

EGG PRODUCTION, QUALITY AND CHICK COLOUR PLUMAGE OF FIVE COLOURS OF KAMPONG HENS FED GOOD QUALITY FEED

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ABSTRACT

An experiment was carried out to study the egg production, quality and chick colour plumage of five phenotypic plumage colours of Kampong hens fed good quality feed. A Randomized Block Design consisted of five treatments and five replicates were used in this experiment. A total of 25 matured kampong chickens consisted of five plumage colours: i.e. Black (*Selem*), Red (*biying*), Mix colour (*brumbun*), white plumage with yellow leg (*putih siung*), and white plumage with white leg (*putih kedas*) and five cockerels with respective colours were used in this experiment. Hens were housed individually in enrich cage. Mating procedure was done in a special mating cage where each cockerel with respective colour stays all the time. Hen was brought into the mating cage and left there for 24 hours and repeated after 5 days, until hens were going into brood. A good quality feed contained 17% CP and 2750 kcal ME were offered to all hens and fresh water were provided *ad libitum*. Observation was made for 14 weeks. This study showed that in one laying cycle except the mixed plumage colour hens produced similar number of eggs while the mix colour was the least. All parameters measured for egg quality from those five plumage colours were similar. Observation of the chicks colour at one day old chick (DOC) showed that black plumage, white plumage with yellow leg, and red plumage hens had 100%, 100% and 81% chicks respectively had similar colour to their respective parents. While those mix colour and white plumage with white leg were only had 38.89% and 30.2% chicks with similar colour to their respective hens. After 8 weeks old, the colour of the chicks from respective colour has changed where black, red, white plumage with yellow leg had 70%, 77.5% and 93.75% chicks with the same colour to their respective hens. While those mix colour and white plumage with white leg had 53.8% and 17.6% chicks with the same colour to their parent. It was concluded that black, red, and white plumage with yellow legs had dominant gen in kampong chickens.

Keywords: Kampong chickens, chick colour distribution, egg production, egg quality

INTRODUCTION

The role of kampong chickens in providing protein from meat and eggs in Bali and Indonesia in general is well documented. In Bali, kampong chickens play a very important role due to the fact that kampong chicken is not only providing egg and meat for consumption but more importantly it is also used for ceremonial purposes as well as for hobby (cock fighting). The total number of kampong chicken in Bali was reported about 4.6 million (*Dinas Peternakan, 2010*). Bali communities where mostly are Hindus needing kampong chicken in their daily life for ceremonial functions, such as "Mecaru", make an offering (*meyadnya*) namely *Dewayadnya*, *Resiyadnya*, *Manusayadnya*, *Pitrayadnya* and *Bhutayadnya* (*Nitis, 2006*). The Chicken needed are those who have five plumage colours namely:

Red (*Biying*), Black (*Selem*), White with yellow legs (*Putih siungan*), White with white legs (*Putih kedas*), and Mixed colour (*Brumbun*). Those five colours follow the positions of the offerings that is red in the South (for the God of *Brahma*), black in the North (for the God of *Wisnu*), yellow in the West (for the God of *Mahadewa*), white in the East (for the God of *Iswara*), and mixed colour in the Centre (for the God of *Siwa*) (*Utarayana, 1993; Budaarsa, 2009*). These functions are common and frequently practiced by the Hindus community in Bali, as well as for hobby or entertainment such as cock fighting purpose. Although the needs of the five colours of kampong chickens are a lot particularly during the ceremonial activities, there is no special production center of those types of chickens at present in Bali. Kampong chickens are commonly raised extensively and are left to scavenge their feeds in the field so

their production is relatively low (Mastika, 2004). To anticipate those needs, an experiment was carried out to study egg and chicken of the five phenotypic plumage colours of kampong chickens when fed good quality feed (15-17% protein) and housed in the intensive farming system to increase the production.

MATERIALS AND METHODS

Chickens. Twenty five mature hens (kampong chickens) comprising of five plumage colours namely Red (*biying*), Black (*hitam*), White with yellow legs (*putih siungan*), White with white legs (*putih kedas*) and Mix colours (*Brumbun*) were used in this experiment. They were housed individually in “enriched floor cages” (Pavlik *et al.*, 2007, Sarica *et al.*, 2008). Each cage was provided with feed and water containers, perching stick and nesting box. The chicken cage size is 100x75cm wide, with 80 cm height.

Feed and Water. Feed were formulated using a mixture of Charoen concentrate, yellow corn, rice brand, additional vitamin and mineral so those mixture contained approximately 17% CP and 2750 kcal ME as suggested by Mastika (*unpublished*) and this feed is considered as good quality feed for kampong chickens. Feed and water were provided *ad libitum*, but on the other hand feed and water intake were weighed and recorded every day.

