Evaluation of the meat quality Yankasa rams fed graded levels of biscuit waste

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Abstract
Twenty Yankasa rams aged between 10 and 12 months with average weight of 12.15kg were used to evaluate the effect of different levels of biscuit waste and Leucaena leucocephala meal inclusion in diets on the quality of their meat samples. The rams were randomly assigned to five treatment diets of 0%, 25%, 50%, 75% and 100% of combined biscuit waste and Leucaena leucocephala in replacement for combined maize and wheat offals or B0, B2, B3, B4 and B5 diets with four rams per diet for 91 days. Data were collected on physical, chemical and sensory variables of meat samples. The results showed that there were significant (P<0.05) differences in the cooking loss, water holding capacity, crude protein and overall acceptability of meat samples from the rams. All the parameters measured were better in meat samples from rams fed treatment diets B1 (25%) and B2 (50%) inclusion of biscuit waste and Leucaena leucocephala meal. The results revealed that feeding biscuit waste to Yankasa rams can improve the quality as well as the consumer acceptability of Yankasa rams meat (mutton).

Key words: Yankasa rams, physicochemical, sensory, biscuit waste, meat.

Introduction

Meat quality evaluation is very important in improving meat production and consumption which is hitherto dependent upon the quality of raw materials fed to the animals and the processing techniques (Berbera and Tassone 2006). Meat of sheep (mutton) is well accepted in Nigeria and other nations, hence their production should be greatly improved through breed crossing with selected good meat types, practicing better feeding and management (Hoffman et al., 2003). Sheep are widely distributed throughout the sub-humid and semi-arid zones and produce, aside meat, milk and skin including other by products (Adewunmi et al., 2006). Meat quality is a measure of meat palatability and acceptability to consumers (Renand and Fisher 1997).

Consumers demand for meat and meat products depend on many criteria such as species of animal, age, sex and eating quality factors like flavour, tenderness, juiciness, colour, texture and overall acceptability which are on a large scale determined by the water holding capacity of the meat (Joseph et al., 1995). The most spectacular factors that affect meat composition and quality in animals are diet formulation and nutrient intake of the animals (Jeremiah et al., 1997), therefore, efforts have to be concentrated on how to improve the quality of feed supplied to meat animals with the view to harvesting superior meat. (Adeyanju et al., 1975). Biscuit waste meal comprises high quality ingredients that have been extracted from food sources intended for
human consumption; it is palatable and high in energy (Olayemi et al., 2007). It has been reported (Alonge 1987) that above 5% of 1,500 tons of biscuit products per week of the manufacturing industry is discarded as waste. There has to be some means of utilizing these wastes in order to prevent environmental hazards (Ayagbile et al., 1998). Biscuit waste compounded with *Leucaena leucocephala* is very rich in protein and can be used to improve the growth of sheep and meat quality. However, comprehensive reports on meat quality of sheep fed biscuit waste are relatively scarce, such information is vital to provide a broad picture of the probable effect of change in meat characteristics or quality arising from feeding these wastes. This study was therefore, designed to evaluate the physicochemical and sensory characteristics of yankasa rams fed graded levels of biscuit waste.

**Materials and Methods**

**Experimental site**
The study was carried out in the College of Agricultural Sciences (Sheep and Goat Unit) Olabisi Onabanjo University, Yewa Campus, Ayetoro, Ogun State.

**Experimental Diet**
Biscuit wastes were purchased from a reputable feed mill at Ibadan and *Leucaena leucocephala* leaves were harvested from the Research Farm of the College. Five experimental diets were formulated (Table 1). The diets contained 0%, 25%, 50%, 75% and 100% combined biscuit waste and *Leucaena leucocephala* in replacement for combined maize and wheat offal: B0, B1, B2, B3 and B4 treatment diets. Proximate analysis of experimental diets was determined (AOAC, 2002).

**Experimental Animals**
Twenty Yankasa rams, between 10-12 months of age weighing 12.15kg were randomly assigned to the diets at the rate of 4 animals per treatment after 14 days adaptation period. The experiment lasted for 91 days during which period the animals were allowed to graze in the day and were fed the test diets in the morning and evening while water was given ad libitum (Okubanjo 1997).

