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EFFECT OF THE COLOUR OF FEEDERS AND DRINKERS ON DEVELOPMENT OF SOME MAINTENANCE BEHAVIORS IN NEWLY HATCHED CHICKEN

Motamed Elsayed Mahmoud**, Reem Mahmoud Dosoky*
and Moustafa Mohamed Ahmed*

*Department of Animal Hygiene, Faculty of Veterinary Medicine, Assiut University, Egypt

**Department of Animal Husbandry, Faculty of Veterinary Medicine, Sohag University, Egypt

ABSTRACT:

Background: Colors of long wave lengths and color contrast can increase the responsiveness of chicken to stimuli. **The purpose:** This study was designated to assess the effect of feeders and drinkers colors and their contrast on ingestion rate and development of some maintenance behaviors **Methods:** This study includes 2 experiments. **Experiment I:** Effect of different colors of feeders and drinkers on rates feeding rates and water intake during 6 weeks rearing period was examined in Ross broiler chicken. **Experiment II:** Assessment of the effect of color contrast of feeders and drinkers with the floor on development of maintenance behaviors in newly hatched chicken. **Results:** The results indicated that red colored feeders and drinkers increased the feed and water intake rates during the first week post hatching ($P < 0.05$). But no such effect was observed in older ages. In addition, the presence of color contrast feeders and drinkers with the floor enhanced the appearance of certain behaviors necessary for survival in newly hatched chicks. In conclusion red colored feeders and drinkers attracted chicks, increased ingestion rate and color contrast accelerated the development of some maintenance behaviors and decreased distress calls. Thus using red colors and presence of contrast environment could enhance the development of maintenance behaviors in newly hatched chicken.

INTRODUCTION:

Chicken relied mostly on its sense of vision for eating, drinking or even survival. Chicken preferred colors of long wave lengths over that of short wave lengths. e.g. the responses of chicks to distant flashing lights were poor to white and blue colors in comparison to red

lights and yellow colors (Thomast & Lyons, 1968; Schaefer & Hess, 1969; Smith & Bird 1971 and Miklo'si *et al.* (2002). Also chicken preferred high color contrast or differing colors over familiar colors (Osorio *et al.*, 1999, 2009). When chicks exposed to a choice situation and the order of preference to colours recorded, the values from highest to lowest were as follows:

blue, red, green and white respectively (Hess, 1959). In a preference test if the bird was given a choice of certain aspects of its environment, it would choose according to how it felt. i.e. in the best interest of its wellbeing or welfare (Duncan, 1991).

Chicken behavior, as the way in which it acts, covers many activities or many patterns. Feeding, drinking, body care and comfort are examples of maintenance behavioral patterns (Broom, 1992). Other patterns of behavior concerned with conveying information to other birds of the same species are called displays (Duncan & Wood-Gush, 1972 and Appleby *et al.* 1992). The process of food ingestion in birds was divided into 5 stages: arousal and food recognition, orientation, grasping, mandibulation and swallowing (Kuenzel, 1983). Birds did not take more time when drink than did as they feed. In addition, there were no strain differences in drinking behavior. However, feeding and picking behaviors were directly facilitated by social stimulation e.g. the presence of an active companion especially during feeding. Birds comfort behaviors or activities have to do with their body care. eg. preening, dust bathing, scratching, head shaking, leg and wing stretching...etc. were an important part of the skin hygiene and self-maintaining behaviors (Fraser & Broom, 1990 and Appleby *et al.* 1992).

In this study 2 separate experiments were performed to assess the effect of colors of drinkers and feeders on feeding and drinking behaviors in chicken and development of

maintenance behaviors in newly hatched chicks. The present study was performed to know the best desirable colors to suffice welfare and enhance productivity in chicken.

MATERIAL AND METHODS:

Subjects and housing:

The study was performed in an experimental farm run by Animal and Poultry Production Department, Faculty of Agriculture, Assiut University, Egypt. All chicks were fed the same total mixed ration. Ambient temperatures were scheduled in a descending gradient (37 to 24°C) and lighting artificially provided by incandescent bulbs (1-5 watt/m²) with (hours; 23.5 L/0.5 D) daily light program (Rose, 1997). Vaccinations and medications were scheduled as recommended by manufacturer companies. Chicks were kept under veterinary supervision, selectively chosen and clinically healthy.