Mating System. In order to have fertile eggs, each hens of the same colour with the cockerels were mated individually in a mating cage. Hens were placed first then followed by the cockerels. This method were performed every day by replacing the hens, until all the hens have been mated and was carried out continuously until the hen is going into brood. The similar system of mating was employed to the other colour group.

Egg production. Egg production was counted and recorded daily for all hens and at the third day of production, one egg from each hen was taken for egg quality measurement.

The measurement of egg quality was carried out following the method explained by Stadleman *et al.* (1973) and Hughes (1974). At the end of production cycle, the birds would have started brooding, but feed and water were provided *ad libitum* and consumption were measured daily to study the pattern of feed and water intakes during brooding time. After 21 days of brooding time, the baby chickens that have hatched were counted and let the hens in the nest for 2-3 days until all the egg hatched. At one day old, chicken (DOC), the colour of the plumage were recorded. Hatched and unhatched eggs were then calculated and all this data were tabulated and analyzed.

Design of the experiment and statistical analyses. A Complete Randomized Design consisted of five treatments (5 plumage colours) as mentioned above (Red, Black, White with yellow leg, White with white leg and mixed colour) and 5 replicates each was used in this experiment. All data were recorded, tabulated, and analyzed using analysis of variance. Whenever significantly differences were found, analyses will be continued using Duncan's Multiple Range Test (Lu Chih Chang, 1982).

RESULTS AND DISCUSSION

Among those five plumage colours of the Kampong chickens produced eggs in one laying cycle between 11,5 to 14,3 eggs per laying cycle (Table 1). This figure is in line with the report of Kingston (1974) that Kampong chickens production was 72 eggs/year. Siregar and Sabrani (1980) also reported that egg production of kampong chickens was 30–60 eggs/year.

Table 1. Production and hatchability of kampong hens (five plumage colours) in intensive rearing

Performance	Plumage colour hens					SEM	
	Black (Selem)	Red (biying)	Mix colour (Brumbun)	White/White legs (Putih kedas)	White/Yellow legs (Putih siung)		
Egg production per laying cycle	14,2a*	12,3a	11,5a	12,8a	14,3a	1,43	(Puger <i>et al.</i> , 2012)
Number of egg brooded	11,8a	11,6a	10,7a	12,5a	12,6a	0,80	(Puger <i>et al.</i> , 2012)
Number of egg hatched	9,0a	7,8a	6,0a	9,7a	9,6a	0,79	(Puger <i>et al.</i> , 2012)
Number of infertile egg	2,8a	3,8a	4,7a	2,8a	3,0a	0,71	(Puger <i>et al.</i> , 2012)
Number of DOC (Day old chick)	8,8a	7,8a	6,0a	9,7a	8,8a	0,80	(Puger <i>et al.</i> , 2012)
Number of chick at one week old chick	8,8a	7,8a	6,0a	9,7a	8,8a	0,80	
Number of chick at two weeks old chick	8,8a	7,8a	6,0a	9,7a	8,8a	0,80	(Puger <i>et al.</i> , 2012)
Number of chick at three weeks old chick	8,5a	7,8a	5,8a	9,7a	6,5a	0,85	
Number of chick at four week old chick	7,8a	7,0a	5,5a	9,2a	6,3a	0,74	

*Note : Means in the same row with different script differ significantly (P<0.05)

This figure of egg production as significantly lower when compared to those kampong chickens housed in battery cages for egg consumption (Cresswell and Gunawan, 1992; Andi, 1988), because in this system each hen has spent time for brooding and looking after the chicks for about 6-8 weeks. It was interesting to note that the number of infertile eggs of mixed colour hens (*brumbun*) was the highest (4,7 out of 11,5 eggs) when compared to others. Although the feed given was the same in quality and quantity, probably those differences were due to the different genetics background of the hens. Scott *et al.* (1982) has reported that the efficiency of vitamins utilization especially riboflavin in chickens was different among species. He stated that those differences due to the ability of protein bonding to a specific vitamin such as a riboflavin binding protein, which are very important in influencing embryo development

thus hatchability of the eggs. He postulated that this condition is controlled by a simple recessive autosomal gene in the homozygote state.

Egg quality of each plumage colour hen are presented on Table 2 as reported Puger *et al.* (2012) Egg quality between the five different plumage colour hens are similar in term of egg weight, albumen weight (%), yolk weight (%). The only slightly different as on egg shell weight of white plumage with yellow legs hens which was the lowest compared to others. This differences due to the fact that the egg production of this hens was the highest, so with the same amount of feed and Ca consumption causing slightly thinner egg shell quality.

