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### Effect of velogenic Newcastle disease virus on production performance of different breeds of ducks

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**Abstract**

The aim of this study was to compare the production performance of Arani, Kuttanadu, Khaki Campbell and White Pekin ducks infected with velogenic Newcastle Disease Virus upto six weeks of age. The final body weight of Arani, Kuttanadu, Khaki Campbell and White Pekin were 822.18, 880.91, 832.09 and 1207.73g, respectively. The total feed consumption of four breeds of ducks up to 6 weeks from brooding were 2995, 2995, 2935 and 4560 g, and the respective mean feed conversion ratio were 3.67, 3.41, 3.63 and 3.82 respectively. The livability of respective breeds of ducks was 100, 96, 88 and 96 percent. Highly significant difference noticed in body weight, feed conversion ratio and livability between four different breeds of ducks. From the study, it is concluded that the virus does not affect the production performance of all ducks to the extent, as ducks were resistant to NDV.

**Keywords:** production performance, feed consumption, brooding, feed conversion ratio, livability, Newcastle disease virus

**Introduction**

Ducks are one of the fastest growing and most efficient producers of meat and egg. India occupies second position next to China with a duck population of 23.53 million in 2012. Ducks are the natural reservoir of Newcastle Disease. NDVs have been isolated from a variety of species of wild, domestic, and caged birds around the world. Most of the strains isolated from wild birds, waterfowl especially, are lentogenic and do not produce overt disease (Kaleta and Baldauf, 1988) [5].

Nishizawa *et al.* (2007) [8] concluded that White pekin ducks were resistant to the development of ND clinical signs when challenged with velogenic NDV and reported that vaccination is essential to reduce elimination of virus. Exotic breed like White Pekin is famous for meat whereas Khaki Campbell and native breeds like Arani and Kuttanadu are popular for egg production. Though they are resistant to NDV, whether it affects the production performance is unknown. This study was designed to study the production performance of ducks challenged with vNDV.

Reported that there was significant difference among exotic and native breeds in body weight gain at different ages as white pekin produced the highest body weight and desi white gained the lowest body weight during first eight weeks. Gajendran and Karthickeyan (2009) [3] recorded the hatch weight, body weights at 8-week, 20-week and at maturity as  $36.88 \pm 0.70$ ,  $1156.00 \pm 56.23$ ,  $1465.02 \pm 23.87$  and  $1454.69 \pm 29.82$  g respectively for the indigenous ducks of Tamil Nadu, whereas, Recorded hatch weight, body weights at 4-week, 8-week, 20-week, 40-week, 52-week and 72-weeks of age as  $47.46 \pm 1.01$ ,  $505.45 \pm 4.35$ ,  $715.02 \pm 5.16$ ,  $1425.23 \pm 12.73$ ,  $1640.07 \pm 13.47$ ,  $1580.52 \pm 14.61$  and  $1985.26 \pm 15.22$  g respectively for *Chara* and *Chemballi* ducks of Kerala under range condition in Assam.

Murugan *et al.* (2009) [7] recorded the hatch weight for *Sanyasi* and *Keeri* varieties of ducks as  $46.84 \pm 0.84$  and  $46.24 \pm 0.37$  g respectively. The body weight at 20 weeks of age for male and female ducks of *Sanyasi* and *Keeri* variety was  $1582 \pm 18.84$ ,  $1543 \pm 17.24$  and  $1559 \pm 20.28$ ,  $1511 \pm 19.28$  g respectively. The respective body weights at 52 weeks of age were  $1292 \pm 12.24$ ,  $1235 \pm 10.24$  and  $1237 \pm 18.22$ ,  $1185 \pm 17.23$  g, whereas Mallick *et al.* (2009) [6] noticed the body weight of 1.515 and 1.710 kg at 40<sup>th</sup> week of age in *Desi* and *Desi* x *Kakhi*

