

Evaluation of Khaki Campbell ducks for commercial production under intensive management practices

Abstract

Khaki Campbell ducks, one the most popular egg type ducks available in India needs evaluation for their growth and production potentialities as they were brought from abroad centuries ago. Thus, 444 day old ducklings (Khaki Campbell) were reared up to 104 weeks (2 yrs) of age under intensive management with standard feed (CP: 16-20% and M.E. 2600 – 2750 kcal) and management practices. The data with regard to body weight (g), conformation traits, age and weight at first egg, egg production (age at 50 percent egg in the flock, duck day egg production up to 40, 72 & 104 weeks of age), egg weight (initial, 72 & 104 weeks age), egg analysis and reproduction traits like fertility and hatchability were recorded. It was observed that the overall growth of birds never cases till 104 wks and significant difference ($p < 0.05$) was found between male and female ducks only at 20 weeks of age. However significant difference ($p < 0.05$) between male and female was observed in conformation traits (bill, kill and shank length) at 20 weeks of age. Further, age at first egg by 137day, 50 percent egg in the flock at 160 days and duck day egg production of 401 nos of egg at 104 weeks of age was observed. The egg analysis at 24, 40, 60, 80 and 102 weeks of age revealed significant difference ($p < 0.05$) for egg weight, yolk percent, shell weight and thickness and above all haugh unit. Fertility and hatchability percent between 50-60 and 80-90 weeks age are significantly higher ($p < 0.05$) than that recorded between 28-36 weeks of age. Thus, Khaki Campbell ducks available in different parts of country need to be examined as done in the present experiment and appropriate decision may be taken for its replacement with pure-bred germ-plasm from the place of origin.

Keywords: khaki campbell duck, growth and egg production, conformation traits, egg quality, fertility and hatchability

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Introduction

Khaki Campbell ducks are considered as one of the best egg laying breed of duck in the world. In India duck eggs contribute 1.12-1.15 percent of total egg production inspite of the fact that there is ample scope of duck production in the country. However, duck production in India is mostly confined to either backyard farming or as an integrated practice with rice and fish cultivation. Very few commercial duck farms found in this country besides certain government organizations where improved breeds like Khaki Campbell and White pekin ducks are maintained for multiplication and propagation. Clayton¹ described the Khaki Campbell breed is originated from single Indian Runner duck crossed with Rouyen and subsequent generations with wild mallards. In India, almost during mid 1960's the Regional Duck breeding farm, Haringhatta, West Bengal imported Khaki Campbell ducks from UK; so also Central Duck Breeding farm, Hessarghatta, Bengaluru in 1981 which were subsequently multiplied and supplied to different states of India for propagation. Under the present circumstances, when farmers are encouraged to initiate commercial duck production in large scale to meet the national requirement of eggs for table, the need of the hour is to ascertain the source of potential duck germ-plasm like Khaki Campbell be available to the farmers. With this objective, the present study was undertaken to evaluate the growth and production potentialities of the present stock of Khaki Campbell ducks available in Regional Station, Directorate of Poultry Research, Bhubaneswar, India (A research Institute under Indian Council of Agricultural Research, Ministry of Agriculture and Farmers welfare, Government of India) which supplies a sizable number of duck germ-plasm to the farmers of different states of the country. This may help the policy makers to decide for import of pure bred germ-plasm from its origin in near future.

Materials and methods

Experimental birds

With an aim to evaluate the performances of Khaki Campbell ducks, the present experiment is conducted with available germ-plasm of Regional Station, ICAR-Directorate of Poultry Research, Bhubaneswar, Odisha (India) between January 2023 to February 2025 for a period of 2 years (104 weeks). The present stock of Khaki Campbell in the Regional Station was procured from Central Poultry Development Organisation, Hessarghatta, Bengaluru during year 2005 and 2007 which are multiplied and supplied to duck farmers of many states of India since 2008. A total of 444 day old Khaki Campbell ducklings collected from experimental hatchery of the regional station were randomly divided (6 replicates of 74 each) and maintained with uniform managerial practice with iso-nitrogenous and iso-caloric diet throughout the experiment period.

