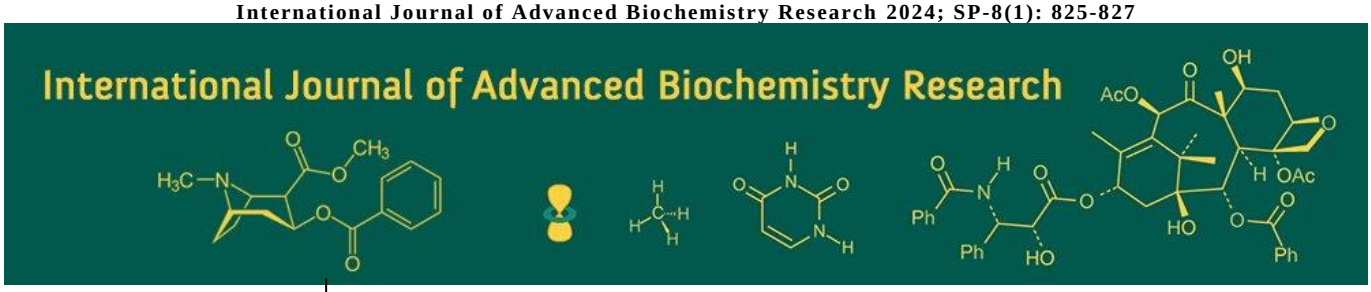

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Effect of colour light and stocking density on litter pH of broiler

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Abstract
We evaluated the effects of colour LED light with different stocking density on litter pH. A total of 270-day old broiler birds were brooded together for one week. After one week birds were randomly distributed into three colour light treatment *viz*. Control (white LED light), Blue LED, Green LED at three different stocking density (0.8 sq ft, 1 sq ft, 1.2 sq.ft) for each light group with three replicates in each density. Light intensity was 20 lux with 23L: 1D light regimes. Result revealed that at 3rd week white colour showed significantly ($p \leq 0.05$) higher pH (alkaline) that blue and green colour. At 5th week of age birds reared under white colour showed non significantly ($p \geq 0.05$) higher value pH(alkaline) than blue and green. Concerning the effect of density litter pH was found to non-significant among the groups. The interaction effects data showed the lowest value of pH in blue light stocked at 1 sq. ft significantly ($p \leq 0.05$) in 3rd week and non-significantly in 4th and 5th week. This result revealed that colour LED light with right stocking density improves litter quality.

Keywords: Colour light, broiler, Litter, pH, stocking density

Introduction
Monochromatic light-emitting diode (LED) sources are been used to a greater extend in poultry house as they are environmentally favourable and less electric consumption (Seo *et al*., 2016) [1]. Different monochromatic colour light affects growth, development, behaviour, and immune system in chickens (Rozenboim *et al*., 2004; Cao *et al*., 2008; Sultana *et al*., 2013; Xie *et al*., 2008) [16, 3, 18, 20].
Litter material is a dry material spread on the floor of poultry houses where the birds are reared. Casey *et al*., (2005) [5] explained litter as the amalgamation of bedding material, drooping, feather, wasted feed and spilled water. Demirulus, (2006) [6] reported that litter material undergoes bacterial breakdown procedure and hence preventing from foul odour and insanitary condition. Litter material is a key environmental factor affecting productive performance of broiler. Therefore, a standard litter material has following characteristics *viz*. low pH, moisture, ammonia production, not damp and adhesive, highly absorptive, emit moisture quickly, easily available, moulds free (Reece *et al*.,1979; Elliott and Collins, 1982 and Carr *et al*.,1990) [15, 7, 24].
Stocking density is one among the factors influence indirectly the moisture, temperature and quality of litter. High stocking density leads to soiled litter, foot pad dermatitis and leg disorders in birds ((Thomas *et al*., 2004; Jones *et al*., 2005; Campo and Prieto, 2009) [19, 8, 2]. Growth performance of birds depends upon stocking density.
There is a significant relationship between stocking density and litter quality. High stocking density stressed out birds and increase moisture level leading to leg problems (McLean *et al*. 2002) [18].
However very meagre information is available on the interactive effects of colour light and stocking density on litter quality. So, hence the present study was done to assess the influence of colour light, stocking density and their interactive effect on litter quality (pH).

Materials and Methods

The experiment was conducted in instructional Livestock Farm Complex, College of Veterinary science and animal Husbandry, OUAT, Bhubaneswar. Bhubaneswar is located at an elevation of 45 m above sea level and latitudes 20.27˚ N 85.84 ˚E. It has tropical savannah climate. The hottest month are May and June where mean maximum temperature ranges from 38 ºC to 45 ºC, respectively. December and January are the coldest months of the year with low average temperature ranges from 15 ºC-18 ºC. The average annual rainfall falls around 208 to 281 mm for all round the four months from June to September. The research was carried out in winter season from Dec –January for 35 days. 270-day old broiler birds were obtain from hatcheries and brooded conjointly for one week. After one week birds were randomly distributed into three colour light treatment *viz* T1: Control (white LED light), T2: Blue LED, T3: Green LED at three different stocking density (0.8 sq ft, 1 sq ft, 1.2 sq.ft).Thus there are nine treatment. Each treatment was then offered three replicate group of ten birds each. Light intensity was 20 lux at bird's eye level. Twenty-three hours' light (12-hour day light with colour LED light) and one-hour darkness was provided. Bird were reared in deep litter well ventilated house provided with adlibitum feed and water.