Experiment I:

Measuring effect of feeders and drinkers colors on ingestive behavior in broiler chicken during 6 weeks rearing period:

It was performed on 40-Ross broiler chicks from one day to 42-days old. Feeders and drinkers colors were red, green, white and blue. Locations of feeder and drinkers were oriented from time to time to preclude the location preference (Duncan, 1991). In addition, the size of feeders and drinkers were increased gradually to adapt chicken ingestion rate. The following 2 rules of Duncan (1991) were adapted to avoid preference testing shortcomings: 1-A wide rang of choices were made to avoid the

only two percentage values results (eg: 70%+30%). 2-Limiting the test time to one hour to assure the resulted preference value indicated the current feeling of birds and allowed a sufficient time for birds to perform their full repertoire of behavior. Ingestion rate was measured according to Murphy & Preston (1988) protocol with slight modifications; the consumption rate/chick/feeder or drinker/hour were calculated by computing weighing differences among feeders/drinker full of ration/water (A), weighing of feeders/drinker after test (B) and weighing of ration/water on the sheet underneath (C).

Experiment II:

Effect of colors contrast on development of maintenance behaviors in newly hatched chicks: The number of birds was 30 newly hatched chicks which are divided into 5 groups (6 chicks each). Each group was stocked in a plastic hatching basket (95×37×23 cm³) for one week. Each group of chicks were daily observed for 10-min sessions and sequentially repeated for 3- hrs (9:00-12:00) in the morning and 3-hrs (3:00-6:00) afternoon. Each chick displayed a certain behavior was described and recorded as first time record to that behavior. e.g.: feeding from dish, drinking, preening, dust bathing, and perching, picking, vocalization, resting, sleeping and dozing. Dozing was recorded when the chicken was sitting with neck withdrawn, the head motionless and the eyes either half closed or slowly opening and closing.

If the bird's neck was fully recumbent and the eyes permanently closed, it was recorded as sleeping (Vestegaard, 1982 and Broom, 1992). Also any of walking, drinking, floor picking, picking other birds, wing stretching, leg stretching, preening...etc. or any other activities were recorded. In addition the frequencies of such behaviors during the observation were tabulated (Prayitno *et al.*, 1997).

Statistical analysis:

All statistical analysis of data was performed using SPSS (2007) Software. All values were presented as means±standard error (SEM). Groups at different ages were analyzed by two-way analysis of variance (ANOVA). Tukey's HSD was used for multiple comparisons among mean values in different groups.

Total average feed and water intake were calculated. Data are presented as mean±SE. Values with asterisks mean significant versus # (P<0.05).

Data in Fig. 1 indicated that red colored feeders and drinkers increased total feed and water intake rate when compared with blue colored feeders and drinkers during first week. Murphy and Preston (1988) found that mean values for feeders visit times were generally short; almost less than a minute. On contrast, the drinker visit times were shorter than feeder visit times. About 93% of all drinker visit times were less than 1 minute in length. The number of beak dips/time ranged from 1 to 27.

Table 1: Groups and types of feeders, drinker and floor contrast in plastic hatching baskets

Groups Name	Feeder color	Drinker color	Floor color
No contrast (NC)	Transparent	Transparent	White
RF- RD	Red	Red	White
RF-NCD	Red	Transparent	White
NCF-RD	Transparent	Red	White
WF-WD	White	White	Red

RESULTS & DISCUSSION:

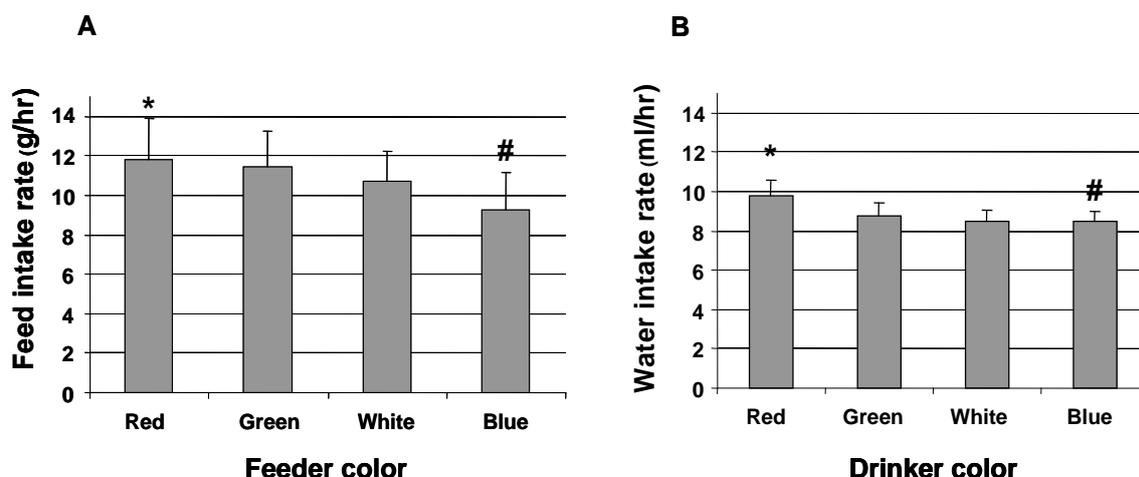


Fig. 1 : Effect of feeders and drinkers color on total feed (A) and water intake (B) rates (chick/hr) during 6 weeks period in Ross broiler chicken

Table 2: Effect of feeders and drinkers colours on ingestive behavior in Hubbard broiler chicken

Age (day)	Feeder Color				Drinker Color			
	Red	Green	White	Blue	Red	Green	White	Blue
1 st	5.6 ±0.2 ^a	3.1 ±0.1	4.7 ±0.1	3.2 ±0.1	6.7 ±0.2 ^a	5.5 ±0.4	5.0 ±0.3	5.1 ±0.4
2 nd	6.5 ±0.3 ^a	3.3 ±0.1	5.6 ±0.1	4.3 ±0.4	6.6 ±0.2	6.0 ±0.1	5.5 ±0.2	6.0 ±0.3
3 rd	6.5 ±0.4 ^a	4.8 ±0.3	4.5 ±0.2	5.1 ± 0.2	8.8 ±0.4 ^a	6.5 ±0.3	5.4 ±0.4	5.6 ±0.1
4 th	6.7 ±0.3 ^a	5.9 ±0.2	4.2 ±0.3	5.4 ±0.3	9.1 ±0.3 ^a	7.0 ±0.3 ^b	5.1 ±0.5	5.5 ±0.2
5 th	7.1 ±0.3 ^a	4.5 ±0.3	4.9 ±0.4	5.1 ±0.4	8.6 ±0.5 ^a	7.6 ±0.1 ^b	5.6 ±0.2	6.1 ±0.4
6 th	6.9 ±0.4 ^a	4.8 ±0.2	4.9 ±0.1	5.8 ±0.3	8.7 ±0.3 ^a	6.1 ±0.3	5.1 ±0.3	6.4 ±0.5
7 th	7.6 ±0.5	7.2 ±0.3	6.9 ±0.5	6.9 ±0.5	8.0 ±0.2	5.0 ±0.2	5.7 ±0.5	5.2 ±0.3
8 th	7.3 ±0.2 ^a	6.5 ±0.4 ^b	5.8 ±0.3	5.9 ±0.3	7.7 ±0.3	7.1 ±0.4	8.5 ±0.3	7.9 ±0.2
9 th	8.1 ±0.3	7.5 ±0.3	7.8 ±0.4	7.6 ±0.4	7.8 ±0.2	7.8 ±0.5	8.4 ±0.4	7.9 ±0.5
10 th	8.0 ±0.4	7.7 ±0.5	7.9 ±0.3	7.5 ±0.3	8.6 ±0.3	7.6 ±0.6	8.3 ±0.3	8.2 ±0.2

Feed intake rate (chick/gram/hr) from feeders and water intake (ml/hr) from drinkers during first 10 days post hatching were measured. Two ways ANOVA indicated an age and color effect on feed and water intake. There was a general increase in ingestion rate with

advancing age. Tukey's HSD tests indicated that red feeder and drinker increased the feed intake rates in chicks up to 6 days post hatching. Data are presented as mean±SE. Values with superscripted letters mean significant ($P<0.05$) differences.

