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EFFECT OF DIFFERENT LIGHT COLOURS ON SOME BEHAVIOURS AND GROWTH PERFORMANCE IN JAPANESE QUAIL

(With 2 Table)

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تأثير ألوان الضوء المختلفة على بعض السلوكيات والكفاءة الإنتاجية فى السمان اليابانى

أجريت هذه الدراسة لأستبيان مدى تأثير الوان الضوء المختلفة على بعض السلوكيات والكفاءة الإنتاجية فى السمان اليابانى. وأوضحت النتائج مايلى: ١- أن نسبة السلوك العدوانى وصلت الى أدنى مستوى عند استخدام الضوء الأزرق والأحمر بينما سلوك الراحة وصلت الى أعلى مستوى عند إستخدام نفس الضوء ، وعلى النقيض من ذلك كانت نسبة السلوك العدوانى وصلت إلى أعلى مستوى وسلوك الراحة وصلت إلى أدنى مستوى فى وجود اللون الأبيض والأصفر. ٢- حالة الريش فى الطيور التى تعرضت للضوء الأزرق ، الأحمر ، الأخضر ، الأصفر، الأبيض من الناحية المثالية كانت ١٠٠٪ ، ١٠٠٪ ، ٤٥ر٩٥٪ ، ٤٨ر٩١٪ ، ٧١ر٨٥٪ على التوالى. ٣- كان أعلى متوسط أوزان الجسم ، معدل زيادة الجسم اليومية ، معدل التحويل الغذائى ، الكفاءة الغذائية فى الطيور التى تعرضت خلال تربيتها للضوء الأزرق ، بينما النقيض كان بالنسبة للضوء الأحمر. ٤- نسبة الوفيات وصلت إلى أدنى مستوى فى الطيور التى نمت فى الضوء الأزرق بينما وصلت إاى أعلى مستوى فى الضوء الأبيض. من هذه الدراسة نستنتج أن إستخدام لون الضوء الأزرق أثناء نمو السمان يزيد من وزن الطائر وفى نفس الوقت يقلل من حدوث السلوك العدوانى.

SUMMARY

This study was designed to determine the effect of white, red, blue, green and yellow coloured lights on pecking and resting behaviour (crouching and huddling) percent, feather condition, body weight, feed intake, body weight

gain, feed converaion, feed efficiency and mortality percent. The blue and red coloured lights provided the lowest pecking and the highest resting behaviour (crouching & huddling) precent. The greatest pecking and the lowest resting behaviour percent were among the birds reared under either white or yellow coloured lights. The green illuminated group was inbetween the two extremes in regard to pecking and resting behaviour. Birds reared under red or blue coloured light had 100% perfect feather scores (grade 1), whereas those reared under the green, yellow and white coloured lights scored 95.5, 91.48 and 85.71% grade 1 respectively. The blue coloured light provided superior body weight at 6 weeks of age, daily body weight gain, feed conversion and feed efficiency, whereas those reared under red coloured light resulted inferior body weight, daily body weight gain, feed conversion and feed efficiency. The lowest mortality percent was found among the birds kept under blue coloured light, while the highest percent was among the birds reared under the white light.

Key words: Japanese Quail-Behaviours- Growth-Light.

INTRODUCTION

Light is an essential tool in the management of birds. The influence of light environment (photoperiod and intensity) on their performance has generated considerable interest in recent years. There is, however, a dearth of information on the influence of different light colours. It is well established that light wavelength plays a role in the photosexual response at puberty. Longer orange- red wavelengths are more effective than shorter blue-green wavelengths in stimulating sexual maturation *(VAN TIENHOVEN and PLANCK, 1973 and BAYLE, 1980). WABECK and SKUGLUND (1974) and OSOL et al. (1980)* reported that blue or green wavelengths enhance growth rate, while red one inhibits growth in broiler chicks. *GILL and LEIGHTON (1984) and LEVENICK and LEIGHTON (1988)* demonstrated that blue-filtered light has improved weight gains of male turkeys during early growth period as compared to either white or red- filtered light. *FOOS et al. (1972)* showed that at 11 weeks of age, cockerels under green light were significantly heavier than those exposed to blue, red, dark or white light.