**Slaughtering and processing of carcasses.**
The rams were slaughtered at the end of the experiment by cutting the jugular veins and carotid arteries of the neck region after fasting them for over 16 hours (Okubanjo 1997). The carcasses were skinned, eviscerated and chilled for 24 hours after which they were dissected into primal cuts viz, leg, loin, rack, shoulder breast-flank and shank (BSF) (Awosanya and Okubanjo 1993).

**Cooking of Meat**
Chops of meat, 5cm thick were removed from the anterior side of the loin and leg weighed, (10g) and fried in vegetable oil for 15 minutes to an internal temperature of 72°C (Awosanya and Okubanjo 1993).

**Determination of cooking loss and water holding capacity**
Cooking loss of the meat chops was determined by taking the initial weight of the chops before cooking and their final weights after cooking.

\[
\text{Cooking loss} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100
\]

Water holding capacity (WHC) was determined by placing 1g of each chop between two filter papers and then enclosed with two plexiglasses and pressed between two jaws of a vice with approximately 35.60kg/cm² for 1 minute. The areas of free water and pressed meat samples were measured using grid method while percent free water was
calculated based on meat samples weight and moisture content (Suzuki et al. 1991).

Thus: WHC is calculated as follows

\[
\text{WHC} = \left( \frac{100 - (Aw - Am) \times 9.47}{Wm \times Mc} \right) \times 100
\]

Where: 
- \( Aw = \) Area of water released from meat samples (cm\(^2\))
- \( Am = \) Area of meat samples (Cm\(^2\))
- \( Wm = \) Weight of meat samples (g)
- \( Mc = \) Moisture content of meat samples (%)
- 9.47 = Constant factor.

**Chemical Analysis of meat samples**

This was carried out following the procedures of A.O.A.C (2002).

**Sensory Evaluation**

Cooked (fried) meat from loin chops were served in plates to a 10-member taste panel drawn from the students and staff population of the department to adjudge the test for flavour, tenderness, juiciness and overall acceptability of meat samples on a 9-point hedonic scale where (1) corresponds to extremely dislike and (9) to extremely like. Panelists were semi-trained before commencing the test and were supplied with craker biscuits and water in between the samples. (AMSA 1995).

**Statistical Analysis**

The data collected from this study were subjected to statistical analysis using SAS (2000), and the means were separated with Duncan Multiple Range Test of the same software.

**Results and Discussion**

The composition of experimental diets is shown in (Table 1) the table shows that the dry and organic matters of the diet as well as the crude protein and energy were high enough for feeding ruminants to produce high quality meat though, the crude protein and energy of the diets reduced as the percentage inclusion of biscuit waste and *Leucaena leucocephala* meal increased, nonetheless, the levels of protein and energy of the diets compared favourably with those reported by (Olayemi et al., 2007).

Table 2 shows the mean physical properties of meat samples from Yankasa rams fed graded levels biscuit waste. The results show that there were of significant (P<0.05) difference in all the physical variables measured. The cooking loss was highest (P<0.05) in loin chops from rams fed diets B\(_3\) and B\(_4\) (20.00%) each and least (P<0.05) in chop from rams fed diet B\(_1\) (10.00) while chops from rams fed diets B\(_0\) and B\(_1\) had the same (P>0.05) cooking losses (15.00%) each. The cooking loss was highest (P<0.05) in leg slice from rams fed diet B\(_3\) (21.60%), followed (P<0.05) by that of slice from rams fed diet B\(_1\) (19.80%) and least (P<0.05) in slice from diet B\(_1\) (17.25%) while the cooking losses of leg slices from rams fed diets B\(_0\) and B\(_1\) were the same (P>0.05). The water holding capacity results show that meat samples from rams fed diet B\(_1\) and B\(_4\) had the same but highest (P<0.05) water holding capacity (88.00%) (79.00%) followed (P<0.05) by those meat samples from rams fed diets and B0 and %4 (76.80%) (76.05%) and least (P<0.05) in meat samples from rams fed diet B3 (75.00%). The results of cooking loss obtained in this study were higher than the values reported for cooking loss by (Omojola and Adesehinwa 2006; Fisher et al., 2000).
Table 1: Composition of Experimental diets

