Essential oil compounds in combination with benzoic acid as a new feed additive concept: effects on performance of broiler chickens

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Abstract

Since the EU-ban on antimicrobial growth promoters, the poultry industry needs alternative products capable of positively modulating the gut microflora. A new feed additive formulation has been developed, which is based on the combination of a mixture of essential oil compounds (main actives: thymol, eugenol, piperine) and benzoic acid to improve digestion and to reduce the negative impact of harmful bacterial activity. This new product, CRINA® Poultry Plus (CPP), was tested in a performance study with broilers. CPP was added at 0, 150, 300 and 450 mg/kg to starter (0-22 d), grower (22-35 d) and finisher (35-42 d) broiler diets. Diets were wheat (40-45%) and barley (5%) based and fed to either Ross 308 males or females (62 birds/pen). AMEn for broilers (kcal/kg) / digestible lysine (g/kg) content was 2900/10.6, 3025/10.2, and 3050/10.0 for starter, grower and finisher respectively. Mineral as well as vitamin contents met the NRC requirements. Starter and grower diets contained a chemical coccidiostat and no NSP enzymes were used. All diets were pelleted and were tested with 6 pens (replicates) per gender. Feed and water were given ad libitum. Performance data was statistically analysed using ANOVA (Genstat) with diet and gender as treatment factors. No interaction effects between gender and diet or effect of dietary treatment on mortality were found. Feed conversion ratio (FCR) of the broilers on CPP was numerically improved in starter (+1%), grower (+1-1.5%) and finisher phase (+1-5%). This resulted in a significantly (P=0.03) improved FCR from 0 to 42 d, when at least 300 mg/kg CPP was supplemented. Over 42 days FCR varied from 1.760 for the unsupplemented groups and 1.741, 1.732 and 1.735 for the dietary groups when 150, 300 and 450 mg/kg CPP was added respectively. Under these conditions, the addition of 300 mg/kg CPP to a wheat/barley based broiler diet did significantly improve FCR of highly productive broilers from 0-42 days of age.

Key Words: Broilers, Feed additives, Essential oil compounds, Benzoic acid, Performance

Reference No.T95 - Page 30 in the abstract book
AIM OF THE STUDY
Since the EU-ban on AMGB’s, there is a need for alternative products, capable of positively modulating the gut microflora of poultry. In this context a new feed additive concept has been developed, which is based on the combination of a mixture of essential oil compounds (main actives: thymol, eugenol, piperine) and benzoic acid to improve digestion and to reduce the negative impact of harmful bacterial activity. This new product was tested in a performance study with broilers.

MATERIAL AND METHODS
- Ross 308 sexed male and female broilers
- Four dietary treatments based on addition of CRINA® Poultry Plus (=CPP)
- 6 replicates (floor pens) per gender x diet treatment and 62 birds per pen (4 m²)
- Starter (0-22 d), Grower (22-35 d) and Finisher 35-42 d diets; with 0, 150, 300 and 450 mg CPP/kg diet
- Per phase, diets based on 40-45% Wheat, 5% Barley and 18-20% Soybean meal (AMEn: 12.1, 12.6, 12.8 MJ/kg; dig. Lys: 10.6, 10.2, 10.0 g/kg) with a chemical coccidiostat in Starter & Grower feeds, no enzymes or AMGB.
- Feed (pelleted) and water for ad libitum intake
- Response parameters: Feed Intake (FI), Body Weight Gain (BWG) and Feed Conversion Ratio (FCR)
- Data analyzed with ANOVA (Genstat)

RESULTS
- No interactions between sex and dietary treatments
- High growth level: BW at day 42 was 2964 g (males) & 2498 g females. No dietary treatment effect
- Addition of 300 and 450 mg/kg CPP improved FCR significantly over 42 days (Graph 1). Overall improvement of FCR by addition of CPP became larger towards the end of the fattening period (Graph 2)

CONCLUSION
CRINA® Poultry Plus at 300 g per ton of feed can be considered as the optimum dietary supplementation level to significantly improve growth of broiler chicks under semi-commercial husbandry conditions.
Dose response effects of a formulation of essential oil compounds with an organic acid in broilers

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Abstract

A 6-week floor pen experiment was conducted in order to evaluate the efficacy of CRINA® Poultry Plus (CPP), a combination of essential oil compounds (thymol, eugenol, piperine) with benzoic acid, when added to a wheat-based diet in broilers (Ross PM3). Control diets were formulated with 3000 kcal metabolisable energy and 20% crude protein or 3100 kcal metabolisable energy and 19% crude protein for starter (1-22 days) and grower periods (23-43 days) respectively. CPP was added at inclusion levels of 0 (control), 200, 300 and 400 g/T of feed. Each of the 4 dietary treatments was assigned to 6 pens of 40 male and 6 pens of 51 female birds. Body weight at 22 and 43 days of age and feed conversion ratio (FCR) per pen and per period were monitored as performance parameters. At 23 days, cecal contents from 4 birds per pen were collected and analyzed for specific intestinal bacteria (Lactobacilli, Clostridium, Coliforms and Streptococci). At 44 days, carcass yield was measured on 5 birds per pen. No differences between groups were observed for FCR, cecal microorganisms or carcass yield, but growth was improved. In females, dietary supplementation with CPP at 300 g/T significantly improved weight at 22 days of age from 760 g (negative control) to 790 g (+ 3.9%). In males, dietary supplementation with CPP at 300 g/T significantly improved weight at 22 days of age from 795 g (negative control) to 866 g (+ 8.9%) and weight at 43 days of age from 2757 g (negative control) to 2860 g (+3.7%), respectively. Since CPP300 resulted in the highest body weight of all treatments (significant on day 22), 300 ppm of CPP was considered as the optimum dose. CPP demonstrates the ability to improve broiler performance and potentially function as an alternative to antibiotic growth promoters.