Data on feed and water consumption three weeks before brooding and three weeks during brooding were presented in Table 3 and 4. Average feed consumption for those five plumage colour hens were 83 g/hens/day with the range

Table 2. Egg quality of kampong hens (Puger *et al.*, 2012)

	Plumage colour hens					SEM
	Black (Selem)	Red (biying)	Mix colour (Brumbun)	White plumage with white leg (Putih kedas)	White plumage with yellow leg (Putih siung)	
Egg weight (g)	38,38a	37,06a	39,33a	38,48a	36,10a	1,32
White egg weight (%)	53,20a	50,41a	51,62a	56,20a	52,72a	1,1
Yolk weight (%)	34,28a	37,20a	36,20a	31,11a	37,72a	1,3
Shell weight (%)	10,78a*	10,69a	10,00a	11,11a	8,68b	0,5
Yolk colour (yolk colour fan score)	8,33a	7,25a	8,00a	6,00a	9,33a	0,6
Whole egg index (%)	76,98a	77,63a	77,31a	75,40a	78,43a	1,57
Egg white Index (%)	84,27a	78,21a	74,39a	65,91a	75,01a	2,9
Yolk index (%)	99,43a	99,10a	97,37a	96,58a	97,44a	0,7

Note: SEM="standard error of treatment means". * Means in the same row with different script differ significantly (P<0.05).

between 71-95 g/hens/day. This figure in line with the figure on White Leghorn hens (Scott *et al.*, 1982). This is logical since body weight of mature hens of kampong chickens is around 1-1,3 kg/hens (Table 5) and this chickens had similar body weight to the light breed of matured White Leghorn (1,2-1,5 kg/head). The only different is egg production of kampong chickens is lower than those WL hens.

The feed consumption pattern consistently followed by water consumption (Table 3 and 4). Water consumption recorded in this experiment average was 215 g/hens/day, and this figure ranged from 153-297 g. This again confirmed the report for Scott *et al.* (1982). Scane *et al.* (2004), Ensminger *et al.* (1992), that water consumption of laying hens was 2-2,5 times compared to feed consumption.

During brooding time which is generally three weeks period, all hens were sit down on the nest provided and arranged a relatively constant temperature and humidity. The brooding hens will be going out from the nest either come for

feed and water or sand bathed in a short period (15-30 minutes) then come back to their nest. Data on feed and water consumption during brooding period are presented in Table 3 and 4.

During brooding period a natural physiological process occurred in which hens has spent their body energy deposit (glycogen, fat, protein) in their body as source of heat for brooding their eggs, so their body weight will drop about 171,6 g after brooding has completed (Table 5). The nature of nutrient depletion on kampong chicken hens is similar with wild birds which were reported by Mrosovsky and Sherry (1980). They state that as in nature, several species of birds self-induce a period of fasting known as molting, where they lose up to 50% of their body mass. After the completion of the molting process, the reproductive system is rejuvenated allowing the birds to enter into an egg production cycle. Similar process probably happened to the kampong chicken while brooding reduced feed and water intake so reduced body weight about 30%.

Table 3. Feed consumption of kampong chicken hens three weeks before and during brooding

Plumage colour of hens	Before brooding (g/head)				During brooding (g/head)			
	Week				Week			
	I	II	III	Average	I	II	III	Average
Black (Selem)	87a*	82a	93a	88a	52a	27b	19b	33ab
Red (Biyang)	57b	82a	75a	71b	44ab	37a	38a	40a
Mix colour	64b	79a	75a	73b	29b	23b	21b	25b
White plumage white leg	92a	95a	99a	95a	33b	26b	24b	28b
White plumage yellow leg	92a	93a	87a	90a	44ab	29b	20b	31b
Average	78	86	86	83	40	28	25	31
SEM	7,2	6,6	7,2	3,9	5,5	2,6	3,3	2,5

Note: * Means in the same column with differ script differ significantly (P<0.05)

Table 4. Water consumption/day of kampong chickens three weeks before and during brooding.

Plumage colour of hens	Before brooding (g/head)				During brooding (g/head)			
	Week				Week			
	I	II	III	Av.	I	II	III	Av.
Black	234a*	342a	315a	297a	109a	99a	52b	87b
Red	134b	176b	148c	153c	116a	115a	105a	112a
Mix colour	207a	233b	182bc	207b	56b	44b	42b	47d
White plumage with white leg	206a	243b	223b	224b	64b	62b	52b	59cd
White plumage with yellow leg	177ab	203b	208bc	196b	89b	55b	51b	65c
SEM	19,8	20,7	23,4	10,2	12,9	10,7	8,7	5,2
Average	192	239	215	215	87	75	60	74

Note : * Means in the same column with different script differ significantly (P<0.5)

Table 5. Body weight changed before and after brooding period.