Brooding management and feeding

The day old ducklings were brooded (for 2 weeks) under hovers fitted with electric bulbs and were regulated to provide optimum temperature for ducklings. Rice husk was used as litter material. Separate feeding trays and chick drinkers were used during this period. Feed (*ad lib*: wet duck brooding mash: CP 21 percent and ME 2900 kcl/kg) and sufficient clean drinking water were offered to the ducklings. Besides, antibiotic preparation (for 3 days) and multivitamin preparation were offered during the first week of brooding to keep the ducklings healthy.

Growing management

After two weeks of brooding, the hovers and guards were removed. Feed and water were offered in duck feeder cum drinker (specially designed “A Feed Tray” and patented: Design No.389357-001 Dated 30/06/2023; by Indian Patent Office) where feed in the centre and water in periphery. Dry sand was used as litter material till the end of experiment. The growing ducks were offered standard duck mash (Table 1) and clean drinking water (*ad lib*) during the experiment period. After 5th week of age the growing ducks were allowed “Run-space” during day time where there was provision of water channel. The birds were maintained up-to 16th week of age with the above standard management practice.

Table 1 Composition of feed for Khaki Campbell ducks during different stages of growth and production. (for 100 kg composite feed)

Ingredients (kg)	Starter (0-4week)	Grower (5-17 week)	Layer (18-104 week)
Wheat	50	40	50
Broken Rice	10	10	9
Soybean	23	14	18
Fish meal	7	3	7
DORB	6.6	30	4
Oyst. Shell	1	1	9
DCP	1	1	1.44
Calcite	1	0.55	1
Trace Min	0.1	0.1	0.1
DL-Meth	0.04	0.04	0.1
Lysine	0.05	0.05	0.1
Vit A,B2,D3,K	0.02	0.02	0.02
B-Complex	0.02	0.02	0.02
Vit.E & Se	0.02	0.02	0.02
Toxin Binder	0.15	0.1	0.1
Choline Chloride	0.1	0.1	0.1
Total (kg)	100	100	100
CP (%)	20	16	18
ME (Kcal/kg)	2700	2600	2750

(Figures in parenthesis indicates the age of ducks)

Egg laying management

After 18 weeks of age the number of male birds were reduced (healthy males were kept at 1:4 ratio) in each pan. The birds were offered (*ad lib*) duck layer mash and sufficient clean drinking water only during day time in the run-space. Provision of light (9 watt CFL bulb) was there in the night shelter room. Earthen wide-mouthed pots with little dry sand were put in tilted manner (1 pot for 4 birds) inside the room which facilitates the nesting and production of clean eggs. Litter materials were changed in each room as and when required and little lime was applied on it so as to rear the ducks in healthy environment. The ducks were maintained in this way till they attained 104 weeks of age.

Data collection and analysis

The observation and data were collected with regard to body weight at different age, body conformation trait at 20 weeks age, body weight and age at first egg, age at 50 percent egg, month-wise egg production (per duck in the flock), egg analysis at different stages of production and reproduction parameters (fertility and hatchability) in three stages of egg production. Statistical analysis was done as per standard procedure Snedechor and Cochran.²

Results and discussions

Growth Performance

The body weight (g) of the ducks (male, female and overall) recorded at different ages is presented (Table 2). Phenotypic sex differentiation is made after the birds attained 12th week of age.

It is observed that Khaki Campbell ducks (mixed sex) attain 1000g and above body weight beyond 8 weeks of age which corroborates the findings of Padhi and Sahoo.³ Between 16 to 104 weeks of age the weight of male ducks are always higher than female ducks of corresponding age where as it is significantly ($p < 0.05$) higher at 20th week of age only. The body weight (overall) recorded in the present observation at 12th, 16th, 20th, 40th and 60th week are found to be less as reported by Padhi et al.⁴ which might be due to the fact that the number of birds taken in the present investigation (444) is much higher. However, Mallick and Gosh⁵ reported 1600g body weight of Khaki Campbell ducks (mixed sex) at 40 weeks of age under extensive system of rearing which is little higher than the present finding under intensive management.