Key words: benzoic acid, thymol, eugenol, growth, broiler

Reference No.T96 - Page 30 in the abstract book
AIM OF THE STUDY
To determine the potential effects of a novel eubiotic feed additive (CRINA® Poultry Plus, DSM Nutritional Products Ltd, Basel, Switzerland), containing a mixture of essential oils compounds (thymol, eugenol, piperine) with benzoic acid, on growth performance in broiler chicks.

MATERIAL AND METHODS
- 2,184 day-old broiler chicks of the breed ROSS PM3, separated by sex, raised in 3 m² floor pens.
- Basal diet: wheat and soybean meal, fed as pellets ad libitum.
- 2 experimental periods: day 1 to 22 and day 23 to 43.
- 4 experimental treatments: Control and CRINA Poultry Plus at 200 g/t, 300 g/t or 400 g/t.
- 6 replicates per treatment and per sex (51 females or 40 males per replicate).

RESULTS

Graph 1 Effect on body weight at day 22

Graph 2 Effect on body weight at day 43

DISCUSSION
- Positive dose response effect of CRINA Poultry Plus on weight at day 22 and day 43 for males.
- Positive dose response effect of CRINA Poultry Plus on weight at day 22 for females.
- No effect of CRINA Poultry Plus on feed to gain ratio.

CONCLUSION
CRINA® Poultry Plus at 300 g per ton of feed can be considered as the optimum dietary supplementation level to significantly improve growth of broiler chicks under semi-commercial husbandry conditions.
Effect of a wheat-based diet supplemented with a formulation of benzoic acid and essential oils compounds on broiler performance

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Abstract

This trial was conducted at the Avian Research Centre of the Scottish Agricultural College (UK) to investigate the ability of CRINA® Poultry Plus (CPP), a formulation of benzoic acid and essential oils compounds (including thymol, eugenol, piperine), to improve broiler performance. 688 Ross 308 broilers from one breeder flock were distributed into two treatment groups with 8 pens per treatment (4 containing male and 4 containing female) in a randomized block design. The period of the trial was 40 days in order to achieve body weights representative of commercial field results and the stocking density was 33 kg/m² to mimic challenging commercial conditions. Treatment one [T1] contained no growth promoter additives (negative control) and treatment two [T2] contained 300 mg/kg CPP. A 4-phase feeding schedule was applied and the same wheat based diet was used for both treatments and formulated: at 12.8 MJ/kg and 23 % crude protein for the starter period (1-11 days), 13.1 MJ/kg and 20.0 % crude protein for the grower phase (11-25 d), 13.5 MJ/Kg and 18 % crude protein for the finisher phase (25-35 d) and the withdrawal phase (35-40 d). Both feed and water were available ad libitum throughout the study. In all experimental periods, the body weight (BW) of broilers fed T2 was significantly higher than T1 with a final difference of 131 g in favor of the CPP group of which the average weight was 2,614 g at 40 d. An improvement in the feed conversion ratio (FCR) was also observed in all growth phases. FCR in T2 at 40 days was 1.56, which was significantly higher (+7 points) than the control (T1). In conclusion, CPP is a tool to consider for improving the profitability of modern broiler operations.

Key Words: essential oils, organic acid, broiler, performance

Reference No.P155 - Page 47 in the abstract book
Effect of a wheat-based diet supplemented with a formulation of benzoic acid and essential oils compounds on broiler performance

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AIM OF THE STUDY

Since the ban of Antibiotic Growth Promoters in 2006, the market offers a large range of alternatives. In poultry, organic acids and essential oils are considered to be the most effective and profitable solutions to maintain gut health. Recent studies demonstrated the efficacy of their combinations. In this context the poultry research station of Scottish Agricultural College (UK) investigated different feed additives aiming at improving broiler productivity. This experiment evaluated the effect of CRINA® Poultry Plus (CPP), which includes the essential oil compounds (thymol, eugenol, piperine) and benzoic acid.