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>B0</th>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>32.50</td>
<td>24.37</td>
<td>16.02</td>
<td>8.13</td>
<td>-</td>
</tr>
<tr>
<td>Wheat offal</td>
<td>30.00</td>
<td>22.50</td>
<td>15.00</td>
<td>7.50</td>
<td>-</td>
</tr>
<tr>
<td><em>Leucaena leucocephala</em></td>
<td>-</td>
<td>7.50</td>
<td>15.00</td>
<td>22.50</td>
<td>30.00</td>
</tr>
<tr>
<td>Biscuit waste</td>
<td>-</td>
<td>8.13</td>
<td>16.05</td>
<td>24.37</td>
<td>32.50</td>
</tr>
<tr>
<td>PKC</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
</tr>
<tr>
<td>BDG</td>
<td>23.50</td>
<td>23.50</td>
<td>23.50</td>
<td>23.50</td>
<td>23.50</td>
</tr>
<tr>
<td>Premix</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>Oystershell</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>Bone meal</td>
<td>2.50</td>
<td>2.50</td>
<td>2.50</td>
<td>2.50</td>
<td>2.50</td>
</tr>
<tr>
<td>Salt</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>Total</td>
<td><strong>100.00</strong></td>
<td><strong>100.00</strong></td>
<td><strong>100.00</strong></td>
<td><strong>100.00</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

**Determined Analysis (%)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>B0</th>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>92.62</td>
<td>93.08</td>
<td>93.02</td>
<td>92.15</td>
<td>93.05</td>
</tr>
<tr>
<td>OM</td>
<td>83.40</td>
<td>87.52</td>
<td>84.11</td>
<td>82.50</td>
<td>82.05</td>
</tr>
<tr>
<td>CF</td>
<td>11.20</td>
<td>13.61</td>
<td>13.16</td>
<td>13.00</td>
<td>14.15</td>
</tr>
<tr>
<td>EE</td>
<td>3.17</td>
<td>7.56</td>
<td>2.34</td>
<td>2.21</td>
<td>2.08</td>
</tr>
<tr>
<td>ASH</td>
<td>10.40</td>
<td>9.66</td>
<td>9.80</td>
<td>8.56</td>
<td>9.25</td>
</tr>
<tr>
<td>NFE</td>
<td>52.60</td>
<td>47.77</td>
<td>53.42</td>
<td>54.19</td>
<td>43.53</td>
</tr>
<tr>
<td>Calculated ME (kca.kg)</td>
<td>3.15</td>
<td>3.10</td>
<td>2.95</td>
<td>2.92</td>
<td>2.85</td>
</tr>
</tbody>
</table>

Legends: PKC: Palm kernel cake, BDG: Brewers dried grain, DM: Dry Matter
BDG: Brewers dried grain, DM: Dry matter, OM: Organic matter, CP:Crude protein, CF: Crude fibre, EE: Ether extract, NFE: Nitrogen free extract
ME: Metabolizable energy

Table 2: Mean physical properties of meat samples from rams

<table>
<thead>
<tr>
<th>Variable</th>
<th>B0</th>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loin chop Weight (g)</td>
<td>105.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>105.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>95.00&lt;sup&gt;c&lt;/sup&gt;</td>
<td>100.00&lt;sup&gt;b&lt;/sup&gt;</td>
<td>90.00&lt;sup&gt;d&lt;/sup&gt;</td>
<td>4.58</td>
</tr>
<tr>
<td>Cooking loss (%)</td>
<td>15.00&lt;sup&gt;b&lt;/sup&gt;</td>
<td>10.00&lt;sup&gt;c&lt;/sup&gt;</td>
<td>15.00&lt;sup&gt;b&lt;/sup&gt;</td>
<td>20.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>20.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.63</td>
</tr>
<tr>
<td>Leg slice weight (g)</td>
<td>255.00&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>250.00&lt;sup&gt;b&lt;/sup&gt;</td>
<td>260.00&lt;sup&gt;c&lt;/sup&gt;</td>
<td>230.00&lt;sup&gt;c&lt;/sup&gt;</td>
<td>220.00&lt;sup&gt;d&lt;/sup&gt;</td>
<td>9.32</td>
</tr>
<tr>
<td>Cooking loss (%)</td>
<td>18.50&lt;sup&gt;c&lt;/sup&gt;</td>
<td>17.25&lt;sup&gt;d&lt;/sup&gt;</td>
<td>18.30&lt;sup&gt;c&lt;/sup&gt;</td>
<td>21.60&lt;sup&gt;a&lt;/sup&gt;</td>
<td>19.80&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.68</td>
</tr>
<tr>
<td>WHC (%)</td>
<td>76.80&lt;sup&gt;b&lt;/sup&gt;</td>
<td>88.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>77.90&lt;sup&gt;a&lt;/sup&gt;</td>
<td>75.00&lt;sup&gt;c&lt;/sup&gt;</td>
<td>76.05&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.23</td>
</tr>
</tbody>
</table>

