

## ENHANCING NEWCASTLE DISEASE VIRUS ANTIBODY TITERS IN BROILERS THROUGH ORAL ADMINISTRATION OF A PLANT-DERIVED IMMUNOMODULATOR

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### SUMMARY

A trial was conducted to determine whether a plant-derived immunomodulator could enhance vaccine-induced NDV antibody titers in broilers. Four groups of 50 chickens were used. Group A served as a control group, group B received multivitamins, groups C and D received the immunomodulator, STF/Aq at 2 and 5 µg/bird respectively. The results showed that the higher dose of STF/Aq significantly ( $p < 0.05$ ) enhanced NDV antibody titers after 4 weeks of age. No significant differences ( $p > 0.05$ ) in feed conversion rate (FCR) between the groups were noted. The study demonstrated the potential of plant compounds in immunostimulation.

Keywords: immunomodulators, broilers, NDV antibody titers, immunity

### INTRODUCTION

Stress is unavoidable in animal husbandry. Even normal handling and factors beyond the farmers control may act as stressors. It is well known that stress leads to impairment of the well being and productivity of animals (Zulkifli, 1995). Stress-related immunosuppression favours disease outbreaks and breakdown in vaccinations against important pathogens. Low weight gains, high feed conversion rates and mortality may seriously affect the farmers profits (Strauss, 1998). Several products are being used to potentiate immunity and therefore minimise the adverse effects of stress upon the immune system. In general, they are known as immunostimulants or in a broader sense, immunomodulators. The compounds range from killed pox viruses (Baypamun, Bayer) to enzymes and herbals (Lisovit, Biomin).

Our works concentrate on enhancing both innate and specific immunities by supplementation with immunomodulators of plant origin. We have shown that the STF/Aq extract is mitogenic for Balb/c mice splenocytes (Israf *et al.*, unpublished findings). In this study, we aim to induce significant enhancement of specific anti-NDV immunity by oral administration of STF/Aq on days when ND vaccinations were performed and observe the productivity-related effects that transpire from the use of the STF/Aq extract.

### MATERIALS AND METHODS

#### Chickens and management

Two hundred, day-old Arbor Acre chicks were randomly assigned to four groups of 50 chicks each. The chickens were fed *ad libitum* with broiler starter

feed and later changed to broiler finisher at 4-weeks of age (Federal Flour Mill Sdn Bhd). Prophylactic treatment (Nurfloz 20) against bacterial infection was conducted according to the manufacturer's instructions. All chickens were vaccinated with ND-IB combined vaccine (C305, ASL, USA) via eye-drops at 5 and 18 days of age. IBD vaccination was given at 14 days of age via eye-drops (G603, ASL, USA). Due to the restrictions on floor space, a number of chickens from each group were culled throughout the trial.

#### Immunomodulator

The STF/Aq extract is an aqueous extracted from *Solanum torvum*. The extract was obtained by incubating the powdered plant material in distilled water followed by evaporation and lyophilisation.

#### Experimental design

Chicks of group A did not receive any treatment and therefore was used as a control group. Group B received multivitamins (BOSFAS-B; Bruce-Mall, USA) via drinking water every other day as directed by the manufacturer. Group C received 2 µg of STF/Aq per chicken in drinking water while group D received 5 µg of STF/Aq per chicken. The STF/Aq treatments were given on the days when the ND-IB vaccinations were given (twice throughout the trial).

#### Sampling

Eighteen chicks were randomly selected, weighed and bled on arrival. These chicks were not included in the trial. Thereafter, ten randomly selected chickens from each group were weighed and bled weekly. Feed intake and feed conversion rate (FCR) were recorded and calculated, respectively. Blood samples were allowed to clot and the serum was collected and stored

at  $-20^{\circ}\text{C}$  until used. Post-mortem examinations were carried out on all dead chicks.

#### Measurement of NDV titres

The hemagglutination inhibition (HI) test to detect NDV antibody titres was performed according to standard procedure (Hitchner *et al.*, 1979).

#### Statistical analysis

The HI titres were  $\log_2$  transformed and compared on a weekly basis. Since cumulative FCR could not be statistically analysed, we calculated the weekly FCR for each group and used these values as group variables for the analyses. All data was analysed by ANOVA followed by LSD post hoc test. The level of significance used was  $p < 0.05$ .

## RESULTS

#### NDV antibody titres

Fig. 1 shows the HI titres throughout the trial. Significant enhancement of NDV titres was demonstrated on weeks 5 and 6 by chickens that received  $5 \mu\text{g}$  of STF/Aq. All groups experienced a reduction in titres over the first 3 weeks of age but the drop in group A was significantly ( $p < 0.05$ ) lower. Titres of all groups increased thereafter, reaching the protective titres of  $\geq 3 \log_2$  units by week 4 except for group C, which was delayed by a week. At week 5, group D was significantly ( $p < 0.05$ ) higher compared to groups B and C but not significantly ( $p > 0.05$ ) different from the control group. By week 6, group D showed significantly ( $p < 0.05$ ) higher NDV antibody titres while group B showed significantly ( $p > 0.05$ ) lower titres.