MATERIAL AND METHODS

- 688 broilers Ross 308 - 8 pens per treatment (4 with males and 4 with females)
- Duration of the experiment: 40 days
- 2 treatments: T1: control diet not supplemented with any growth promoting additive (negative control) and T2: T1 + CRINA® Poultry Plus (CPP) 300 ppm
- Feeding program in 4 phases with the same diet based on wheat for all treatments:
  - Starter (1-11 days): 12.8 MJ/kg, 23 % total protein, coccidiostat: Maxiban; Grower (11-25 d): 13.1 MJ/kg, 20 % TP, coccidiostat: monensin; Finisher (25-35 d) and Withdrawal (35-40 d): 13.5 MJ/Kg and 18 % TP
- Feed and water available ad libitum
- Tested parameters: Liveweight (LW): the birds were weighed at the start and at the end of each feeding phase; Feed Intake (FI) and Feed Conversion Ratio (FCR); European Production Efficiency Factor (EPEF)

RESULTS

Table 1: Effect on liveweight (LW, in g) at different ages

<table>
<thead>
<tr>
<th>Treatment/Day</th>
<th>10</th>
<th>25</th>
<th>35</th>
<th>40</th>
</tr>
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<tbody>
<tr>
<td>T1 - Control</td>
<td>313</td>
<td>2'40a</td>
<td>2'080a</td>
<td>2'521a</td>
</tr>
<tr>
<td>T2 - CRINA Poultry Plus</td>
<td>320</td>
<td>1'262b</td>
<td>2'220b</td>
<td>2'652b</td>
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</tbody>
</table>

Graph 1: Effect on FCR

Table 2: Effect on European Production Efficiency Factor (EPEF)

<table>
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<tr>
<th>at day 40</th>
<th>T1 - Control</th>
<th>T2 - CRINA Poultry Plus</th>
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</thead>
<tbody>
<tr>
<td>EPEF</td>
<td>371a</td>
<td>397a</td>
</tr>
</tbody>
</table>

CONCLUSION

This experience confirms and strengthens previous observations that showed a significant improvement in chicken production indices (LW and FCR) by supplementing feed with CRINA® Poultry Plus compared to a negative control. CRINA® Poultry Plus is a tool to consider for improving productivity and profitability in broiler production.
Effect of a formulation of benzoic acid and essential oil compounds on performance and intestinal micro-flora population of broilers

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Abstract

The aim of this experiment was to evaluate the effects of a formulation of essential oil compounds (thymol, eugenol, piperine) and benzoic acid (CRINA® Poultry Plus, CPP) on performance and intestinal micro-flora of broilers. One day old broiler chicks were randomly allocated to 3 different treatments, replicated with 6 pens of 32 males and 6 pens of 36 females, each. The same wheat based diet in pellet form was used for all treatments and formulated at 12.3 MJ/kg and 20.7% crude protein for the starter period (1-21 days) and 12.7 MJ/kg and 20.0% crude protein for the grower period (22-42 days). CPP was added to the feed at 0 mg/kg from 1 to 42 days for T1; 300 mg/kg from 1 to 42 days for T2; 450 mg/kg up to 22 days, 150 mg/kg up to 42 days for T3. Over the entire growth period, body weight was slightly higher with T2 and T3 compared to T1. The results at 42 days of age are presented in Table 1. Feed conversion was improved for T2 and T3 and significantly decreased (p <0.05) with the step down program T3 (-0.02 compared to T1). There was a reduction of the counts of potentially pathogenic bacteria (Clostridia, Coliforms, Streptococci) without any negative effect on Lactobacilli, in the ceca of broilers fed with T2 and T3. In conclusion, CPP improved feed conversion and tended to positively modulate the intestinal micro-flora population of highly productive broilers.

Key Words: Broilers, Essential oils, Benzoic Acid, Performance, Intestinal micro-flora

Reference No.P158 - Page 47 in the abstract book
Effect of a formulation of benzoic acid and essential oil compounds on performance and intestinal micro-flora population of broilers

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2) DSM Nutritional Products Ltd, Basel, Switzerland

AIM OF THE STUDY
Healthy balance of micro-flora in the gastrointestinal tract is closely related with performance in broilers: this is of greatest interest among broiler producers because of its impact on economic profitability. Since the EU-ban on antibiotic growth promoters, there is a need of the poultry industry for alternative products aimed at positively modulating the gut micro-flora. In this context a new feed additive concept CRINA® Poultry Plus (CPP) has been developed by the DSM research, which exploits the synergy between selected essential oil compounds (thymol, eugenol, piperine) and benzoic acid. The aim of the study was to determine the potential effects of this product on broiler growth performance and bacterial profile of its intestinal micro-flora.

MATERIAL AND METHODS
- Floor pen trial with 3 treatments and 12 replicates per treatment (6 per sex): T1 = Control diet / T2 = T1 + CRINA® Poultry Plus 300 ppm / T3 = T1 + CPP 450 ppm (0-21d)/150 ppm (21-42d)
- Ross 308 sexed male and female broilers (32 males or 36 females per replicate)
- Diets: Starter feed (0-22 d), Grower feed (22-35 d) and Finisher feed (35-42d), all pelleted
- According to growth phase, diets were based on 44-50% Wheat, 21-22% Soybean meal (AMEn: 12,3-12,7 MJ/kg; Lys: 1,12-1,07) - Anticoccidials: diclazuril (D1-D21); monensin (D22-D35)
- Feed and water for ad libitum intake
- Analyzed parameters: feed intake, body weight gain (BWG), feed conversion ratio (FCR)
- At day 21, 1 or 2 birds per pen were removed for microbial profiling of the cecal flora