Determination of litter pH: Litter pH was recorded at weekly interval. Ten grams of litter sample were collected randomly from each pen at weekly interval and suspended for 20 minutes in 50 ml of distilled water and stirred of properly. Then pH meter (Mettler Toledo, GmbH, Switzerland) (Milles *et al*. 2006; Petek *et al*. 2014) [12, 13] was used for determination of litter pH.

Statistical analysis

The litter pH was analysed by Anova with three levels of colour LED light and three levels of stocking density. Comparison of means was done by Duncan test using SPSS software.

Results and Discussion

The data for means of litter pH for broiler birds exposed to light colours, reared at different stocking density and their interaction effects are presented in Table 2. The weekly mean litter pH values did not reveal any significance difference among the light groups in respect to litter pH at 2nd week, 4th week and 5th week. At 3rd week white colour showed significantly ($p \leq 0.05$) higher pH (alkaline) that blue and green colour. At 5th week of age birds reared under white colour showed non significantly ($p \geq 0.05$) higher value pH (alkaline) than blue and green. Concerning the effect of density litter pH was found to non-significant among the groups. The mean weekly pH at 5th week were 8.48, 8.42. 8.44 for 0.8 sq ft, 1 sq ft and 1.2 sq ft respectively. Mean pH of the birds reared at 0.8 sq ft showed non significantly high value than the birds stocked at 1 sq ft and 1.2 sqft at 5th week. The interaction effects data revealed that at 2nd week birds reared under white colour stocked at 0.8 sq ft showed significantly lower pH than other. Conversely at 3rd week birds exposed to white colour stocked at 0.8 Sq ft showed significantly ($p \leq 0.05$) higher value (alkaline) than other interaction group. However identical trend was seen in 4th and 5th week non significantly white bird stocked at 0.8 sq ft showed higher pH value than other interaction group. The lowest value was seen in blue light stocked at 1 sq ft. In this context Prayitno *et al*. (1997) [14] reported that colour light is considered as an important management key tool for poultry production (Prayitno *et al*., 1997) [14]. The higher pH may be due to higher proportion of drooping's in the litter of birds reared at higher stocking density. There was an increased trend of litter pH all through the experiment in regards to light, stocking density and interaction effect. This study showed similar finding of Jones and Hagler (1983) [9], (Brake *et al*., 1992) [1]. Increased of pH may be due to deliverance of ammonical compounds by microbial activity. It also reflects that high pH aggravates the conversion of excretory uric acid into ammonia (Melluzzi *et al*., 2008) [11].

Table 1: Effect of colours light and stocking density on litter pH of broiler at different weekly intervals

Parameters / Treatment	pH 2nd Week	pH 3rd Week	pH 4th Week	pH 5th Week
Effect of colour light				
White	7.46±0.025	7.76^{b}±0.037	7.93±0.036	8.47±0.032
Blue	7.50±0.025	7.63^{a}±0.037	7.89±0.036	8.42±0.032
Green	7.49±0.025	7.60^{a}±0.037	7.87±0.036	8.44±0.032
P - Value	0.41	P≤0.05	0.46	0.59
Effect of Stocking density				
0.8 Sq. ft	7.45±0.025	7.66±0.037	7.91±0.036	8.48± 0.032
1.0 Sq. ft	7.52±0.025	7.70±0.037	7.91±0.036	8.42±0.032
1.2 Sq. ft	7.48±0.025	7.63±0.037	7.87±0.036	8.44±0.032
P-Value	0.17	0.45	0.69	0.43
Interaction effect (Colour LED X Stocking Density)				
White LED x 0.8 Sq. ft	7.43^{a}±0.041	7.83^{c} ±0.057	7.97 ±0.061	8.55± 0.054
White LED x 1.0 Sq. ft	7.46^{ab}±0.041	7.69^{abc} ±0.057	7.89 ±0.061	8.46±0.054
White LED x 1.2 Sq. ft	7.49^{ab}±0.041	7.75^{bc} ±0.057	7.94 ±0.061	8.40±0.054
Blue LED x 0.8 Sq. ft	7.50^{ab}±0.041	7.62^{ab}± 0.057	7.85 ±0.061	8.39±0.054
Blue LED x 1.0 Sq ft	7.58^{a}±0.041	7.73^{bc} ±0.057	7.92 ±0.061	8.39±0.054
Blue LED x 1.2 Sq. ft	7.43^{ab} ±0.041	7.53^{a}± 0.057	7.91±0.061	8.50±0.054
Green LED x 0.8 Sq. ft	7.43^{a} ±0.041	7.53^{a} ±0.057	7.91±0.061	8.50±0.054
Green LED x 1.0 Sq. ft	7.53^{ab} ±0.041	7.67^{abc}±0.057	7.93±0.061	8.41±0.054
Green LED x 1.2 Sq. ft	7.52^{ab} ±0.041	7.60^{ab}±0.057	7.77±0.061	8.42±0.054
P-Value	P≤ 0.05	$p \leq 0.05$	0.57	0.36

Conclusion

Based on the findings of present research it may be interpreted that colour light with right stocking density and with precise arrangement of ventilation can improves the soothing effect of bird's microclimate by reducing the microbial and coccidial load.

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Conflict of Interest

The authors declare no conflict of interest.

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