Plumage colour of hens	Before brooding (during production/kg)	During brooding (kg)	After brooding (kg)
Black	1.080a*	1.245a	1.038a
Red	1.190a	1.262a	1.057a
Mix colour	1.194a	1.229a	1.061a
White plumage with white leg	1.130a	1.343a	1.090a
White plumage with yellow leg	1.195a	1.279a	1.094a
Average	1.158	1.271	1.068
SEM	50,28	67,66	58,65

Note : *Means in the same column with different script differ significantly (P<0.05)

Those pattern of feed intake was followed by the amount of water intake in which the average of water consumption is 74 g (47-112 g) (Table 4). This again showing that the comparison of feed and water intake was about 2-2,5 times to those feed intake. This experiment suggest therefore regardless of the hens either on production state or in brooding condition, the water intake always following pattern of feed intake that is 2-2,5 times as much as the feed intake.

From those five plumage colour hens, the colour of DOC produced can be seen in Table

6 as reported Puger *et al.* (2012).The hens with black plumage and white plumage with yellow legs had 100% similar colour to their parents, followed by red plumage hens with 81%. Those three plumage colours mentioned above apparently have homozygote dominant gen and genetically inherited from respective plumage colours or to the respective offspring. It was also reported by Puger *et al.* (2012), those mix plumage (*brumbun*) and white plumage with white legs hens (*putih kedas*) have DOC with similar colour to their parents were only 38,89% and 30,2%

Table 6. Plumage colour of DOC (%) from 5 colour hens (Puger *et al.*, 2012)

Chick colour plumage	Plumage colour of hens				
	Black (<i>Selem</i>)	Red (<i>biying</i>)	Mix colour (<i>Brumbun</i>)	White plumage with white leg (<i>Putih kedas</i>)	White plumage with yellow leg (<i>Putih siung</i>)
Black (<i>selem</i>)	100	16	47,22	28,3	0
Red (<i>biying</i>)	0	81	0	3,8	0
Mix colour (black, white, red) or <i>brumbun</i>	0	0	38,89	13,2	0
White plumage with white leg (<i>putih Kedas</i>)	0	3	2,78	30,2	0
White plumage with yellow leg (<i>putih siung</i>)	0	0	0	0	100
Mix colour (black, white)	0	0	0	9,4	0
Mix colour (black, white, gray)	0	0	11,11	15,1	0

Table 7. Distribution plumage colour of chickens from 5 colour hens (first production) at two months (%)

Chick colour plumage	Plumage colour of hens				
	Black (<i>Selem</i>)	Red (<i>biying</i>)	Mix colour (<i>Brumbun</i>)	White plumage with white leg (<i>Putih kedas</i>)	White plumage with yellow leg (<i>Putih siung</i>)
Black (<i>selem</i>)	70	0	0	0	0
Red (<i>biying</i>)	5	77,5	0	4,8	0
Mix colour (black, white, red) or <i>brumbun</i>	3,6	20,0	53,8	11,5	0
White plumage with white leg (<i>putih Kedas</i>)	0	0	0	17,6	0
White plumage with yellow leg (<i>putih siung</i>)	0	0	0	0	93,75
Mix colour (black, white)	17,9	2,5	36,9	22,8	0
Mix colour (black, white, gray)	0	0	0	21,1	0
Others	3,6	0	9,3	22,2	6,25

respectively. Perhaps their gene make-up is a mixgene or heterozygote gene which influences the plumage colours of their offspring. The observation of plumage colours changed was continued until the chicks were two months old.

The interesting finding in this experiment is that after 8 weeks observation on the chick's plumage, those white plumage hens with white legs only 17,6% of the chicks has similar colour to their parents (Table 7)

After two months old, It was observed that the plumage colour percentage has changed (see Table 7), where those DOC black plumage has 70% still black (*hitam*), followed by 77,5% red (*biying*) and 93,75% still white plumage with yellow legs. Those mix colour chicks (*brumbun*) has increased the number to 53,8% mix colours chicks (*brumbun*). Probably the colour changed was influenced by growth and sex hormone in birds. This pattern of colour change was also observed in Bali cattle, where the breeds colour will change from red to black during their growing and at sexual maturity.

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