RESULTS
- Body weight: numerically higher in CPP treatments (Table1)
- Feed conversion: significantly superior with CPP 450/150 ppm (Graph1)
- Production value: numerically superior for CPP treatments (Table 2)
- Bacterial profiling (cecal micro-flora): numerical reduction of Clostridia, Coliforms and Streptococci for CPP; no negative effect on Lactobacilli. (Graph 2)

CONCLUSION
The addition of CRINA® Poultry Plus to a wheat based diet improved feed conversion ratio and body weight of highly productive broilers effectively over an entire fattening period. Parallel to growth improvement, the CRINA® Poultry Plus fed birds tended to show a positive modulation of their cecal micro-flora with a numerical reduction of coliforms, streptococci and clostridia, while the population of lactobacilli was maintained.
Effect of a formulation of benzoic acid with essential oil compounds on performance of broiler chicks

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Abstract

This study aimed at determining the effects of a mixture of essential oil compounds (thymol, eugenol, piperine) with benzoic acid (CRINA® Poultry Plus; CPP) on the performance of broiler chickens. Three hundred 1-day-old male chicks (Cobb 500) were allotted randomly to 3 dietary treatments, each replicated with 10 groups of 10 birds per pen. The pens were distributed along 2 drinking lines in a commercial broiler house, containing 8500 loose-housed birds of the same age. By that housing, the experimental chicks were exposed to the pressure of the loose-housed broilers with respect to health, hygiene, husbandry and stocking density. The experimental broilers were subjected to one of 3 treatments: T1 = basal diet not supplemented with CPP (control), T2 = basal diet with the addition of 150 mg/kg CPP or T3 = basal diet with the addition of 300 mg/kg CPP. A 4-phase feeding schedule was applied: Starter (days 0-10), grower (days 11-20), finisher (days 21-34) and withdrawal (days 35-42). All feeds were pelleted; both feed and water were available ad libitum throughout the 42 days of the study. Weight of chicks and feed consumption were determined on days 10, 28, 35 and 42. In all experimental periods the body weights (BW) of broilers supplemented with CPP (T2 and T3) were numerically superior to the control (T1), but the difference was only statistically significant in the starter period between T1 and T3. Feed intake was generally similar between the various treatments, but during the finishing period (days 35-42), T3 was significantly lower than T1 (P≤0.05). Over the entire trial, the feed conversion ratio (FCR) of T3 (1.62) was significantly lower than the FCR of T1 (1.69) (P≤0.05). The FCR of T2 (1.65) was intermediate. In conclusion, the supplementation of feeds with CPP tended to improve performance (BW, FCR) of broilers in a dose response fashion.

Key Words: Broilers, Essential oils, Benzoic acid, Performance, FCR

Reference No.P159 - Page 48 in the abstract book
Effect of a formulation of benzoic acid with essential oil compounds on performance of broiler chicks

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OBJECTIVE
This study assessed a new eubiotic product (CRINA® Poultry Plus), a formulation of essential oils compounds (thymol, eugenol, piperine) and benzoic acid, on broilers’ growth performance.

MATERIAL AND METHODS
• 300 day-old male chicks (Cobb 500) reared in 30 pens with fresh straw bedding
• in a broiler house containing about 8500 commercial chickens freely moving around the pens.
• 3 treatments: T1: CRINA® Poultry Plus (CPP) 0 mg/kg feed (control group); T2: CPP = 150 mg/kg; T3: CPP = 300 mg/kg
• Diets: Starter (0-10 d), Grower (11 to 20d), Finisher (21 to 34d) and Withdrawal without anticoccidial (35 to 42d).
• All feeds were pelleted. Water and feed ad libitum.
• Parameters: broiler weight at 0, 11, 21, 35 and 42 days, feed intake per pen, mortality. Calculation of weight gain (WG), feed intake and feed conversion ratio (FCR) per pen & European Production Efficiency Factor (EPEF) at 42 days
• Statistics: variance analysis, GLM procedure of SAS version 6.12 and Duncan test (P ≤ 0.05).

