

## Effect of Lemon and Orange Peel Essential Oils on Body Weight and Body Weight Gain of Broilers Reared under Treated Bedding Material with Dry Neem Leaves during Summer Season

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**ABSTRACT:** With increasing intensive poultry production systems, competent managerial practices must be adopted to combat stressful conditions. With this aim, an experiment was conducted to assess the effect of lemon and orange peel essential oils on body weight and body weight gain of broilers reared under treated bedding material with dry neem leaves during summer season.

In total, 240 day-old broiler chicks (Vencobb-400) were randomly assigned to eight treatment groups, having two replicates in each viz. T<sub>1</sub> and T<sub>5</sub> (control groups), T<sub>2</sub> and T<sub>6</sub> (supplemented Lemon peel essential oil @ 200mg/kg), T<sub>3</sub> and T<sub>7</sub> (supplemented Orange peel essential oil @ 200mg/kg), T<sub>4</sub> and T<sub>8</sub> (supplemented Lemon and Orange peel essential oil both @ 200mg/kg each in combination). T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub> and T<sub>5</sub>, T<sub>6</sub>, T<sub>7</sub>, T<sub>8</sub> were kept on saw dust and saw dust with dry neem leaves, respectively.

Significant effect was observed due to dietary supplementation on body weight & average body weight gain while, effect of interaction of dietary supplementation and different bedding materials was non-significant.

**Keywords:** Broiler, Lemon peel oil, Orange peel oil, Anti-oxidant.

### INTRODUCTION

Poultry has an essential place in India as the eggs and chicken meat are important, rich and one of cheap sources of protein, vitamins and minerals. The total poultry population in the country has increased by 16.80 per cent over the previous census and reached 851.81 million in 2019 (All India Report on 20<sup>th</sup> Livestock census, 2019). So, to counterpart the positively increasing poultry production system, managerial factors should also be equivalently optimum.

High ambient temperature is one of the most commonly faced problems for poultry production in many hot regions of the world. Prolonged heat stress reduces visceral blood supply to the intestine and causes damages to epithelial cells in the gut there by affecting feed digestion and nutrients absorption (Cronje *et al.*, 2007). It may also disrupt intestinal barrier increasing the likelihood of pathogenic bacteria and endotoxin entry, which can then result in excessive inflammation, decreasing production performance, and possibly death (Quinteiro-Filho *et al.*, 2012). Moreover, increasing environmental temperature results in physiological disturbances such as enhanced panting and more

urinary output as heat stress signs. These exert negative impact on the broiler performance, since heat stress is one of the oxidative stress inducer components.

A new strategy of using phytochemicals as potential stress-relieving substances came into light. Essential oils are derived as a mixture of aromatic oily liquids obtained from plant materials such as flowers, buds, seeds, leaves, twigs, bark, herbs, wood, fruits and roots. They are found to have antibacterial property and also exhibiting antioxidant, antiinflammatory, anticarcinogenic, digestion-stimulating and hypolipidemic activities (Viuda-Martos *et al.*, 2009; 2010).

Orange peel and Lemon peel essential oils (EOs) are rich in phenolic compounds (Sun, 2007) and numerous other components (limonene,  $\beta$ -myrcene) which have significant anti-oxidant activities. Neem leaves have some medicinal properties like antibacterial, antifungal, antimalarial, antiviral, anticancer, etc. (Agarwal *et al.*, 2001; Subapriya and Naigin 2005) and therefore used as treatment for bedding material. Good bedding material is known to reduce ammonia level and absorb the other toxins to prevent infection and diseases to the birds which can lead to improve carcass quality and growth performance.

Therefore, the objective of the present trial was to assess the effect of lemon and orange peel essential oils on body weight and body weight gain of broilers reared under treated bedding material with dry neem leaves during summer season.

## MATERIALS AND METHODS

### A. Experimental Area Location

The present experimental trial was conducted at Poultry Unit, Livestock Farm Complex, College of Veterinary and Animal Science, Bikaner, Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan.

### B. Experimental Birds and Design

The study was conducted on two hundred forty (240) day-old commercial broiler chicks (Vencobb-400), in 2021 for five weeks. Procured chicks were individually weighed and randomly divided using completely randomized block design into eight dietary treatment groups (T<sub>1</sub>-T<sub>8</sub>) of 30 chicks each having relatively equivalent average body weight and each treatment group was further subdivided into two replicates (R<sub>1</sub>& R<sub>2</sub>) having 15 chicks per replicate. The treatment groups were designated as follows: T<sub>1</sub> and T<sub>5</sub> i.e. control group reared on basal diet, T<sub>2</sub> and T<sub>6</sub> supplemented with @ 200mg/kg Lemon peel essential oil in the experimental broiler starter and finisher ration, respectively. T<sub>3</sub> and T<sub>7</sub> were supplemented with @ 200mg/kg Orange peel essential oil in the experimental broiler starter and finisher ration, respectively. T<sub>4</sub> and T<sub>8</sub> were supplemented with @ 200mg/kg each Lemon and Orange peel essential oil both in combination, respectively. T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub> and T<sub>5</sub>, T<sub>6</sub>, T<sub>7</sub>, T<sub>8</sub> were kept on saw dust and saw dust with dry neem leaves, respectively. Feed and clean water supplied *ad libitum*. During first three days, newspapers were used over the bedding material. No litter materials were added, removed or replaced during course of trial, although regular stirring of litter material was done.