<sup>a,b,c,d</sup> Means within the same row with differing superscripts are significantly different (P<0.05)

WHC: Water holding capacity
Meat quality of rams fed biscuit waste

Table 3: Mean percentage proximate composition of rams meat sample

<table>
<thead>
<tr>
<th>Treatment diets</th>
<th>Variable</th>
<th>B0</th>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Moisture content</td>
<td>71.60</td>
<td>71.85</td>
<td>72.10</td>
<td>71.45</td>
<td>71.55</td>
<td>0.92</td>
</tr>
<tr>
<td></td>
<td>Crude protein (%)</td>
<td>18.75&lt;sup&gt;b&lt;/sup&gt;</td>
<td>19.60&lt;sup&gt;a&lt;/sup&gt;</td>
<td>19.40&lt;sup&gt;a&lt;/sup&gt;</td>
<td>18.85&lt;sup&gt;b&lt;/sup&gt;</td>
<td>18.60&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td>Ether extract (%)</td>
<td>7.45</td>
<td>7.05</td>
<td>7.35</td>
<td>7.40</td>
<td>7.80</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>Ash (%)</td>
<td>1.15</td>
<td>1.00</td>
<td>1.15</td>
<td>1.15</td>
<td>1.20</td>
<td>0.03</td>
</tr>
</tbody>
</table>

<sup>ab</sup> Means within the same row with differing superscripts are significantly different (P<0.05).

for rabbits, barrows and gilts. Also the values obtained for water holding capacity in this study were not inagreement with the values reported by (Geenty et al., 1979; Kempster et al., 1976) which could be due to differences in breed, feed quality as well as the cooking method employed.

The mean percentage proximate composition of meat samples from yankasa rams fed graded levels of biscuit waste is presented in (Table 3). The results show that there were no significant (P>0.05) differences in all the proximate variables tested except in the crude protein content of the meat samples. Meat samples from rams fed diet B<sub>1</sub> and B<sub>2</sub> had the highest (P<0.05) crude protein (19.60%), (19.40%) while the crude protein of meat samples from rams fed diets B<sub>3</sub>, B<sub>4</sub> and B<sub>5</sub> in that order were highly (P<0.05) accepted while the meat samples from rams fed diet B<sub>4</sub> was least (P<0.05) preferred by the taste panelist. The results also show that values for flavour, juiciness and tenderness as well as overall acceptability were numerically highest in meat samples from rams fed diet B<sub>1</sub> and closely followed by those from rams fed diet B<sub>2</sub>. These results revealed that the levels of diets tested did not affect the sensory properties of rams adversely, which could be due to the quality of feed (biscuit waste) given to the rams.

Table 4: Mean scores for sensory evaluation of ram’s meat samples

<table>
<thead>
<tr>
<th>Treatment diets</th>
<th>Variable</th>
<th>B0</th>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flavour</td>
<td>6.21</td>
<td>6.82</td>
<td>6.80</td>
<td>6.32</td>
<td>6.32</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>Tenderness</td>
<td>6.43</td>
<td>6.91</td>
<td>6.81</td>
<td>6.43</td>
<td>6.73</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>Juiciness</td>
<td>6.52</td>
<td>6.94</td>
<td>6.65</td>
<td>6.52</td>
<td>6.52</td>
<td>0.27</td>
</tr>
<tr>
<td>Overall acceptability</td>
<td>6.52&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.81&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.72&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.24&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.20&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.26</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a,b</sup> Means within the same row with differing superscripts are significantly different (P<0.05).
Conclusion
The results form this study show that Yankasa rams fed graded levels of biscuit waste compared favorably with the rams fed control (BO) diet and that physical, chemical and sensory properties measured were better in meat samples from rams fed treatment diets B1 and B2 followed by others. But, in general it was observed that biscuit waste meal in combination with leucaena leucocephala can be used in replacement of maize and wheat offal to improve the quality as well as the consumer acceptability of Yankasa rams meat (mutton).

References