RESULTS
Table 1: Effect of CRINA Poultry Plus on broiler performances

<table>
<thead>
<tr>
<th></th>
<th>T1 - Control</th>
<th>T2 - CPP 150 ppm</th>
<th>T3 - CPP 300 ppm</th>
<th>SD</th>
<th>P²</th>
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</thead>
<tbody>
<tr>
<td>Weight Gain (g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n=10) days 0-10</td>
<td>258¹</td>
<td>267ᵃ</td>
<td>261ᵇ</td>
<td>1.26</td>
<td>0.003</td>
</tr>
<tr>
<td>days 11-20</td>
<td>611</td>
<td>629</td>
<td>625</td>
<td>4.84</td>
<td>0.274</td>
</tr>
<tr>
<td>days 21-34</td>
<td>1376</td>
<td>1386</td>
<td>1399</td>
<td>13.29</td>
<td>0.802</td>
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<tr>
<td>days 35-42</td>
<td>578</td>
<td>560</td>
<td>568</td>
<td>13.44</td>
<td>0.870</td>
</tr>
<tr>
<td>days 0-42</td>
<td>2823</td>
<td>2842</td>
<td>2853</td>
<td>16.12</td>
<td>0.757</td>
</tr>
<tr>
<td>Feed Intake (g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n=10) days 0-10</td>
<td>352</td>
<td>352</td>
<td>350</td>
<td>1.88</td>
<td>0.850</td>
</tr>
<tr>
<td>days 11-20</td>
<td>939</td>
<td>959</td>
<td>940</td>
<td>7.35</td>
<td>0.471</td>
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<tr>
<td>days 21-34</td>
<td>2219</td>
<td>2176</td>
<td>2208</td>
<td>21.43</td>
<td>0.702</td>
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<td>days 35-42</td>
<td>1260ᵇ</td>
<td>1196ᵃᵇ</td>
<td>1125ᵇ</td>
<td>17.41</td>
<td>0.003</td>
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<tr>
<td>FCR (n=10)</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>days 0-10</td>
<td>1.36</td>
<td>1.32</td>
<td>1.34</td>
<td>0.010</td>
<td>0.152</td>
</tr>
<tr>
<td>days 11-20</td>
<td>1.54</td>
<td>1.52</td>
<td>1.50</td>
<td>0.008</td>
<td>0.269</td>
</tr>
<tr>
<td>days 21-34</td>
<td>1.61</td>
<td>1.57</td>
<td>1.58</td>
<td>0.013</td>
<td>0.389</td>
</tr>
<tr>
<td>days 35-42</td>
<td>2.20</td>
<td>2.16</td>
<td>2.01</td>
<td>0.045</td>
<td>0.207</td>
</tr>
<tr>
<td>days 0-42</td>
<td>1.69ᵃ</td>
<td>1.65ᵃᵇ</td>
<td>1.62ᵇ</td>
<td>0.011</td>
<td>0.030</td>
</tr>
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</table>

Table 2: Effect on mortality and EPEF

<table>
<thead>
<tr>
<th></th>
<th>T1 Control</th>
<th>T2 CPP 150 ppm</th>
<th>T3 CPP 300 ppm</th>
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<tr>
<td>Mortality</td>
<td>4.0</td>
<td>5.0</td>
<td>4.0</td>
</tr>
<tr>
<td>EPEF</td>
<td>397</td>
<td>406</td>
<td>416</td>
</tr>
</tbody>
</table>

• Weight gain:
Birds fed CRINA Poultry Plus (T2 and T3) were always numerically higher than the control (T1)
Statistically significant differences in the starter between control (T1) and T2
• Feed intake:
Lower in the withdrawal period in T3 than control (T1).
• Feed Conversion Ratio:
Overall improved FCR in T3 versus control (T1)
• No difference in Mortality and EPEF
EPEF of group T3 numerically 20 points higher than control (T1)

CONCLUSION
In conditions as close as possible to the practical ones in the broiler industry, 300 mg of CRINA Poultry Plus / kg feed significantly improved the feed conversion ratio (FCR).
Evaluation of a combination of essential oil compounds and organic acids on broiler and laying hen performance

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DSM Nutritional Products, St. Louis, Alsace, France

Abstract

This paper contained two trials conducted with the objective of evaluating the effects of a blend of essential oil compounds (thymol, eugenol, piperine) and benzoic acid (CRINA® Poultry Plus, CPP) on broiler chicken and laying hen performance. In the broiler trial (d8-29 of age), 216 day-old Ross PM3 chicks were used in a 2x2 factorial arrangement with two iso-protein and iso-energetic diets (Corn-SBM or Corn-wheat-SBM) and two supplementation levels of CPP (0 and 300 mg/kg feed). Each treatment was replicated in nine pens of six birds each. Performance, apparent ileal protein digestibility (AID) and intestinal morphology were measured. The inclusion of CPP in both diets was tending to improve body weight gain compared to the respective control. BWG was improved by 1.8 and 3.1 % in corn-SBM and cornwheat- SBM diet respectively. CPP supplementation influenced the intestinal mucosa morphology with longer villi observed in birds fed CPP and this was related to an increased AID of protein. CPP treated birds had 1.3 % and 1.1 % improved AID of protein in corn-SBM and Corn-wheat-SBM diet, respectively. The trial demonstrated the potential benefit of CPP to improve broiler performance. In the layer hen trial, 360 thirty week-old Hy-Line Brown hens were fed a standard laying diet supplemented with 150, 300 or 600 ppm CPP. They were compared with a non supplemented control group. The trial lasted 12 weeks. CPP supplementation significantly improved egg weight, egg shell breaking force and eggshell thickness (P <0.05). These results showed that supplementing layer hen diet with CPP at the tested levels improved laying hen performance and egg shell quality. CPP supplementation from 150 to 600 ppm tended to increase the % of lay in a dose dependant way from 90.4% to 93.3% respectively compared to the control. In conclusion, CPP is an alternative solution to reduce egg breakage problems and to optimize profitability in egg production.

Key Words: essential oils, protein digestibility, intestinal morphology, broiler and laying hen performance, egg shell quality

Reference No.P161 - Page 48 in the abstract book
Evaluation of a combination of essential oil compounds and organic acids on broiler and laying hen performance

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The objective of this study was to evaluate the effects of a blend of essential oil compounds and benzoic acid (CRINA® Poultry Plus, CPP) on the performance of broiler and laying hen

**BROILER TRIAL DESIGN:**
Animals: 216 day-old Ross PM3 in a 2x2 factorial arrangement (2 diets; Corn-SBM (Diet I) or Corn-Wheat-SBM (Diet II) and 2 levels of CPP; 0 and 300 mg/kg of diet); **Diets:** iso-nitrogen and iso-energetic (12.5 MJ/kg ME; 22% CP); **Duration:** day 8-29 of bird age; **Data & analysis:** Performance, apparent ileal protein digestibility (AID), intestinal morphology, ANOVA (p<0.05).