Table 2 Growth performance of Khaki Campbell ducks up to 104 weeks of age

Age (wk)	Total number of birds	Body wt (g) (Mean $\pm$ S.E)		
		Male	Female	Overall
Day old	449	--	--	40.61 $\pm$ 0.14
4th	445	--	--	579.17 $\pm$ 3.19
8th	444	--	--	968.82 $\pm$ 4.47
12th	444	--	--	1199.64 $\pm$ 5.55
16th	444	1388.07 $\pm$ 9.94 (209)	1228.74 $\pm$ 5.92 (235)	1303.72 $\pm$ 6.78
20th	309	1512.88 a $\pm$ 11.40 (79)	1344.39 ^b $\pm$ 5.69 (229)	1387.72 $\pm$ 6.65 ^b
24th	309	1434.65 $\pm$ 10.53 (79)	1322.93 $\pm$ 6.74 (229)	1351.41 $\pm$ 6.37
32nd	307	1402.87 $\pm$ 8.54 (79)	1339.40 $\pm$ 7.37 (227)	1348.18 $\pm$ 6.71
40th	299	1487.49 $\pm$ 10.62 (76)	1451.41 $\pm$ 9.74 (222)	1460.69 $\pm$ 7.74
60th	289	1393.25 $\pm$ 6.58 (72)	1379.65 $\pm$ 10.36 (216)	1347.35 $\pm$ 5.81
72nd	204	1425.71 $\pm$ 12.43 (51)	1336.80 $\pm$ 9.28 (153)	1359.03 $\pm$ 8.08
80th	203	1435.51 $\pm$ 11.58 (50)	1380.76 $\pm$ 11.54 (153)	1394.24 $\pm$ 8.32
104th	115	1607.17 $\pm$ 25.34 (26)	1496.88 $\pm$ 23.59 (89)	1535.93 $\pm$ 33.22

(Superscripts indicates significant difference ($p < 0.05$) between the group in a row)

Body conformation traits

The body confirmation traits of Khaki Campbell ducks (male and females) in the present investigation was recorded at 20th week of age and presented (Table 3).

Table 3 Body conformation traits of Khaki Campbell ducks at 20th week of age

Parameters	Male (n= 50)		Female (n=100)	
	Mean	± S.E	Mean	± S.E
B wt (g)	1488.90*	12.95	1396.59	7.9
Bill length (mm)	66.35*	0.28	61.34	0.27
Shank (mm)	68.19*	0.28	64.32	0.22
Keel (mm)	119.74*	0.51	111.74	0.46
Neck (cm)	22.12	0.2	19	0.23
Head (cm)	7.44	0.1	7.28	0.05
Body Length (cm)	41.92	0.27	38.92	0.23
Body Girth (cm)	33.78	0.2	31.91	0.12

(Superscripts indicates significant difference ($p < 0.05$) between the group in a row)

It is observed that besides body weight, the other body conformation traits i.e bill length, shank length and keel length are significantly ($p < 0.01$) higher in male ducks when compared with female ducks of same age.

Padhi et al.⁶ reported few body conformation traits of male and female ducks of various genetic groups including Khaki Campbell at 8 weeks of age and the values are lower than the present observation as in the current experiment the data were recorded at 20th week of age.

Egg production and reproduction

The egg production and reproduction performances of the Khaki Campbell ducks under experiment were recorded by rearing them in six different chambers with similar provisions of feeding and management. However, the numbers of ducks reduced after 72 weeks of age. The observations recorded is presented (Table 4).

