Sensory and chemical/physical characteristics of broiler breast fillets from Brazil, Thailand and The Netherlands

S. KOK, J. VAN DER PALEN and G. HEMKE*

CCL Research, Meat Research, P.O. Box 107, 5460 AC Veghel, The Netherlands
*gert.hemke@ccl.nl

Keywords: chicken; meat quality; Brazil; Thailand; The Netherlands

Summary
Sensory evaluation and objective meat quality measurements were performed on fresh broiler breast fillets from The Netherlands and frozen broiler breast fillets from Brazil, The Netherlands and Thailand. Drip loss was highest for Brazilian fillets (P<0.05). Cooking loss and shear force were higher for fillets from Brazil and Thailand than for fresh or frozen fillets from The Netherlands (P<0.05). Colour differences were also noted between the fillets. Fresh fillets exhibited the highest L*-value, fillets from Thailand exhibited the highest a*-value, and fillets from Brazil exhibited the highest b*-value (P<0.05). Sensory evaluation confirmed the objective measurements with fillets from The Netherlands being judged the most tender and juicy (P<0.05). Chicken flavour was most intense for frozen fillets from the Netherlands, whereas off flavour was more intense for fillets from Brazil and Thailand than for fillets from The Netherlands. Overall it can be concluded that the sensory quality of the Dutch fillets was superior to the fillets from Brazil and Thailand. If the results of this experiment properly reflect a general difference in quality between European chicken and frozen imported chicken from low-cost countries, it may give the European poultry processors a competitive edge.

Introduction
The import of chicken breast fillet from Brazil and Thailand in Europe grows rapidly. Growth percentages of more than 300% are common (PVE, 2003). An explanation for this growth is the relatively low cost of fillets from Brazil and Thailand. To be able to compete, European poultry processors have to focus on fresh, instead of frozen chicken, and quality rather than low cost production. A classic example of this strategy is the Label Rouge poultry system in France (Westgren, 1999).

The ISO definition of quality is “the totality of features and characteristics of a product that bear on its ability to satisfy stated or implied needs” (ISO 1986). Quality aspects of meat include food safety, sensory quality, animal welfare and sustainability of production. With regard to sensory quality, appearance criteria are important in choosing meat, but in re-purchase, factors like taste may dominate over appearance (Dransfield et al., 2005). Thus, to be able to compete with frozen chicken from low-cost countries on sensory aspects, European fresh chicken has to be superior in appearance and taste. In the present study we investigated whether there are differences in sensory and technological quality of fresh and frozen Dutch broiler breast fillets and frozen Brazilian and Thai broiler breast fillets.

Material and methods

MATERIAL
Broiler breast fillets were obtained from two Dutch processing plants. No data were available on differences in breed, feeding, husbandry, age and slaughtering processes. Fillets were transported chilled to CCL Research and stored at 3°C until analyses were performed.

MEAT QUALITY MEASUREMENTS
For the measurement of drip loss, cooking loss, shear force and colour 9 fresh and 10 frozen broiler breast fillets from the Netherlands were used and 15 fillets from Brazil and Thailand each. Weights
were recorded for all of these fillets. Intramuscular fat was measured on 5 fillets from the respective groups. Measurement of Intramuscular fat (g/kg) was performed by a commercial laboratory (CCL Nutricontrol) according to ISO/IEC 17025:2000.

Colour (L*-a*-en b*-values) of the fillets was determined using a Minolta Chromameter CR-210 (Minolta Co., Osaka, Japan).

For determination of drip loss (%), two circular samples with a diameter of 4 cm were removed from the fillets using a cork borer. The samples were weighed, hanged on a hook in individual closed containers and stored for 48 hours at 4-6 °C. After storage, the samples were patted dry with paper towel, and drip loss (%) was determined by reweighing the samples.

For the determination of cooking loss (%), vacuum packaged fillets were cooked during 1 hour in a waterbath at 75°C and chilled under running tapwater. After cooking, the samples were patted dry with paper towel, and cooking loss was determined by reweighing the samples. The same samples were used for shear force measurement. Of each sample 4 till 9 rectangular subsamples of 1 cm² were cut parallel with the fibre direction. Shear force (N/cm²) was determined perpendicular to the fibre direction using a draw bench (Adamel Lhomargy DY 30; Division d'Instruments S.A., Paris, France) equipped with a triangular shearing blade.

SENSORY EVALUATION

Sensory evaluation was performed on both cooked and grilled fillets. Cooked fillets were vacuum packaged and heated during 1 hour in a waterbath at 75°C. Grilled fillets were grilled, without added fat or oil, at 185°C on a Tristar TSK grill plate (Tristar b.v., The Netherlands), with regular turning of the fillets until the meat was done.

Before evaluation of the samples, all panellist (10) received a training on the attributes tenderness, juiciness, chicken flavour and off flavour of the fillets. Panellist became acquainted with the samples and procedures and were trained on the scale use.

After grilling and cooking, samples (1 x 2-3 cm) were cut from the centre of the fillets, wrapped in aluminium foil to prevent cooling, and transferred to the panellist. Two samples per fillet were served warm to each panellist. The panellists scored one sample on chicken flavour and off-flavour and the other sample on tenderness and juiciness.

Individual evaluation took place in separate cabins. The attributes were scored on a nine point scale. The scales were anchored at 1 with “not at all” and at 9 with “extremely”. The samples were judged warm, at random and in duplicate, with a total number of 32 samples for each person.

Four series of samples were evaluated. The first two series were on cooked fillet, the second two series on grilled fillet. There were 8 different samples per series. Between the samples panellist could use water and crackers to neutralise the taste.