**LAYING HEN TRIAL DESIGN:**
Animals: ISA-Brown laying hens (30 weeks old); **Diet:** 11.6 MJ/kg ME; 16% CP; 3.8% Ca; **Treatments:** 1 Control, & 3 levels of CPP (150, 300, 600 mg/kg of diet); **Duration:** 12 weeks; **Data & analysis:** Performance, egg quality, ANOVA (p<0.05).

**Table 1.** Effects of CPP supplementation on performance from day 8-29, and on apparent ileal digestibility of protein (at day 29)

<table>
<thead>
<tr>
<th>Diet / treatment</th>
<th>CPP (mg/kg feed)</th>
<th>Weight gain g/d</th>
<th>FCR g feed/g gain</th>
<th>AID of protein % intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>-</td>
<td>1543</td>
<td>1.563</td>
<td>74.0</td>
</tr>
<tr>
<td>CPP</td>
<td>300</td>
<td>1571</td>
<td>1.543</td>
<td>74.9</td>
</tr>
<tr>
<td>P&lt;</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>SEM</td>
<td></td>
<td>0.98</td>
<td>0.023</td>
<td>0.44</td>
</tr>
<tr>
<td>Diet II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>-</td>
<td>1533</td>
<td>1.549</td>
<td>77.9</td>
</tr>
<tr>
<td>CPP</td>
<td>300</td>
<td>1582</td>
<td>1.563</td>
<td>78.7</td>
</tr>
<tr>
<td>P&lt;</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>SEM</td>
<td></td>
<td>0.91</td>
<td>0.023</td>
<td>0.41</td>
</tr>
</tbody>
</table>

CPP supplementation influenced the intestinal morphology resulting in longer villi and showed potential beneficial effects on growth performance and AID of protein in broiler chickens especially in diet I.

**Table 2.** Effect on mean egg production (%), egg weight (g), FCR, broken eggs (%) and egg shell thickness (mm).

<table>
<thead>
<tr>
<th>Study Parameter</th>
<th>Treatments</th>
<th>P</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egg production (%)</td>
<td>90.4</td>
<td>NS</td>
<td>0.59</td>
</tr>
<tr>
<td>Egg weight (g)</td>
<td>64.1b</td>
<td>65.9a</td>
<td>63.6b</td>
</tr>
<tr>
<td>FCR (g feed/g egg)</td>
<td>2.15</td>
<td>2.08</td>
<td>2.13</td>
</tr>
<tr>
<td>Broken eggs (%)</td>
<td>0.3</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Eggshell thickness (mm)</td>
<td>0.340</td>
<td>0.342</td>
<td>0.349</td>
</tr>
</tbody>
</table>

Improved eggshell breaking force and improved egg production with the supplementation of CRINA® Poultry Plus

**CRINA® Poultry Plus has beneficial effects on broiler and laying hen performance**
CRINA® Poultry Plus as an alternative feed additive to antibiotic growth promoters in broiler diets

Lenise Boemo*1, Alexandre Rosa*1, Patricia Arsitumunha*1, Anelcir Scher1, Dino Garcez2, Daniele Rosa1, Camila Santos1, Vitor Manfio1

1Poultry Science Lab – Universidade Federal de Santa Maria, Santa Maria, Rio Grande do Sul, Brazil; 2DSM Nutritional Products, São Paulo, Brazil

Abstract

The objective of this study was to evaluate the addition of CRINA® Poultry Plus, a blend of plant extracts and benzoic acid, in diets based on corn and soybean meal for broilers and its action as an alternative to antibiotic growth promoters (AGP). For that reason, a 6-week floor pen study was conducted at Poultry Laboratory at Universidade Federal de Santa Maria - Brazil. It were used 1550 one-day old Cobb 500 male broiler chicks. Birds were randomly assigned in five treatments with ten replicate pens of 31 birds each. The diets were: without growth promoters (WGP); with 0.1kg/ton of AGP (avilamycin); with 0.3kg/ton of CPP from 1-42 days (CPP), a diet with 0.1kg/ton AGP from 1 – 21 days and 0.3kg/ton of CPP from 22-42d (AGP/CPP) and a diet with 0.1kg/ton AGP and 0.3kg/ton of CPP from 1-42d (AGP & CPP). All the diets were mashed and had the same nutrient levels. The data were submitted to ANOVA and Tukey’s test. Significant differences were observed in body weight gain (BWG), daily weight gain (DWG), feed conversion rate (FCR) and productive efficiency index (PEI). The CPP diet increased (P=0.0001) BWG (2518.7g) in 1-42d period compared to birds fed on WGP diet (2383.9g) and AGP diet (2439.6g). The FCR (P=0.0001) and PEI (P=0.0030) are better in birds fed on CPP (1.83 and 321.6), AGP/CPP (1.86 and 307.1), AGP & CPP (1.88 and 306.8) than birds fed on WGP (1.94 and 286.4) in 1-42d period. However It was not observed significant differences on these parameters compared to AGP (1.86 and 306.5). Birds fed on CPP, AGP/CPP and AGP & CPP presented higher DWG (59.9, 58.6 and 58.5g, respectively) than birds fed on WGP (56.7g) and AGP (58.1g) diets. The results suggest that CRINA® Poultry Plus can be used as an alternative product to antibiotic growth promoters.

