Effect of grape pomace supplementation on broiler performance and eating quality

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Background

Modern consumers have an increased interest in natural and “clean label” products.

Consumers prefer to read for example “rosemary extract” not “butulated hydroxytoluene” (Zink, 1997; Joppen, 2006)

They are willing to pay significant premiums for such products.
Background

Lately, environmental consciousness has laid great social and political pressure for the re-utilisation of the agro-industrial co- and by products (Mirzaei-Aghsaghali and Maheri-Sis, 2008).

Fruit and plant co-/by- products that have a little effect in animal feeding as major feed components, have potential as functional feed ingredients. They are good sources of natural antioxidants due to their high phenolic content (Rice-Evans et al., 1997; Schieber et al., 2001).
Grape pomace

The by-product after grape pressing and wine/grape juice collection that contains grape seeds, skins, and/or stems.

Wine waste accounts for approximately 20% of wine production (Maier et al., 2009). Global production of grape pomace is 10 million tons (Negro et al., 2003).
Properties of phenolic compounds (Negro et al., 2003).

- Anti-inflammatory
- Anticarcinogenic
- Antioxidant

Principal phenolic compounds with demonstrated antioxidant activity (Makris et al., 2007): Anthocyanins, Flavanols, Proanthocyanidins, Hydroxycinnamates, Gallic acid.
Grape pomace concentrate could be a new source of antioxidant in animal nutrition – as equal in antioxidant potential as vitamin E (Brenes et al., 2008).

A dietary inclusion rate up to 30 g/kg of grape pomace did not impair chickens growth performance and protein and amino acids digestibilities and increased antioxidant activity in diet and excreta (Còni et al., 2007)
Pre-mortem addition of grape seed extract in broiler diets resulted in growth retardation (Lau and King, 2003).

Post-mortem inclusion of grape seed extract resulted in colour differences in cooked meat products (Lau and King, 2003; Carpenter et al., 2007; Ahn et al., 2007; Brannan, 2008)

Redder products may appear undercooked.
Objectives

To determine the effect of ground and dried grape pomace (simple processing procedure) inclusion on:

- Broiler performance
- Meat eating quality

The production of broiler meat with extended shelf life
Materials and methods (I)

- Four groups (4 replicates/group) of day old, mixed sex, Ross 308 chicks;
- Standard commercial diet containing either either 0 (CON), 2.5 (DGP 2.5), 5 (DGP 5) or 10 g/kg (DGP 10) feed ground and dried grape pomace for 42 days;
- Grape pomace consisted of peels, seeds and a small amount of stems from the Greek indigenous red grape variety Xinomavro;
Materials and methods (II)

Bird performance
Materials and methods (III)

- Refrigerated (4°C) air packed skinless breast (m. pectoralis superficialis) and thigh muscle (m. biceps femoris) samples for:
  - Lipid oxidation (TBARS) storage days 2 and 5
- Refrigerated (4°C) air packed skinless breast (m. pectoralis superficialis) for:
  - Colour evaluation (CIELAB system) storage days 1-5
- Vacuum packed frozen (-20°C) skinless breast samples for:
  - Sensory evaluation in 5 point scale by 10 panelists
## Results (I): Bird performance

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Daily weight gain</th>
<th>Weight 42 days</th>
<th>Carcass weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>CON</td>
<td>71.42±0.85</td>
<td>2484.55±25.55</td>
<td>1884.44±58.12</td>
</tr>
<tr>
<td>DGP 2.5</td>
<td>67.32±0.84</td>
<td>2358.17±25.52^a</td>
<td>1835.56±22.36^a</td>
</tr>
<tr>
<td>DGP 5</td>
<td>70.56±0.95</td>
<td>2458.61±28.65^b</td>
<td>1953.08±1.93^b</td>
</tr>
<tr>
<td>DGP 10</td>
<td>72.97±0.85</td>
<td>2535.13±25.92^c</td>
<td>1950.00±59.43^b</td>
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</tbody>
</table>
Results (II)

Breast muscle lipid oxidation levels during storage at 4°C

<table>
<thead>
<tr>
<th>TBARS (mg/kg muscle)</th>
<th>Storage day</th>
<th>Control</th>
<th>DGP 2.5</th>
<th>DGP 5</th>
<th>DGP 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>0,000</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>0,050</td>
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<td>0,100</td>
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<tr>
<td>0,300</td>
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<tr>
<td>0,350</td>
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<tr>
<td>0,400</td>
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</tbody>
</table>

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Results (III)
Thigh muscle lipid oxidation levels during storage at 4°C

![Bar chart showing TBARS levels during storage](chart)

- **TBARS (mg/kg muscle)**
  - 0.000
  - 0.050
  - 0.100
  - 0.150
  - 0.200
  - 0.250
  - 0.300
  - 0.350
  - 0.400

- **Storage day**
  - 2
  - 5

- **Pe 0.05**

- **Control**
- **DGP 2.5**
- **DGP 5**
- **DGP 10**

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Results (IV)
Breast colour redness ($a^*$) during storage at 4°C

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Results (V) : Breast colour difference ($\Delta E^*$) during storage at 4°C

$\Delta E^* = \left[ (L^*)^2 + (a^*)^2 + (b^*)^2 \right]^{1/2}$

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Results (VI) : Breast muscle sensory evaluation

- Colour
- Odour
- Tenderness
- Juiciness
- Fatness
- Fibrousness
- Aftertaste
- Taste
- Overall acceptability

Control
DGP 2.5
DGP 5
DGP 10

P≥0.05

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Results (VI) : Whole bird sensory evaluation

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Conclusions

- Grape pomace supplementation did not affect broiler performance;

- Inclusion of grape pomace at levels up to 10g/kg feed did not result to enhanced protection against lipid oxidation during refrigerated storage;

- The highest scores for overall acceptability were recorded for the samples from the broilers supplemented with 5g grape pomace/kg feed.
Future research

- Optimisation of the processing procedure for the reutilisation of grape pomace;

- Determination of the minimum and the optimum supplementation levels required for enhanced antioxidant protection and meat quality characteristics.
Acknowledgements

MERCI POUR VOTRE ATTENTION!