Results in Table 2 could be interpreted by finding of Gray (1961) who mentioned that the responses of broiler chicks to colours were high to red color when compared with white, blue and green colors during first 5 days post-hatching. Regarding the effect of age on ingestion Richard *et al.* (1997) and Savory & Mann (1997) observed an age-related increase in ingestive behavior because the frequency of its corresponding exploratory behavior decreased with advancing age in chicken. However Newberry *et al.* (1988) and Blokhuis & Haar (1992) found that frequency of feeding and drinking declined as the age of chicks increased.

Effect of color contrast of feeders and drinkers on appearance and frequency of behaviors in newly hatched chicks during 3 hours daily observation. Behaviors recorded were counted/ group/3 hours observation. Key: NC; No contrast by colorless feeders and drinker, RF- RD; red feeder and red drinker, RF-NCD red feeder and colorless drinker, NCF-RD; colorless feeder and red drinker, WF-WD; white feeder and white drinker. Values scale: (+=1-5, += 6-10, +++= 11-15 and ++++ = over 15).

First of all, behaviors observed during first week post hatching were nutritional (feeding, drinking, and elimination), body care behaviors

(preening and stretching), resting and sleeping and vocalization.

Since the time of the day had no significant effect on the following behaviors; wing/leg stretch, wing flapping, head scratching and preening (Nicol, 1987 a & b) this finding could validate time limited observation schedule in the present study.

With respect to feeding behavior, NCF-group and also WF-WD group only one chick identified and reached feeder at first day. While all chicks developed feeding within the first 3 hours after provision o feeders and drinkers in other groups. RF-WD- group developed feeding pattern during the first 90-min of observation all chicks. This may be attributed to the good contrast made by red feeder that could be very attractive for chicks to begin picking. All chicks of WF-RD group reached the feed dishes and showed picking and feeding during the first 45-minutes. WF-WD-group with red colored floor possibly made the best contrast to the white colored feeders and yellowish colored ration. On other hand, all chicks in NC-group appeared lazy and drowsy and remained without noticeable movement during the first day observation hours. Only one chick reached the feeder. Colourless feeder had the worst contrast with the white floor and probably was not attractive to newly hatched chicks.

Table 3: Qualitative assessment of the effect of color contrast of feeders, drinkers and floor on appearance and frequency of behaviors in newly hatched chicks

Behavioral pattern recorded first	Group				
	NC	RF-RD	RF-NCD	NCF- RD	WF-WD
First Day					
Feeding bouts	++	++++	+++	+	+
Drinking bouts in form of pick drinking	++	+++	++	++++	++++
Elimination times	+	+	+	+	+
Picking of grains from beaks of other birds	+	+	-	+	+
Ground picking	-	-	-	-	+
Sleeping with head on ground	+	+	+	+	+
Sleeping with beak on ground	+	+	+	+	+
Loud vocalization calls	++	+	+	+++	+
None loud vocalization calls	+	+	+	+	+
AutoPreening	+	++	+	+	++
AlloPreening	+	+	-	-	+
Resting	+	-	+	-	++
Dozing	+	++	+	-	++
Second Day					
Toe picking	+	-	-	+	-
Ground Picking	+	-	-	-	-
Leg stretching	+	+	+	-	+
Wing stretching	-	-	+	-	+
Third Day					
Drinking bouts in form of scope drinking	+	+++	+++	++	++
Drinking bouts in form of pick drinking	+	-	+	-	+
Autopreening of back while standing	++	++	++	++	+++
Autopreening of outside wing while standing	+	+	+	+	++
Autopreening of inside wing while standing	-	-	-	-	+
Autopreening of wing while sitting	+	+	+	++	+
Autopreening of back while sitting	+	+	+	+	+
Picking of environmental conspecifics	-	+	+	+	+
Wing flapping	+	-	-	+	-
Fourth Day					
Drinking bouts in form of pick drinking	+	+	+	+	+
Drinking bouts in form of scope drinking	+	+	+	+	+
Autopreening of head by leg while standing	+	+	+	+	+
Floor scratching	+	+	+	+	-
Perching on feeder	+	+	+	+	-
Fifth Day					
Scoop drinking	+	+	+	-	+
pick drinking	+	+	+	+	+
Dust bathing in feed trough	+	++	++	-	+
Six Day					
Scope drinking	+	+	+	+	+
Autopreening of back	+	-	-	+	+
Stretching of wing and leg	+	+	+	+	++
Seventh Day					
Autopreening of wing while sitting	+	-	+	+	-