Key Words: antibiotic growth promoters, broiler, organic acid, animal performance, plant extracts

Reference No.P165 - Page 49 in the abstract book
CRINA® Poultry Plus as an alternative feed additive to antibiotic growth promoters in broiler diets

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¹Poultry Science Lab – Universidade Federal de Santa Maria, RS, Brazil
²DSM Nutritional Products, São Paulo, Brazil

INTRODUCTION

Due to several discussions about the possibility of bacterial resistance by the use of antimicrobial growth promoters in broiler feed and the limitations of international market, alternative products to replace them must be found (1,2,3). CRINA® Poultry Plus is a blend of components of plant essential oils and benzoic acid. The objective of this study was to evaluate the addition of CRINA® Poultry Plus in diets based on corn and soybean meal for broilers and study its action as an alternative to antibiotic growth promoters.

MATERIAL AND METHODS

A six week floor pen study was conducted at Poultry Laboratory at The Federal University of Santa Maria (UFSM), Brazil. It was used 1550 one-day old Cobb 500 male broiler chicks. Birds were randomly assigned in five treatments with ten replicate pens of 31 birds each. The diets were: without growth promoters (WGP); with 0.1kg/ton of AGP (avilamycin 10 ppm); with 0.3kg/ton of CRINA® Poultry Plus from 1-42 days (CPP), a diet with 0.1kg/ton AGP from 1 – 21 days and 0.3kg/ton of CPP from 22-42d (AGP/CPP) and a diet with 0.1kg/ton AGP and 0.3kg/ton of CPP from 1-42d (AGP & CPP). All the diets were mashed and had the same nutrient levels (table 2). The estimated parameters were: body weight gain (BWG), daily weight gain (DWG), feed conversion rate (FCR) and productive efficiency index (PEI).

RESULTS

Significant differences were observed in BWG, DWG, FCR and PEI (table 2). The CPP diet increased the BWG, DWG and PEI compared to the WGP diet in all phases. In 1-42d period, the BWG was higher in the CPP group than AGP, and the AGP/CPP and AGP & CPP had better BWG than WGP. In relation of the FCR and PEI, on the 1-42d period, CPP, AGP/CPP and AGP & CPP showed better results than WGP group, however it was not observed significant differences on these parameters compared to AGP. The WGP group showed the worst result in PEI and the other groups didn’t have significant differences in this parameter between them. Moreover, birds fed with, AGP/CPP and AGP & CPP presented higher BWG than birds fed with WGP diet and didn’t have significant differences on these parameters compared to AGP diet.

TABLE 2 - Effect of the treatments on the body weight gain, feed conversion rate, daily weight gain and productive efficiency index in the experimental period

<table>
<thead>
<tr>
<th>Treatments</th>
<th>BWG(g)</th>
<th>FCR</th>
<th>DWG</th>
<th>PEI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-21 d</td>
<td>22-35 d</td>
<td>36-42 d</td>
<td>1-21 d</td>
</tr>
<tr>
<td>WGP¹</td>
<td>783.39 b</td>
<td>1045.69 b</td>
<td>545.03 b</td>
<td>2383.99 c</td>
</tr>
<tr>
<td>AGP¹</td>
<td>806.97 a</td>
<td>1076.42 ab</td>
<td>553.35 ab</td>
<td>2479.62 b</td>
</tr>
<tr>
<td>CPP¹</td>
<td>815.51 a</td>
<td>1087.18 ab</td>
<td>568.38 ab</td>
<td>2548.43 ab</td>
</tr>
<tr>
<td>AGP/CPP¹</td>
<td>802.92 ab</td>
<td>1064.02 ab</td>
<td>596.54 a</td>
<td>2461.48 ab</td>
</tr>
<tr>
<td>AGP&amp;CPP¹</td>
<td>802.86 ab</td>
<td>1067.18 ab</td>
<td>568.38 ab</td>
<td>2458.43 ab</td>
</tr>
<tr>
<td>Average</td>
<td>801.93</td>
<td>1078.17</td>
<td>571.58</td>
<td>2452.44</td>
</tr>
<tr>
<td>C.V. (%)</td>
<td>2.31</td>
<td>3.23</td>
<td>7.29</td>
<td>1.97</td>
</tr>
<tr>
<td>p</td>
<td>0.0050</td>
<td>0.0122</td>
<td>0.0247</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