STATISTICAL ANALYSIS

Data from the chemical/physical measurements and the sensory evaluation were analysed using the SAS statistical software package (SAS Institute Inc., 1990). Two-way analysis of variance was conducted using the Generalised Linear Models (GLM procedure) of SAS, using the following model:

\[ Y = \text{Country} + \text{error}. \]

P< 0.05 was taken as a significance level.

Results and discussion

MEAT QUALITY MEASUREMENTS

Cooking loss and shear force were lowest (P<0.05) for the Dutch fillets (Table 1). The differences in cooking loss are likely explained by the difference in weight of the fillets. In a separate experiment it was determined that the cooking loss of Dutch fillets is significantly related to the weight of the fillets (data not shown).

Numerous factors may affect the shear force of breast fillets like animal age (Iqbal et al., 1999), diet (Lyon et al., 2004), preslaughter stress (Abdalla et al., 1999), stunning (Savenije et al. 2002), chilling, time of deboning, and ageing time (Smith et al., 1992). It is not known which of these factors are responsible for the observed differences. However, it is evident that many factors should be controlled to produce consistently tender chicken.

Drip loss was significantly higher for the Brazilian fillets (P<0.05). A possible explanation for increased drip loss is heat stress (Sandercock et al., 2001). Evidently, the risk of heat stress is bigger
in countries with a hot climate, like Brazil, than in countries with a more temperate climate like the Netherlands.

The L*-value (lightness) was highest for the fresh fillet, and no differences were observed between the frozen fillets. Dutch fillets were less red (lower a*-values) and less yellow (lower b*-values) than the fillets from Brazil and Thailand. Thus, fresh fillets were different in appearance from frozen fillets and the appearance was affected by country of origin. However, it remains to be determined which colour consumers prefer. As for shear force, numerous factors affecting colour can be found in the literature on the subject. Which factors are mainly responsible in the present study is unknown.

Differences in intramuscular fat content were not significant (P>0.05). This might be due the fact there were only 5 samples from each country were analysed on this parameter.

<table>
<thead>
<tr>
<th>Country</th>
<th>Brazil</th>
<th>Thailand</th>
<th>Dutch frozen</th>
<th>Dutch fresh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (g)</td>
<td>89.9³</td>
<td>66.0¹</td>
<td>168.2¹</td>
<td>191.8³</td>
</tr>
<tr>
<td>Drip loss (%)</td>
<td>2.2²</td>
<td>1.2¹</td>
<td>0.9¹</td>
<td>1.1¹</td>
</tr>
<tr>
<td>IMF (g/kg)</td>
<td>6.4</td>
<td>3.8</td>
<td>4.6</td>
<td>5.8</td>
</tr>
<tr>
<td>Cooking loss (%)</td>
<td>24.4³</td>
<td>27.4²</td>
<td>16.9¹</td>
<td>16.7¹</td>
</tr>
<tr>
<td>Shear force (kg)</td>
<td>35.2³</td>
<td>42.7²</td>
<td>22.6¹</td>
<td>11.8¹</td>
</tr>
<tr>
<td>L*-value</td>
<td>55.5¹</td>
<td>54.5²</td>
<td>53.0¹</td>
<td>57.7¹</td>
</tr>
<tr>
<td>a*-value</td>
<td>13.1³</td>
<td>14.3²</td>
<td>11.6¹</td>
<td>10.8¹</td>
</tr>
<tr>
<td>b*-value</td>
<td>12.0³</td>
<td>9.7²</td>
<td>5.0³</td>
<td>6.7³</td>
</tr>
</tbody>
</table>

Means in rows without a common superscript differ significantly (P<0.05)

SENSORY EVALUATION

Sensory evaluation revealed significant differences (P<0.05) between the countries (Table 2). Tenderness scores confirmed the results of the shear force measurements, with fresh fillets being most tender and Dutch fillets being more tender than fillets from Brazil and Thailand. Differences in cooking loss were reflected in differences in juiciness, with fillets from Thailand having the highest cooking loss and the lowest juiciness score. Chicken flavour was highest for the frozen Dutch fillets. The reason for this is unclear. Off flavour was lowest for the fresh fillets and highest for the fillets from Thailand.

<table>
<thead>
<tr>
<th>Country</th>
<th>Brazil</th>
<th>Thailand</th>
<th>Dutch frozen</th>
<th>Dutch fresh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenderness</td>
<td>3.9³</td>
<td>4.8²</td>
<td>7.3¹</td>
<td>8.1³</td>
</tr>
<tr>
<td>Juiciness</td>
<td>4.4¹</td>
<td>3.3²</td>
<td>5.9³</td>
<td>5.6³</td>
</tr>
<tr>
<td>Chicken flavour</td>
<td>5.7³</td>
<td>5.1³</td>
<td>6.8³</td>
<td>5.8³</td>
</tr>
<tr>
<td>Off flavour</td>
<td>5.5²</td>
<td>6.1³</td>
<td>4.6²</td>
<td>4.1³</td>
</tr>
</tbody>
</table>

Means in rows without a common superscript differ significantly (P<0.05)

Overall it can be concluded that the sensory quality of the Dutch fillets was superior to the fillets from Brazil and Thailand. If the results of this experiment properly reflect a general difference in quality between fresh European chicken and frozen imported chicken from low-cost countries, it may give the European poultry processors a competitive edge. To capitalise on this, these quality differences should be made evident to the consumer. As mentioned above, the quality of chicken is influenced by a multitude of factors. To maintain a competitive edge with regard to quality, the European poultry industry should focus on optimising the different factors that affect quality.

References