MACK (1984), FRASER and BROOM (1990) and RAMADAN (1991) demonstrated that red light reduced cannibalism in fowl. *LEVENICK and LEIGHTON (1988)* concluded that feather condition was poorest for turkeys reared under the white diurnal photoperiod, they reported also that no

significant differences in feed conversion between broilers reared under different photoperiod and light colours, while the early mortality was highest under blue light but late mortality was greater under red and white lights. Because wavelength of light appears to affect growth as well as reproductive performance, it is essential to evaluate the effects of traditional as well as the other light colours on performance of quail. Therefore the objectives of the present work were to study the effect of different coloured lights on pecking and resting behaviour incidence, body weight, daily feed intake, body gain, feed conversion and efficiency, mortality percent and feather condition, also the capability of using new light colours in quail rearing houses without adverse effect on its growth performance and behaviour was studied.

MATERIAL and METHODS

This study was carried out in Faculty of Veterinary Medicine, Moshtohor, Benha Branch, Zagazig University.

150 quail chicks obtained from a private farm at Al-Santa, Gharbia Governorate one day old, were raised together for two weeks, then at 2 weeks old they were randomly grouped into five light- proof pens (The floor area was 1,00 x 1.75 meters). The birds were reared on deep liter system. Light treatments were white, red, blue, green and yellow coloured Leuci lamps of 60 watts and reflector R80. The light sources were located 2.20 m at head height of the bird and centered in the pen. Light intensity at the level of the birds was measured according to *(FRANCIS and HARVEY, 1976).*

$I = I_o e^{-\alpha x}$ where I is the intensity of light at the level of the bird, lo is the source intensity, α is the absorption coefficient and x is the distance between the source of light and the birds, so the light intensity used was approximately 2.66 lux / square meter per second.

23 hrs on & 1 hr off lighting program was followed during the course of the experiment.

The birds were daily provided by water and a ration of broiler starter containing 28% protein ad-libitum at 9.00 a.m and the residuals of food were measured by weight back technique at 9.00 a.m in the next day. Ten birds from each group were randomly picked and identified. They were weighed weekly till the end of the experiment (6th week of age). Body weight, body weight gain, feed conversion and efficiency according to *DEATON et al. (1978)* and mortality percent were recorded.

The behavioural observations were performed according to the recommendation of *FRASER and BROOM (1990).* The five groups were

observed three times daily at early morning (7: 00-7: 50 a.m), late morning (11: 00- 11: 50 a.m) and afternoon (3: 00- 3: 50 p.m.) for three days weekly, so each group was observed 30 minutes daily for recording the percent of birds exhibited pecking and resting behaviour (crouching and huddling). At the end of the experiment, each bird was assigned a feather score: 1= fully feathered; 2= bare wing bows, or bare neck or back base of wings; 3= bare wing bows and bare backs; 4= devoid of feathers.

The statistical analysis was carried out according to *SNEDECOR and COCHRAN (1982).*

RESULTS and DISCUSSION

*** Effect of light colour on pecking, resting behaviour and fearher condition.**

Pecking:

Birds exposed to the blue or red coloured light had the lowest pecking percent, whereas birds exposed to white or yellow lights had the greatest percent and the green one had intermediate pecking percent, (Table. 1). Significant differences ($P< 0.01$) were found between all light colour groups except between the groups of red and blue light colours. The decreased pecking percent during the exposure of birds to blue and red coloured light may be attributed to that blue and red coloured lights are of markedy of lower intensity and limit the vision of the bird. The increased pecking percent in white and yellow coloured light groups may be attributed to the level of sex hormones which may increase sexual excitation and consequently the aggression *(KUO, 1960). OISHI and LAUBER (1973)* reported an interaction between wavelength and irradiant light intensity on gonadal development of the Japanese quail. Moreover, *DAVIDSON and LEIGHTON (1988)* found that most of the gonadal stimulation was associated with white light in turkeys, while blue light was ineffective in stimulating gonadal development. This is in agreement with the findings of *BOWLBY (1957), FRASER and BROOM (1990), RAMADAN (1991) and MICHAEL et al. (1992)* who demonstrated that red light reduced cannibalism in fowl and those reared undert white light were excitable. *SCHUMAIER et al. (1968)* observed that there was less cannibalism under red light than under green, yellow or white in broiler ckicks. *MCNITT (1983) and MACK (1984)* concluded that red light was the most effective measure for controlling cannibalism in broiler chicks.

