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# Grommune: *Morinda citrifolia*-based herbal tonic for growth and immunity for commercial broilers

Jai Sunder[a]*, S. Jeyakumar[b], T. Sujatha[a] and A. Kundu[a]

[a]*Division of Animal Science, Central Agricultural Research Institute, Port Blair, Andaman & Nicobar Islands, India;* [b]*NDRI Regional Station, Bengaluru, India*

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A herbal tonic (Grommune) was prepared from *Morinda citrifolia* fruit juice and fed to the broilers at various levels viz., 5 ml, 10 ml and 15 ml, and one group was kept as control. The result revealed that highest body weight (3.06 ± 0.10 kg) and better feed conversion ratio (FCR; 2.53) were recorded in the group fed with 15 ml of tonic as compared to the other groups though it was not significantly higher. The humoral immune response revealed significantly higher titre values with increase in level of tonic supplementation. The result indicated that feeding of herbal tonic at the dosage of 15 ml per bird up to 4 weeks and 30 ml per bird up to 8th week of age improved the body weight, FCR and immune competency status of broilers.

**Keywords**: broiler; growth; immunity; *Morinda citrifolia*

## 1. Introduction

Medicinal plants are an integral component of ethno-veterinary medicine. Farmers in several countries use medicinal plants in the health care of livestock. Andaman and Nicobar Islands, the hotspot of biodiversity represent a great emporium of ethno-botanical wealth. The agro-climatic condition of Andaman and Nicobar Islands is very much congenial for the cultivation of medicinal plants. More than 300 medicinal/aromatics plants are indigenous to these islands. Many studies on traditional uses of medicinal plants in human have been conducted throughout India; however, very little study is being carried out on the ethno-veterinary uses of these plants in different parts of India, particularly work on herbal medicine for livestock and poultry is very scarce in Andaman and Nicobar Islands.

*Morinda citrifolia* var. *citrifolia*, popularly known as Noni is a wonder plant with its amazing health enhancing and healing power, is a member of the Rubiaceae family and found in these islands. In Andman and Nicobar Islands, the plant is mainly found in the Nicobar goup of islands and is one of the most significant shrubs of traditional medicines among Nicobari tribes of these islands. All the components of this plant have high demand in case of alternative medicines and herbal medicines for human ailments (Younos et al. 1990; Bruggnecate 1992; Hiramatsu et al. 1993; Hirazumi et al. 1996; Solomon 1999). Due to its wide range of health benefits and therapeutic value, the studies on the effect of feeding of crude fruit extract to Nicobari fowl and broilers were conducted (Sunder et al. 2007, 2011). However, no work has been reported on its commercial preparation in the commercial broilers where the avenue for searching an alternative to antibiotics is being given due concern over the last two decades. Hence, the present study was carried out with an objective of studying the growth-promoting and immune-enhancing effects of *M. citrifolia* fruit-based herbal tonic in broiler birds.

## 2. Materials and methods

### *2.1. Experimental design*

A herbal tonic (Grommune) was prepared by mixing fresh *M. citrifolia* fruit juice (25% v/v) with sugar-syrup base (Figure 1). A total of 100-day-old commercial broiler chicks were procured and grouped into four groups with five replicates in each group and six birds each replicate. The birds were managed under deep litter system and provided with standard chick, grower and finisher ration and water ad-lib. No medication, deworming, was given throughout the experiment. Each of the four groups was given water supplement with the prepared herbal tonic at various levels as mentioned below:

Group A: control group with no tonic

Group B: tonic 5 ml up to 4 weeks; 10 ml 5–8 weeks daily in water per 30 birds

Group C: tonic 10 ml up to 4 weeks; 20 ml 5–8 weeks daily in water per 30 birds

*Corresponding author. Email: jaisunder@rediffmail.com


Figure 1. Grommune tonic prepared from *M. citrifolia* fruit juice.

Group D: tonic 15 ml up to 4 weeks; 30 ml 5–8 weeks daily in water per 30 birds

### 2.2. Production performance

The observations on weekly body weight, mortality, feed intake and carcass quality were recorded and body weight gain and feed conversion ratio (FCR) were calculated.

### 2.3. Humoral immune response

Humoral immune response was assessed against goat red blood cells (GRBCs) as per the method by Siegel and Gross (1980) with a slight modification. The suspension of GRBC used as an antigen was prepared (2% v/v) in Phosphate Buffer Saline (PBS) (pH 7.2) and injected into wing vein of the birds at the dosage of 0.25 ml per bird. The blood samples before the injection and at every week interval were taken from each bird till eighth week of age. The sera were separated and were assessed for presence of anti-GRBC antibodies in the sera by Heamagglutination (HA) test. The HA test was carried out in 96 well U-shaped microtitre plate. In all the wells 25 µl of PBS was added, then in the first well 25 µl of test sera was added, and double-fold dilution was made in the respective wells. Then 25 µl of freshly prepared 2% GRBC was added into all the wells and mixed properly. In the control wells only 25 µl of 2% GRBC was added. The plate was then incubated at 37°C for 1–2 hr. The plate was read for button formation and mat formation. The button formation was considered as negative. The titre was expressed as the $\log_2$ of the reciprocal of the highest dilution giving visual agglutination (button formation), and the data were statistically analysed.