### Measurements

**Growth Performance Measurements.** Live body weight was measured for each replicate group each week and thus body weight gain was calculated accordingly.

### C. Statistical Analyses

The experimental data obtained were subjected to analysis of variance (2×4 factorial design) (Snedecor and Cochran, 1989). Means showing significant

differences were compared by Duncan's New Multiple Range Test (DNMRT, 1955). Statistical significance was accepted at P≤0.05. The results were interpreted and expressed as means ± SEM.

## RESULTS AND DISCUSSION

### A. Average Body Weight

The weekly average body of broiler chicken due to dietary supplementation of Lemon and Orange peel essential oil in alone and in combination and bedding materials was presented in Table 1 and that of interaction between dietary supplements and different bedding materials were showed in Table 2.

**1. Effect of dietary supplementation.** The statistical analysis of data revealed highly significant (P<0.01) effect of incorporation of supplements on mean body weight of broilers at 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> week of study but also non-significant results were obtained for rest of the periods. Statistically highest body weight at 5<sup>th</sup> week was recorded in S<sub>3</sub> group.

These results well corroborated with that of Al-Kassie *et al.* (2010); Karadas *et al.* (2014); Mehr *et al.* (2014); Sahu *et al.* (2019). They also reported positive effects on average body weight due to supplementation of various essential oils in the broiler diets. The higher body weights observed in the present experiment might attribute to limonene, the principle bioactive molecule present in lemon peel essential oil along with terpinene, pinene and geranial.

**2. Effect of bedding materials.** The effect among different bedding material was found to be non-significant for body weight in broilers during entire period of experiment. The mean body weight (g/bird) of chicks reared on saw dust (B<sub>1</sub>) and saw dust with dry neem leaves (B<sub>2</sub>) were recorded to be 1280.14 and 1295.35, respectively at five week of age.

These findings of present study were in close agreement with that of Nagaraj *et al.* (2007), who showed different litter materials, had non-significant effect on the mean body weight.

**3. Interaction effect of dietary supplements × bedding materials.** No significant effect of interaction between incorporation of dietary supplements and different bedding materials was found throughout the experiment. However, numerically highest body weight was observed in T<sub>8</sub> group (1342.69 g/bird) at the end of experiment in comparison to rest of the groups.

**Table 1: Effect of dietary supplementation and bedding materials on Average body weight (g) at different weeks.**

Supplement Effect / Age in Weeks	Day old	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>
S <sub>0</sub>	42.68	138.25	293.70	505.63 <sup>a</sup>	816.79 <sup>a</sup>	1234.50 <sup>a</sup>
S <sub>1</sub>	42.61	138.33	294.06	521.94 <sup>bc</sup>	852.88 <sup>c</sup>	1298.18 <sup>b</sup>
S <sub>2</sub>	42.56	139.63	296.90	519.16 <sup>b</sup>	839.83 <sup>b</sup>	1278.32 <sup>b</sup>
S <sub>3</sub>	42.60	137.21	291.56	530.18 <sup>c</sup>	865.35 <sup>d</sup>	1338.15 <sup>c</sup>
SEM	0.22	1.30	2.56	3.13	3.99	8.29
Bedding Material	Day old	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>
B <sub>1</sub>	42.70	138.85	295.00	519.36	842.24	1280.14
B <sub>2</sub>	42.53	137.86	293.11	519.31	845.56	1295.35
SEM	0.15	0.92	1.81	2.21	2.82	5.86

Means having different superscripts in a column differ significantly

**Table 2: Effect of dietary supplements × bedding materials Interaction on Average body weight (g) at different weeks.**

Supplement Effect / Age in Weeks	Day old	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>
T <sub>1</sub>	42.83	138.23	293.46	506.03	817.07	1227.35
T <sub>2</sub>	42.70	139.03	295.43	522.58	849.82	1287.51
T <sub>3</sub>	42.63	139.40	296.53	516.43	834.46	1268.27
T <sub>4</sub>	42.63	138.73	294.56	531.63	866.20	1333.76
T <sub>5</sub>	42.53	138.26	293.93	505.26	816.53	1241.41
T <sub>6</sub>	42.53	137.63	292.70	521.33	855.83	1308.50
T <sub>7</sub>	42.50	139.86	297.26	522.00	845.37	1288.37
T <sub>8</sub>	42.56	135.70	288.56	528.73	864.50	1342.69
SEM	0.31	1.84	3.62	4.42	5.65	11.72

**B. Average body weight gain**

Table 3 shows overall weekly average body weight gain of broiler chicks due to dietary supplementation of Lemon and Orange peel essential oil in alone and in combination and bedding materials and Table 4 presents data regarding interaction between dietary supplements and different bedding materials.