Resting Behaviour:

With regard to resting behaviour (crouching and huddling), it was clear that the highest percentage for crouching and huddling was among birds kept under either blue or red coloured lights, while the lowest percentage was among birds reared under either white or yellow coloured lights (Table. 1). From results of table 1, it was observed that birds reared under blue light showed significantly ($P< 0.01$) higher crouching and huddling percent than those reared under either yellow or white light. Moreover, birds reared under either red (Crouching & huddling%) or green (crouching only) light showed significantly higher percent of resting behaviour ($P< 0.05$ & 0.01) than those reared under white light. No significant differences between crouching and huddling % were observed among blue, red and green light treatments. Also, there were no significant differences between the percentages of crouching and huddling in birds kept under red, green and yellow lights. The same observation was found between yellow and white light groups.

Rhythmic activity is a feature of the endocrine system. *FRASER and BROOM (1990) and JAMES & BURK (1992)* demonstrated that pineal melatonin increased in the dark and decreased in the presence of bright light. The lowest percent of resting behaviour in yellow and white light groups may be attributed to the high level of melatonin in their blood.

Feather condition:

Birds reared under red or blue light had 100% perfect feather scores (grade. 1), whereas those reared under the green, yellow and white coloured lights scored 95.45, 91.48 and 84.71 grade 1, respectively. These different scores may be attributed to the incidence of pecking under the different light treatments. *LEVENICK and LEIGHTON (1988)* reported that females of turkey reared under white light had perfect feather score (92%), whereas those reared under red, all had 100% perfect feather.

Effect of light colour on growth performance:

Body weight:

The influence of the light colour on average body weight at 6 weeks of age is summarized in Table (2). The blue and green illuminated birds were the heaviest, next in weight were the white and yellow groups. The lightest birds were red lighted group. Significant differences ($P< 0.05$ & 0.01) in final weight (at 6 weeks of age) were reported between groups of different colours of light.

In other words, the blue colour gave superior body weight at 6 weeks of age. those exposed to red coloured light had significantly ($P< 0.1$) inferior body weight at the same age. Reduced soical stress because of poor recognition or through limited visibility is suggested for the superior body

weight recorded by the group of blue light. Moreover, the birds reared under blue light colour showed much more resting behaviour than those under other colours which all reduced the energy lost in such activities.

Differences in body weight due to exposure to different light colours have been reported by several investigators in other bird. *WABECK and SHOGLUND (1974)* recorded a depressed body weight from 0 to 9 weeks of age among broiler chicks reared under red fluorescent light. *LEVENICK and LEIGHTON (1988)* stated that turkeys reared under blue or green lights were heaviest, whereas white or yellow light produced intermediate growth response.

Feed intake, weight gain, feed conversion and feed efficiency:

The influence of light colour on daily feed intake, daily body weight gain, feed conversion and feed efficiency is summarized in table (2). The obtained results showed that the greatest feed consumption was under red and white lights, whereas birds reared under blue or yellow light showed the lowest feed consumption. *SMITH and PHILLIPS (1959)* reported that a greater feed consumption was under green light in turkeys. These observations may possibly be explained by species differences in response to light colours used.

With regard to daily body weight gain, the results showed that birds reared under blue or green light showed the greatest daily body weight gain and birds reared under red light showed the lowest daily body weight gain, whereas those reared under white or yellow lights showed an intermediate response. In this respect, *LEVENICK and LEIGHTON (1988)* showed that male turkeys reared under blue light showed significantly greater body weight gain than those reared under either red or white light. Since *GILL and LEIGHTON (1984) and LEVENICK and LEIGHTON (1989)* showed that the wavelength of light influenced the growth of male and female turkeys, the response may relate to the slight differences in spectral distribution among the various light sources used. The lowest daily body weight gain in the birds reared under the red light may be due to the elevation of thyroxine harmone above the physiological limit which leads to elevated basal metabolic rate, increased appetite and weight loss *(HADLY, 1984).*