### 2.4. T-cell immune response

The *in vivo* cell-mediated immune response to phytohaemagglutinin (PHA-P) was assessed by the method of Cheng and Lamont (1988). The PHA-P (0.1 mg/ml in PBS) at the dosage of 0.1 ml was injected inter-digitally between the third and fourth toe of the right foot of the chicken. The left foot served as control and was injected with 0.1 ml of PBS. The skin index was calculated as the difference between the swelling in the right minus left foot, before and 24 hrs after the injection and expressed as millimetre.

### 2.5. Carcass quality study

Six birds from each treatment were slaughtered at eighth week of age. The birds were fasted overnight and slaughtered as per the procedures outlined by Kotula et al. (1960).

The experimental data were analysed statistically (Snedecor & Cochran 1994).

## 3. Results and discussion

The mean body weight and FCR at market age of 8 weeks for the various treatment groups are presented in Table 1. The body weight at the end of eighth week was found to be highest in the Group D (3.06 ± 0.10 kg) compared to the other group of birds. However, significant difference was not observed in the body weight of different groups. Similarly, the FCR of Group D (2.53) was found to be better than the other treatment groups. The body weight of control group was found slightly better than the Groups B and C; however, the FCR of the Groups B and C was found to be better than the control group. An overall 3.6% increase in body weight and 7.3% better FCR was observed in the Group D birds as compared to the Group A birds. Further, the FCR of Groups B, C and D was found to be better than that of the control group which showed that the feeding of the Grommune tonic enhances the feed utilisation ability of the birds. The non-significant increase in body weight gain with the treated Groups B, C and D might be due to low concentration of the active compounds consumed by these birds through just 0.4, 0.8 and 1.2 ml of Grommune tonic per bird from fifth–eighth week. Results of the present study agree with the reports by Sunder et al. (2007, 2011) in which they

Table 1. Body weight and FCR in different groups of birds.

| Group | Body weight (kg) eighth week | Average feed conversion ratio |
|---|---|---|
| Group A | 2.95 ± 0.73 | 2.73 ± 1.98 |
| Group B | 2.70 ± 0.10 | 2.55 ± 2.13 |
| Group C | 2.90 ± 0.12 | 2.56 ± 3.54 |
| Group D | 3.06 ± 0.10 | 2.53 ± 3.69 |

Table 2. Haemagglutination titre ($log_2$ value) value in different groups of birds.

| Group | 0 day | 1st week | 2nd week |
|---|---|---|---|
| A | 0.1806 | 0.9924 | 0.7826 |
| B | 0.2408 | 0.6622 | 0.8127 |
| C | 0.1806 | 0.6923 | 0.7525 |
| D | 0.0903 | 1.2341 | 1.0845 |

observed improvement in body weight with supplementation of crude fruit juice of *M. citrifolia*, though the present study recorded comparatively lower body weight than these studies. However, all the previous studies had used the crude fruit juice of *M. citrfolia*. The present preparation contains only 25% of the crude fruit juice compared to the crude fruit juice used in the earlier studies. *M. citrifolia* is very rich in the neutraceutical compounds, amino acids, vitamins, minerals, coenzyme carbohydrates and alkaloids which might have played an important role in uptake of the nutrients and its efficient utilisation for the feed conversion ability and help in overall growth of the cells and tissues (Singh et al. 2008). Hence, the higher the quantity supplementation, the better the overall performance than the non-fed control group.

The mean HA titre ± standard error (SE) is given in Table 2. The results revealed the appearance of antibody in all the groups on 0 day of immunisation. The HA titre values in Group D were found to be significantly higher ($p < 0.05$) than other treated and control groups. The antibody titre reached its peak at 1 week post-immunisation in Groups D and A. Statistical analysis revealed the significant difference ($p < 0.05$) of the HA value at different days in the entire group. The interaction between all the groups was also found to be significant ($p < 0.05$) at different day's intervals of antibody titre. The effect of *M. citrifolia* on the humoral immune response and cellular-mediated immune response has been studied by Sunder et al. (2007, 2011), where they have reported the high B-cell and T-cell response in Nicoabri fowl, broiler and Japanese quail. The present study also corroborates with the finding of the earlier studies. The fruit is reported to contain various compounds which are responsible for eliciting the immune response (Hirazumi & Furuwawa 1999). Report suggested that *Morinda* is capable of stimulating the release of several mediators from murine effector cells, IL-1, IL-10, IL-12, Interferons (IFNs) and nitric oxide (Hirazumi & Furuwawa 1999). They reported that fruit juice contains a polysaccharide rich substance which activates the host immune response.