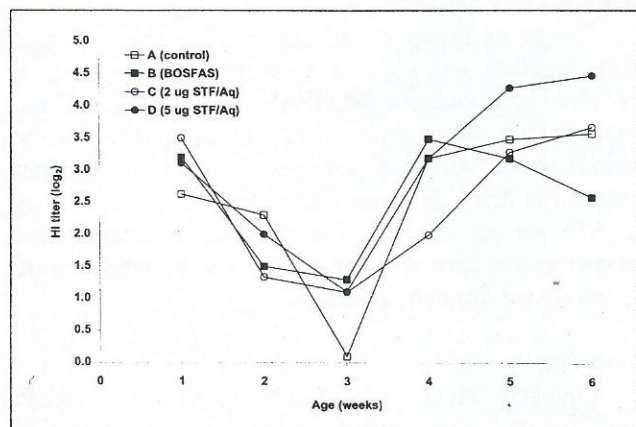


Fig. 1. The haemagglutination inhibition (HI) titres for the different treatment groups throughout the trial.

#### Feed conversion rates

Fig. 2 shows a comparison of mean weekly FCR of all groups. There were no significant ( $p > 0.05$ ) differences between groups. The cumulative FCR for

groups A, B, C and D were 2.08, 1.91, 1.82 and 1.90, respectively.

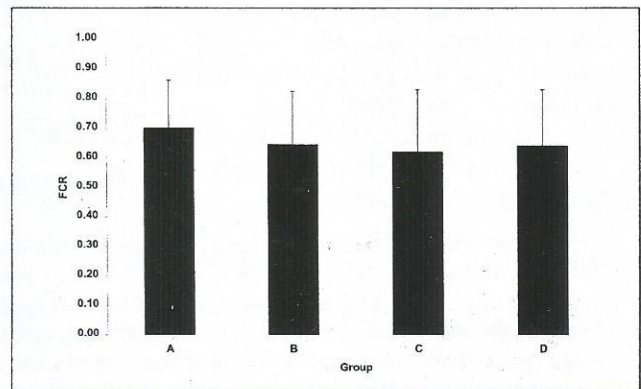


Fig. 2. Mean weekly feed conversion rates (FCR) for the different treatment groups.

#### Weight gains

The final body weight of group C was significantly ( $p < 0.05$ ) higher than other groups (Fig 3). Group D, however, did not differ significantly ( $p > 0.05$ ) from the control group.

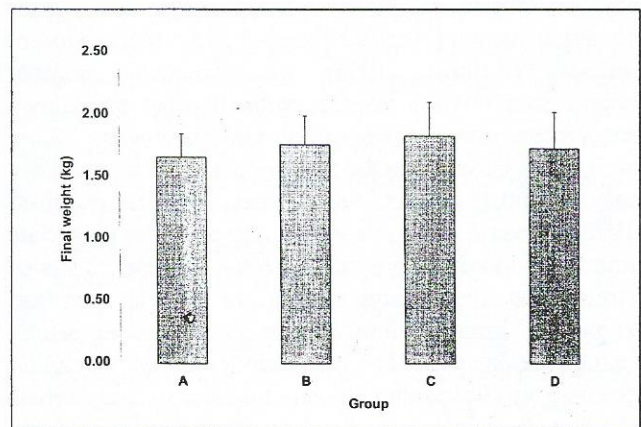


Fig. 3. The final body weight of chickens from the different treatment groups.

## DISCUSSION

The results of this trial show that the STF/Aq extract can enhance specific antibody synthesis towards a NDV vaccine strain. The enhancement of immunity is usually correlated well with the performance. However, we observed that in chickens which showed a significant increase in HI titres (group D) had significantly lower final body weight compared to the groups receiving lower dose of the extract (group C). These findings are somewhat conflicting and remain unexplained. Nevertheless, the FCR between groups showed no significant difference.

The major issue now is the ability of STF/Aq to enhance growth and immunity if used at other doses or in another regimen. Additionally, the synergistic effect

between STF/Aq and BOSFAS to enhance growth and immunity has never been determined. Further studies should be carried out to clarify these issues. It is worthy to note that STF/Aq was formulated as an immunopotentiator and not as growth supplement. However, one would expect, under farm conditions, a better growth from a more effective immune system.

Our previous studies with this extract involved the use of a mouse model in which STF/Aq was administered with model proteins such as bovine serum albumin (BSA) and ovalbumin (OVA). When administered orally with OVA, we demonstrated a significant increase in the number of cytokine-producing T cells from the Th1 and Th2 phenotypes (Israf *et al.*, 1999). In the same study, a significant increase in the mucosal IgA and peripheral IgG concentrations was also demonstrated. Similar findings were demonstrated when BSA was used (Israf *et al.*, 1998). This is the first attempt to use STF/Aq in chickens and therefore further work is needed to determine an optimal dose that not only boosts both innate and adaptive immunities but also indirectly enhancing growth.

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#### RINGKASAN

#### PENGUATAN TITER ANTIBODI VIRUS PENYAKIT NEWCASTLE DALAM AYAM PEDAGING MELALUI PEMBERIAN ORAL PENGIMUNOMODULATAN TERBITAN TUMBUHAN

Satu percubaan dijalankan untuk menentukan sama ada pengimmunomodulatan terbitan tumbuhan dapat menguatkan titer antibodi virus penyakit Newcastle (NDV) teraruh vaksin. Empat kumpulan 50 ekor ayam setiap satu telah digunakan. Kumpulan A bertindak sebagai kumpulan kawalan menerima multivitamin, kumpulan C dan D masing-masing menerima pengimmunomodulatan, STF/Aq sekadar 2 dan 5 µg/ayam. Hasil kajian menunjukkan dos STF/Aq lebih tinggi, telah secara tererti ( $p < 0.05$ ) menguatkan titer antibodi NDV selepas umur empat minggu. Tidak kelainan tererti ( $p < 0.05$ ) dapat dikesan pada kadar penukaran pakan (FCR) di antara kumpulan. Kajian ini telah menunjukkan potensi sebatian tumbuhan dalam pengimmunorangsangan.