+ = 1-5, ++ = 6-10, +++ = 11-15, ++++ = over 15.

Regarding drinking Behavior, initially, it was observed that all chicks performed a less developed form of drinking that was not like the ordinary scope form of drinking. This form of drinking continued up to the 3rd day post hatching. Our finding in present study was that head movement during drinking was the only component similar to developed scope form of drinking. In WF-RD-group was the first group showed drinking. All chicks attracted to the drinker tried to investigate water and began to drink within the first 5 min after placing the drinker dish in the plastic hatching basket. This may be due to the red colored drinker was the only attractive thing inside chicks' environment. On contrast, chicks of the NC-group were the last group reached drinkers. It was after about 15-20- minutes. The remaining 3 groups, within 5-to 10-minutes began drinking. During the third day all chicks from all groups showed developed form of scope drinking.

Considering picking behavior, day ground picking was firstly appeared in the WF-WD group during the first. That could be related to attraction by red floor. During the second day, picking of environmental conspecifics observed in all groups of birds with varied frequencies. Hence all chicks at second day showed feeding activity picking of that could be initiated by feeding. This result agreed with Fischer, *et al.* (1975) presumed that, newly hatched chicks did not pick much more before their second day of life because of the compensated utilization of the yolk sac during such period. During the third day, NCF-RD and WF-WD-groups showed the

highest picking to environmental conspecifics. With respect to the NC-group the absence of any environmental contrast or any color attractive in their neighborhoods perhaps was the causal factor for increased a searching for food component of exploratory behavior or as redirected ground picking (Broom, 1992). The latter probably indirectly reflected in increased conspecifics' picking. Picking other birds or cannibalism was not observed in the present study. This may be related to elimination of this trait by selective breeding because nervousness was found to be negatively correlated to meat production in chicken (Jones, 1996).

According to Fraser & Broom (1990) preening can divided into 2 categories: auto-preening or itself body care and allo-preening or their selves body care. Preening can also divided according to the part of the body engaged in preening activity into wing, body and head body care or preening behaviors. In present study body care behaviors, preening, or combing the feather covering the body appeared firstly by combing the back region. Back preening was observed in all groups within the first three hours post hatching. In one day old chicks, head preening activity was only observed in the NCF-RD group.

The highest allopreening activity was observed in the WF-WD group that probably correlated to the highest action of ground picking that may be considered as redirected ground picking behavior. On other hand NC-group did not show any allo-preening activity. These results could be attributed to hunger

associated with inactivity. However, Webster (2000) and Na"tt, *et al.* (2007) found that stimulations of preening by feather growth might be the most important causal factor for the development of that behavior.

Regarding sleep, huddling and sleeping was observed in two groups; NC-group and WF-RD group during the first day. Chicks of these groups were apparently inactive remained motionless and walked in lazy manner during first day. To elucidate the appearance of huddling and sleeping in these 2 groups could be due to lowered feed visits and consequent decreased feed consumption and consequent diminished heat increment. After that birds felt cold and tried to warm that could be found by huddling together. Allam (1994) mentioned that huddling provided warmth function by contact and decreased heat loss.

In the present study loud and non loud vocalizations were emitted by chicks from all groups. During the first day the variations was as following: Chicks of NC-RD group produced the highest frequency of vocalization of loud type (17- calls) followed by NC-group. Chicks of this group showed the lowest feeding and drinking bouts during first day (Table 3). These calls could be attributed to thirst, hunger or distress calls. In agreement with that Andrew (1973) who named loud vocalization calls by hunger or distress calls.