The carcass quality study revealed no significant difference in the dressing percentage among various treated groups of birds, however, Group D birds showed better dressing percentage (74.64%) as compared to other groups (Table 3).

Table 3. Carcass weight and cut-up parts of different group of birds.

| | Group A | Group B | Group C | Group D |
|---|---|---|---|---|
| Live weight (g) | 2950 ± 164.31 | 2716.67 ± 204.12 | 2900 ± 268.33 | 3066.67 ± 242.1 |
| Blood loss | 166.67 ± 81.65 | 233.33 ± 121.11 | 166.67 ± 51.64 | 183.33 ± 75.28 |
| Head + feet | 105.25 ± 15.39 | 92.92 ± 24.50 | 109.33 ± 17.03 | 108.17 ± 11.66 |
| Wing loss (g) | 189 ± 21.25 | 165.17 ± 18.76 | 183.33 ± 13.40 | 191.5 ± 15.40 |
| Feather loss | 299 ± 39.44 | 297.17 ± 38.99 | 291.33 ± 30.30 | 294.83 ± 20.40 |
| Dressed weight (g) | 2189.91 ± 152.32 | 1928.08 ± 200 | 2149.34 ± 280.48 | 2288.84 ± 263.94 |
| Blood loss (%) | 5.65 | 8.59 | 5.75 | 5.98 |
| Head + feet loss (%) | 3.57 | 3.42 | 3.77 | 3.53 |
| Wing loss (%) | 6.41 | 6.08 | 6.32 | 6.24 |
| Feather loss (%) | 10.14 | 10.94 | 10.05 | 9.61 |
| Dressed weight (%) | 74.23 | 70.97 | 74.12 | 74.64 |
| Cut-up parts | | | | |
| Thigh weight (g) | 603.67 ± 29.60 | 517.67 ± 51.66 | 566.83 ± 55.08 | 647.83 ± 54.39 |
| Breast weight (g) | 590.67 ± 101.89 | 506.17 ± 71.73 | 546.17 ± 97.89 | 629.33 ± 92.54 |
| Back + neck weight (g) | 272.33 ± 66.63 | 237.5 ± 74.18 | 245.75 ± 57.01 | 257.58 ± 82.18 |
| Giblet weight (g) | 145.5 ± 13.84 | 118.33 ± 11.54 | 116.5 ± 13.97 | 119.33 ± 11.57 |
| Thigh weight (%) | 27.57 | 26.85 | 26.67 | 28.3 |
| Breast weight (%) | 26.97 | 26.25 | 25.41 | 27.5 |
| Back + neck weight (%) | 12.44 | 12.32 | 11.43 | 11.25 |
| Giblet weight (%) | 6.64 | 6.14 | 5.42 | 5.24 |

Table 4. The production cost–benefit ratio.

| Economic details | Group A | Group B | Group C | Group D |
|---|---|---|---|---|
| Chick cost (Rs) | 25 | 25 | 25 | 25 |
| Total feed consumed till market age (kg) | 4.3 | 3.45 | 3.4 | 3.4 |
| Feed cost (Rs.) at the rate of Rs. 25/kg | 108 | 86 | 85 | 85 |
| Production cost per broiler (Rs.) | 132 | 111 | 110 | 110 |
| Body weight (kg) | 2.95 | 2.7 | 2.9 | 3.06 |
| Cost–benefit ratio | 44.9 | 41.2 | 37.9 | 35.9 |

The lowest production cost ratio (Table 4) that was recorded with Group D revealed that 1 kg of body weight can be produced with comparatively lower-cost investment by giving Grommune tonic as water supplement at a dosage of 15 ml per bird up to 4 weeks and 30 ml per bird up to eighth week of age of broilers.

The results clearly demonstrated that Grommune tonic at a dosage of 15 ml per bird up to 4 weeks and 30 ml per bird up to eighth week of age improved the body weight, FCR and immunity in the birds fed with tonic. The last two decades have seen tremendous interest in the area of medicinal and aromatic plants. The role of plant-derived drugs has been emphasised both at the national and international levels. The commercialisation of the herbal-based formulation will generate employment and provide opportunity for the farmers to earn more income. However, further research is required to improve the product for further improvement in body weight gain and other beneficial properties.

## 4. Conclusion

In conclusion, feeding of herbal tonic at a dosage of 15 ml per bird up to 4 weeks and 30 ml per bird up to eighth week of age improved the body weight, FCR and immune competency status of broilers.

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