TABLE 1 - Experimental diets

<table>
<thead>
<tr>
<th>Ingredients (%)</th>
<th>Phases</th>
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<tbody>
<tr>
<td></td>
<td>1-21 d</td>
</tr>
<tr>
<td>Corn</td>
<td>56.63</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>34.28</td>
</tr>
<tr>
<td>Meal meat</td>
<td>4.88</td>
</tr>
<tr>
<td>Vegetable oil</td>
<td>2.68</td>
</tr>
<tr>
<td>Salt</td>
<td>0.39</td>
</tr>
<tr>
<td>Limestone 38% Ca</td>
<td>0.30</td>
</tr>
<tr>
<td>Dicalcium Phosphate</td>
<td>0.23</td>
</tr>
<tr>
<td>Vit. &amp; Min. Premix</td>
<td>0.15</td>
</tr>
<tr>
<td>L-Threonine</td>
<td>0.05</td>
</tr>
<tr>
<td>DL-Methionine</td>
<td>0.294</td>
</tr>
<tr>
<td>L-Lysine 98%</td>
<td>0.107</td>
</tr>
</tbody>
</table>

BIBLIOGRAPHY


CONCLUSION

The results suggest that CRINA® Poultry Plus can be used as an alternative product to antibiotic growth promoters.
Effect of optimal levels of vitamins and of combination of essential oils on the performance of broiler chickens

C. Paulus*1, M.F. Soto Salanova 2, P. Cachaldora2, B. Losada2, J.M. Hernandez1
1DSM Nutritional Products, Basel, Switzerland; 2COREN, San Cibrao das Vinas, Orense, Spain

Abstract

The effect of optimal levels of vitamins (Optimum Vitamin Nutrition, OVN®) alone or with a combination of essential oils (CRINA® Poultry Plus) on broiler performance was evaluated. 1560 day-old Ross male broilers were randomly allocated to 24 pens and 3 treatments (8 replicates / treatment). Each pen housed 65 birds and the trial lasted 42 days. Broilers were fed a starter diet from 1-21 days and a grower diet from 22-42 days. All diets were based on wheat and soybean meal and supplemented either with: A) control premix with average industry vitamin levels; B) OVN® premix with 69 micrograms 25-hydroxy-cholecalciferol (Hy-D®)/kg feed; or C) like B), but CRINA® Poultry Plus was added at 0.03% (300 mg/kg). At 21 days, performance of B and C birds was better than that of the control birds. Feed conversion (FCR) of B and C birds was significantly better than that of the control birds: 1.429 (A) vs. 1.382 (B) and 1.366 (C). At 42 days, body weight of the B and C birds, although not significant, was numerically higher than that of the control birds: 2.87 kg (A), 2.92 kg (B) and 2.90 kg (C). Similarly, daily weight gain was numerically improved by the treatments (68.21 g vs. 69.47 g and 69.08 g) and FCR (1-42d) showed a similar trend: 1.796 vs. 1.776 and 1.747. Results of this trial suggest that the inclusion of OVN® and CRINA® Poultry Plus in the feed positively affects broiler performance throughout the production period.

Key Words: optimum vitamin nutrition, essential oils, 25-hydroxycholecalciferol, broiler, performance

Reference No.P172 - Page 51 in the abstract book
Effect of Optimal Levels of Vitamins and of Combination of Essential Oils on the Performance of Broiler Chickens

M.F. Soto Salanova1), C. Paulus1), P. Cachaldora2), B. Losada2), J.M. Hernandez1)

1)DSM Nutritional Products, Basel, Switzerland; 2)COREN, Orense, Spain

OBJECTIVE
The objective of the present trial was to evaluate the effect of optimal levels of vitamins (Optimum Vitamin Nutrition, OVN®) alone, or with a combination of essential oils (CRINA® Poultry Plus) on body weight, feed intake, daily weight gain, feed conversion and mortality.

MATERIAL AND METHODS
- 1560 one-day-old Ross male broilers
- Experimental Period: 6 weeks from 1 to 42 days of age
- 3 treatments, 24 pens with 520 birds (8 replicates) per treatment
  A) control premix with the average industry vitamin levels (SIL)
  B) OVN® premix with 69 μg 25-hydroxycholecalciferol (Hy•D®)/kg feed
  C) Like B), but CRINA® Poultry Plus was added at 0.03%.
- Broilers were fed a starter diet (1-21 d) and a grower diet (21-42 d)
- Diets based on wheat and soybean meal; water was available ad libitum
- Monitored parameters at (1), 21 and 42 days of age: Body weight; Feed intake; Feed conversion; Mortality (incl. weight to adjust feed conversion)

RESULTS
Graph 1 Effect on body weight
Graph 2 Effect on feed conversion
Graph 3 Effect on mortality

At 21 days, performance of B and C birds was better than that of the control birds. Feed conversion (FCR) of B and C birds was significantly better than that of the control birds: 1.429 (A) vs. 1.382 (B) and 1.366 (C). At 42 days, body weight of the B and C birds, although not significant, was numerically higher than that of the control birds: 2.87 kg (A), 2.92 kg (B) and 2.90 kg (C). Similarly, daily weight gain was numerically improved by the treatments (68.21 g vs. 69.47 g and 69.08 g) and FCR (1-42d) showed a similar trend: 1.796 vs. 1.776 and 1.747.

CONCLUSION
Results of this trial suggest that the inclusion of OVN® and CRINA® Poultry Plus in the feed positively affects broiler performance throughout the production period.