Regarding ground scratching, chicks of WF-WD-group were the only group showed scratching ground. Chicks scratched the floor with their legs and sprayed the loose materials

on the floor. Ground scratching considered as a component of dust-bathing behavior (Fraser and Broom, 1990). But Blokhuis & Harr (1992) observed that ground picking and scratching were more common after feeding period (s) than before. In present study chicks 5th day old showed dust bathing in feeders this result agreed with Murphy & Preston (1988) and Broom (1992) who observed that chickens would dust-bathe if sand or other alternative materials were available. If there were no alternatives chickens would dust-bathe in dry food. Vestegaard (1982) recorded the development or appearance of dust-bathing behavior in chicks when they were about few days post hatching. On other hand Murphy & Preston (1988) and Savory & Mann (1997) interpreted the lower frequency of dust bathing, preening and non-damaging picking in broiler chicken due to the intensive selection against these behavioral traits in broilers as these traits were undesirable from economic point of view. Vestegaard. (1982) considered allopreening or allopicking to be the result of an abnormal development of the perceptual mechanisms responsible for detection of some substrates, these substrate materials were needed for performance of dust-bathing behavior. In other words, they explained allopreening as redirected behaviors of another behavioral pattern (ground picking).

In conclusion, to conclude red colored feeders and drinkers attracted chicks, increased ingestion rate and color contrast accelerated the development of some maintenance behaviors

and decreased distress calls. Thus using red colors and presence of contrast environment could enhance the development of maintenance behaviors in newly hatched chicken.

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تأثير لون الغذائية والمشروبات على تطور بعض سلوكيات البقاء
في كتاكيت الدجاج حديثة الفقس
معتمد السيد محمود، ريم محمود دسوقي، مصطفى محمد أحمد

الخلفية البحثية: التباين في الألوان داخل نظام التربية المكثفة حيث توافر الإضاءة المنخفضة والأعداد الكبيرة قد يؤثر على استجابة الدجاج للمؤثرات الخارجية الغرض من الدراسة: هو دراسة تأثير بعض الألوان المختلفة للغذائيات والمشروبات مثل الألوان ذات الأطوال الموجية القصيرة (الأزرق والأخضر) والطويلة (الأحمر) واللون الأبيض على السلوك الغذائي بالإضافة إلى دراسة تأثير تباين الألوان ذات الاستجابة العالية على تطور بعض سلوكيات البقاء في كتاكيت الدجاج حديثة الفقس. طرق البحث والنتائج: تم إجراء هذه الدراسة على تجربتين. التجربة الأولى: لقياس تأثير الألوان المختلفة (الأحمر، الأخضر، الأبيض والأزرق) لكل من الغذائية والمشروبات على معدل تناول الغذاء والشرب لكتاكيت دجاج الروس كمثال لبدارى التسمين التجارية، أوضحت هذه الدراسة أن الغذائية والمشروبات الحمراء أدت الى زيادة معدل تناول الغذاء والشرب في الأسبوع الأول من العمر ولكن لم يلاحظ هذا التأثير في العمر الأكبر. التجربة الثانية لقياس تأثير تباين الألوان ذات الاستجابة المرتفعة (الأحمر) للغذائيات والمشروبات مع الأرضية مخلفية للتباين على ظهور بعض سلوكيات البقاء في الكتاكيت حديثة الفقس. وتبين من النتائج أن وجود تباين الألوان في بيئة كتاكيت الدجاج أدى الى الإسراع من تناول الغذاء ، وكذلك ظهور مبكر لبعض سلوكيات البقاء عند مقارنتها بالبيئة التي لا يوجد بها تباين. الاستنتاج: استجابة الكتاكيت للون الأحمر والتباين في الألوان يكون أعلى في الكتاكيت حديثة الفقس عنه في العمر الأكبر مما يجدر بالقائمين على رعاية الدجاج الاهتمام بألوان الغذائية والمشروبات وإيجاد التباين لها في المزارع خصوصا الكتاكيت حديثة الفقس الأمر الذي ينعكس بدوره على الاستجابة للغذاء والشرب وبالتالي على الإنتاجية.