Table 4 Egg production performances of Khaki Campbell ducks

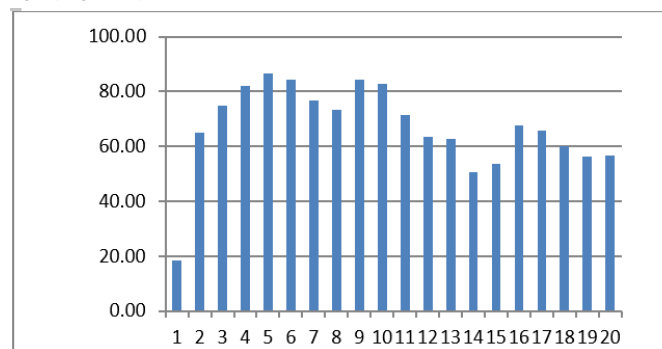
Parameters	No. of ducks / observations	Mean	± S.E
Age at first egg in the duck house (days)	228	137.83	1.47
Body wt at first egg in the flock (g)	228	1344.39	5.69
Initial egg weight (g)	60	46.16	0.63
Egg weight at 72 wk age (g)	60	63.83	0.47
Final egg weight at 104 wk of age (g)	60	67.6	0.27
Age at 50 percent egg in the flock (days)	228	160.83	0.75
Duck day egg production up to 40 wks of age (nos)	226	123.45	3.16
Duck day egg production up to 72 wks of age (nos)	153	259.17	1.6
Duck day egg production up to 104 wks of age (nos)	121	401.14	1.07

The age at first egg and the average body weight at first egg of Khaki Campbell ducks observed in the present study are less than

that reported by Giri et al.⁷ and Giri et al.⁸ when the ducks (KC) were maintained under extensive management practices. The early attainment of sexual maturity in the current study might be due the balanced diet offered to the birds reared with ideal intensive management practice. However, the close proximity of data pertaining to the body weight at first egg between present study and as reported above implies the genetic inheritance of the bird of particular breed.

The egg weight recorded in three stages of laying period i.e beginning, 72 weeks of age and at the end of the study (104 week) reveals steady increase in value which is natural phenomena for avian species and the weight and size of the egg depends on feeding and nutrition. Since the ducks under present experiment were maintained under recommended feeding practice, there showed a continuous increase in egg weight from beginning till end. However, weight of egg (Khaki Campbell) reported by Padhi and Sahoo⁹ at 80, 90 and 100 weeks of age is higher than the present study, but value for 110 weeks age is at par with the present finding of 104 week age. Age at 50 percent egg in the flock observed in the present study is much less than the value reported by Giri et al.⁸ who recorded the value through duck rearing in polythene pond under extensive management practice.

The observation w.r.t. duck day egg production up to 40, 72 and 104 week of age recorded in the present observation reveals that Khaki Campbell ducks lay more number of eggs up to 40 weeks of age (Figure 1)



Months of egg production

Figure 1 Egg production percent (%) in the flock (Khaki Campbell) at different month of laying period.

than later parts. Mohanty et al.¹⁰ reported peak egg production in Khaki Campbell ducks is 24th week of age and this might be the cause of higher duck day egg production up to 40 weeks of age. There is paucity of literature to support the present finding of duck day egg production up to 104 weeks of age in Khaki Campbell ducks. However, Khaki Campbell ducks being the one of the best egg laying duck variety in the world, the value (401.14 numbers of eggs up to 104 weeks of age) recorded under optimum intensive management practice proves the laying potentiality of the bird.

Egg analysis

The egg analysis done at 24th, 40th, 60th, 80th and 102nd week age of bird is presented (Table 5). Every time 60 nos of freshly collected eggs were taken for study. The certain parameters studied under egg analysis showed much similarity at all the ages of duck where as it varies significantly ($p < 0.05$) for few other parameters. Hague unit value at 80th week was found significantly ($p < 0.05$) less among the groups which might be due to the fact that eggs used for the study were stored for three days and analyzed not as same day collection in other cases. The present observation revealed the egg weight increases as age of

the bird advances except at 60th week, a deviation was found which might be due to the quality of feed offered during that period. However, egg weight at 24th week is significantly ($p<0.05$) lower than other age groups. Further, yolk percent increases every time from 24th week

till 104 week of age. However, shell thickness decreases continuously as the duck become old which might be due to the shortage of calcium in the body available for the egg formation in the layer birds.

