05).

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