**1. Effect of dietary supplementation.** The results indicate highly significant ( $P < 0.01$ ) effect of supplements on cumulative mean body weight gain in S<sub>3</sub> group (1295.50 g).

The results regarding use of Lemon and Orange peel essential oil alone and in combination on body weight gain are in accordance to the observations of Sahu *et al.* (2019). Similarly, Alali *et al.* (2013); Gopi *et al.* (2014); Khattak *et al.* (2014) also reported improvement in body weight gain in broilers due to different essential oil supplementation.

**2. Effect of bedding materials.** Non-significant effect among different bedding materials on cumulative mean body weight gain was found. Numerically highest cumulative weight gain at 35<sup>th</sup> day was recorded in group reared on saw dust with dry neem leaves (B<sub>2</sub>).

The results obtained were in line with the findings of Shishir *et al.* (2013); Oviedo-Rondon *et al.* (2013). They evaluated growth performance parameters including average weight gain and found non-significant changes.

**3. Interaction effect of dietary supplements × bedding materials.** Non-significant influence of interaction between incorporation of dietary supplements and different bedding materials was observed for the whole trial. Although, mathematically T<sub>8</sub> group reported highest cumulative body weight gain (1300.03 g/bird) at the end of experiment.

**Table 3: Effect of dietary supplementation & bedding materials on average body weight gain (g) at different weeks.**

Supplement Effect / Age in Weeks	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	Cumulative
S <sub>0</sub>	95.56	155.45	211.12 <sup>a</sup>	311.15 <sup>a</sup>	417.93 <sup>a</sup>	1191.73 <sup>a</sup>
S <sub>1</sub>	95.71	155.73	227.86 <sup>c</sup>	330.93 <sup>c</sup>	445.30 <sup>b</sup>	1255.61 <sup>b</sup>
S <sub>2</sub>	97.06	157.26	222.74 <sup>b</sup>	320.66 <sup>b</sup>	438.03 <sup>b</sup>	1235.75 <sup>b</sup>
S <sub>3</sub>	94.61	154.35	238.61 <sup>d</sup>	335.16 <sup>c</sup>	472.59 <sup>c</sup>	1295.50 <sup>c</sup>
SEM	1.25	1.29	1.72	2.00	6.41	8.25
Bedding Material	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	Cumulative
B <sub>1</sub>	96.15	156.15	223.92	322.88	437.64	1237.40
B <sub>2</sub>	95.33	155.25	226.46	326.25	449.71	1252.82
SEM	0.88	0.91	1.21	1.41	4.53	5.83

Means having different superscripts in a column differ significantly

**Table 4: Effect of dietary supplements × bedding materials interaction on average body weight gain (g) at different weeks.**

Supplement Effect / Age in Weeks	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	Cumulative
T <sub>1</sub>	95.4	155.23	210.89	311.03	410.28	1184.35
T <sub>2</sub>	96.33	156.4	227.06	327.24	437.68	1244.89
T <sub>3</sub>	96.76	157.13	219.9	318.03	433.06	1225.55
T <sub>4</sub>	96.1	155.83	237.06	334.56	467.56	1291.13
T <sub>5</sub>	95.73	155.66	211.33	311.26	425.31	1198.86
T <sub>6</sub>	95.1	155.06	228.63	334.5	452.66	1265.96
T <sub>7</sub>	97.36	157.4	225.68	323.37	443	1245.96
T <sub>8</sub>	93.13	152.86	240.16	335.76	477.79	1300.03
SEM	1.77	1.82	2.43	2.83	9.07	11.67

## CONCLUSIONS

According to the outcomes of this experimental trial, it can be deduced that dietary supplementation of Lemon and Orange peel essential oil at @ 200mg/kg level alone and in combination enhances the overall performance of broiler chicks in terms of final live weight and average body weight gain. However, bedding material and interaction effects were non-significant statistically.

## FUTURE SCOPE

With the increasing awareness and technological aspects regarding poultry rearing on large scale commercial farms, use of phytochemicals could be promising step towards enhanced poultry production. Hence, it is advised for further studies with more number of birds to promote better use of phytochemicals in broiler production to alleviate heat stress conditions and for determination of optimum concentration of essential oils to be added in broiler diets.

**Conflicts of Interest.** None.

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