Table 5 Egg analysis at different age of production

Parameters	Age of ducks (week)				
	24th week	40th week	60th week	80th week	102nd week
Egg wt (g)	56.34 ^b ± 0.26	66.57 ^a ± 0.56	64.30 ^a ± 0.65	67.10 ^a ± 0.57	67.60 ^a ± 0.39
Shape index	72.79 ± 0.32	74.36 ± 0.46	73.83 ± 0.30	74.04 ± 0.43	72.44 ± 0.45
Albumin index	0.20 ± 0.00	0.19 ± 0.00	0.18 ± 0.00	0.16 ± 0.00	0.18 ± 0.00
Yolk index	0.50 ± 0.00	0.42 ± 0.00	0.45 ± 0.00	0.43 ± 0.00	0.44 ± 0.00
Albumin %	56.07 ± 0.38	55.90 ± 0.54	56.37 ± 0.44	55.33 ± 0.50	54.73 ± 0.38
Yolk %	29.84 ^b ± 0.32	32.83 ^{ab} ± 0.46	33.20 ^a ± 0.43	34.21 ^a ± 0.47	35.90 ^a ± 0.29
Shell %	14.09 ^a ± 0.30	11.27 ^b ± 0.31	10.43 ^b ± 0.19	10.47 ^b ± 0.20	9.38 ^b ± 0.23
Shell thickness (mm)	0.51 ^a ± 0.01	0.47 ^a ± 0.01	0.18 ^b ± 0.01	0.11 ^b ± 0.00	0.10 ^b ± 0.00
Hague unit	98.12 ^a ± 0.30	98.82 ^a ± 0.51	97.82 ^a ± 0.58	93.80 ^b ± 0.52	98.97 ^a ± 0.41

(Different superscripts in a row indicates significant ($p<0.5$) difference between the age group)

The present findings corroborates with the report of Giri et al.¹¹ and Padhi and Sahoo⁹ to certain extent where the first one conducted the experiment at 40 week in Khaki X White pekin ducks and second one at 100th and 124th weeks of Khaki Campbell ducks. The present observation w.r.t. egg analysis at a regular interval of age in Khaki Campbell ducks finds no support due to the paucity of literature at present.

Fertility and hatchability

The fertility and hatchability test of Khaki Campbell ducks conducted at different age of the bird is presented (Table 6). For this purpose the mating sex ratio of 1: 4 (M: F) was maintained in the flock and floor matting is allowed. In every age group eight consecutive hatchings were recorded.

Table 6 Fertility and hatchability of Khaki Campbell duck eggs

Age of ducks(wk)	Hatches taken (nos)	Eggs set (nos)	Fertile eggs (nos)	Fertility percent (%)	Ducklings hatched (nos)	Hatchability percent (%)
						FES
28-36 wk	8	7935	5565	70.13 ^b	3704	66.55 ^b 46.68 ^b
50-60 wk	8	6008	4762	79.26 ^a	4096	86.02 ^a 68.17 ^a
80-90 wk	8	4965	3857	77.25 ^a	3320	85.36 ^a 66.05 ^a

(Different superscripts in a column indicates significant ($p<0.5$) difference between age group)

The present observation revealed significantly ($p<0.05$) higher fertility and hatchability percent at 50-60 weeks as well as 80-90 week age group than 28-36 week age ducks. Kamar¹² reported average fertility of 34.4 percent and hatchability (FES) of 51.70 percent and (TES) of 19.40 percent in Khaki Campbell ducks where the ducks were aged between 1-4 yrs and matting sex ratio was between 5-7 females per male. Further, 82.66 percent fertility and 77.42 percent hatchability (FES) in Khaki Campbell ducks of unknown age (matting sex ratio 1: 4) was reported by Jalil et al.¹³ However, 72.37 percent fertility and 90.01 percent hatchability (FES) with 65.13 percent hatchability (TES) in Khaki Campbell ducks of 48 weeks age and 1:4 matting sex ratio was reported by Giri et al.¹⁴ in the same experimental duck farm where the present investigation is carried out. Thus the present finding corroborates with the findings of Jalil et al.¹³ and Giri et al.⁷ but not with Kamar¹².

Conclusion

Considering the observations with regard to production performances of Khaki Campbell ducks up to 104 weeks of age, the policy level decision may be taken whether the existing Khaki Campbell stocks needs replacement. However, more study in this

regard with available population at various states of India might be helpful for the duck farmers in the country to procure for profitable commercial duck production.

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None

Competing interests

Authors have declared that no competing interests exist.

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