Concerning the feed conversion and efficiency, it was found that the birds exposed to the blue light showing the best feed conversion with 2.03 gm of feed required to produce a one gm of body weight. The least feed conversion group was those exposed to red light with a feed conversion figure of 3.34 gm. Meanwhile the best feed efficiency (in gms of meat produced per one gm of feed consumed) was obtained by birds reared under blue light. On the other hand the least feed efficiency was obtained by those reared under the

red light. *WABECK and SKOGLUND (1974)* showed that the broiler chicks exposed to the blue and yellow light showing the best feed conversion, while the least conversion group was those exposed to red light. By contrast, *ZIMMERMANN (1988) and FELTS et al. (1990)* found that light did not significantly affect feed conversion in broiler chicks and turkeys.

Mortality:

The lowest percent was among the birds exposed to blue light, while the highest percent was among the birds reared under the white light (Table. 2). Mortality differences due to exposure to different light colours were highly significant ($P< 0.01$) between blue and green light, yellow and white light. On the other hand there was no significant differences between bue and red lights, green and red lights. Also there were no significant differences in mortality percent between white, green and yellow light groups.

Differences in average mortality due to exposure to different light colours have been reported in other birds by several investigators. *WABECK and SKOGLUND (1974)* reported that the average mortality was 3.47% for the blue light group and 4.86% for the green light group in broiler chicks. *LEVENICK and LEIGHTON (1988)* found that mortality was not affected by light colour in turkeys. The differences between the obtained results and the results reported by *LEVENICK and LEIGHTON (1988)* may be attributed to species differences in response to light colour used.

Results of this study emphasize the dynamic nature of the bird's interaction with its environment, wherein the differences in the behaviour and growth performance can be attributed to light environments with varying biological activity. The use of blue, low intensity, light during the growing period of quails could provide real economic gains due to increased body weight gain, also decreases the occurrence of pecking percent. In this respect a blue light, which is perceived by the quails as less bright than other light colours is preferable than a white light (traditional light), to stimulate growth and decrease the pecking occurrence.

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Table (1): Average incidence of pecking and resting behaviour (crouching & Huddling) and feather condition of quails when exposed to different light colours.

Item	Light treatment				
	White	Red	Blue	Green	Yellow
Pecking %	6.63 ± 0.31a**	2.13 ± 0.23 d	2.05 ± 0.17 d	3.83 ± 0.17 C	5.59 ± 0.25 b
Crouching %	9.74 ± 0.58 c	16.88± 3.03ab*	20.48±2.87a**	13.99±2.02ab*	11.97 ± 1.62 bc
Huddling %	11.97 ± 0.92c**	19.57 ± 2.48ab	23.08 ± 3.29 a	15.96±2.34abc	14.21 ± 2.17 bc*
Feather condition					
a) Grade 1	85.71	100.00	100.00	95.45	91.48
b) Grade 2	14.29	0.00	0.00	4.55	8.52

Means in the same row with different superscripts differed significantly at
* $P < 0.05$
** $P < 0.01$

Table (2) : Means and their standard errors of the effect of different light colours on growth performance.

Item	Light treatment				
	White	Red	Blue	Green	Yellow
Body weight /gm					
a) Initial at 2 wk	25.70 ± 0.42	26.31 ± 0.51	26.00± 0.58	25.43 ± 0.45	25.87 ± 0.60
b) Final at 6 wk	152.13± 2.30C**	136.41± 1.88E**	179.18 ± 3.08 a	169.71 ± 3.40 b*	147.30 ± 2.75 d**
Daily feed intake/gm	12.57	13.13	11.10	12.29	11.26
weight gain / gm					
a) Total at 6 wk	126.43	110.10	153.18	144.28	121.43
b) Daily	4.52	3.93	5.47	5.15	4.34
Feed conversion	2.78	3.34	2.03	2.39	2.59
Feed efficiency	0.36	0.30	0.49	0.42	0.39
Mortality %	11.97 ± 0.92C**	7.44 ± 0.96 ab	5.41 ± 0.87a	9.63 ± 0.60 bc**	10.78 ± 0.66C**

Means in the same row with different superscripts differed significantly

* $P < 0.05$

** $P < 0.01$