Campbell cross under extensive system of rearing. Gajendran *et al.* (2005) [4] reported the body weight of desi ducks at 1<sup>st</sup> and 6<sup>th</sup> week of age as 97.15g and 749g with ration 1 containing ragi and 102.57 and 696.56g with ration 2 containing bajra respectively. The mean feed efficiency of two groups was 3.13 in first group and 3.13 in second group. Body weight of Pekin ducks during breeding was 241g in week 1 and 3401 g in week 8 of breeding. Until week 6 of life inclusive, Pekin ducks weighed more compared to Muscovy ducks and malards; the differences were statistically confirmed. Rashid *et al.* (1995) [10] reported that the weight gain was highest in Khaki campbell x Desi followed by Khaki Campbell and Desi ducks respectively. Onbaşilar *et al.* (2011) [9] stated that the highest increase in body weight gains was at the third week of life in all groups of White Pekin ducks. Steczny *et al.* (2015) [11] also reported that Pekin ducks showed significantly highest body weight gain between weeks 3 and 4 of life, and for Muscovy ducks of both sexes it was between weeks 4 and 5 of breeding. Recorded the feed efficiency of Desi White and White Pekin at 2, 4, 6 weeks of age as 2.93 and 2.36; 3.05 and 2.41; 2.95 and 2.46 respectively. They concluded that better feed efficiency was observed in White Pekin than Desi white. Reported that White Pekin attain a body weight of 1.9-2.0 kg each at six weeks of age with feed efficiency of 2.5-2.6 and 94-96% livability whereas in Kuttanadu, body weight of 1.2 kg and feed efficiency of 3.0-3.2 at 12 weeks of age. Rashid *et al.* (1995) [10] reported that mortality of duck was highest in Khaki Campbell, intermediate in Khaki Campbell x Desi and lowest in Desi ducks. Reported that Desi White is

more resistant to disease than other ducks as they noted the mortality of White Pekin and Desi White were 4 and 2% which were significantly non-significant. Infected the different species of poultry (chicken, ducks and turkey) infected with virulent NDV APMV-1/chicken/Great Britain/1453/96 and noticed that there was no mortality and establishment of infection in Pekin ducks with the highest dose of NDV used (10<sup>6</sup> EID<sub>50</sub>). Zhang *et al.* (2011) [12] infected the ducks with NDV / Duck / China / GD09-2 / 2009 and NDV / Duck / China / SD09 / 2009 and observed that one bird died on 9 day of post infection.

### Materials and Methods

The duck breeds selected for this study was Arani, Kuttanadu, Khaki Campbell and White Pekin in which two breeds were native and other two were exotic breeds. A total 25, day old ducklings of each breed were used in the present study. 120 embryonated eggs of White Pekin and Arani were procured from PGRIAS, Kattupakkam whereas Khaki Campbell and Kuttanad were obtained from CPDO & TI, Bangalore and Duck farm, Kerala respectively. These eggs were incubated in hatchery unit located at PGRIAS, Kattupakkam. The design of experiment consisted of four breeds as four treatment (15 birds each) with four controls (10 birds each). All the experimental birds were wing banded and maintained under identical management condition in cages. Birds were fed with ad libitum feed with known quantity of standard feed formulated as per BIS 1992 requirements for poultry feeds as tabulated below and were provided with ad libitum clean potable water.

Sl. No.	Chemical composition	Brooder Specification	
		Egg type	Meat type
1	Crude protein (%)	20	23
2	Metabolizable energy (Kcal/kg)	2600	2800
3	Crude fibre (%)	7	6
4	Lysine (%)	0.9	1.2
5	Methionine (%)	0.3	0.5

This study was approved by the Institutional Approval of Ethical Committee (IAEC). The ducks challenged with vNDV at an infectious dose rate of 10<sup>5</sup> EID<sub>50</sub>/ml/bird by subcutaneous route at 15<sup>th</sup> day of age. The birds were monitored clinically and mortality if any was recorded. The data were recorded on hatch weight, weekly body weight, feed consumption, feed conversion ratio and livability.

### Result and Discussion

The production performance of vNDV challenged ducks was discussed in the following sub-headings:

#### 1. Body weight

Mean body weight (g) of Arani, Khaki Campbell, Kuttanadu and White Pekin ducks at weekly intervals as base data is presented in Table.1. Highly significant ( $P < 0.01$ ) difference was observed for body weight at all the six weeks between breeds. Highly significant ( $P < 0.01$ ) difference was noticed in the first week mean body weight between breeds with highest value in White Pekin (1012.79g), followed by Kuttanadu (75.68g), Khaki Campbell (71.48g) and Arani (63.16g). Similar trend was noticed in second week body weight also. Significantly higher body weight was recorded in White Pekin (195.24g) followed by Kuttanadu (163.56g), Khaki Campbell (156.68g) and the least body weight in Arani (140.80g). Significantly ( $P < 0.01$ ) higher body weight was observed in

White Pekin (793.18g) and least with Khaki Campbell (507.29g) and Arani (484.94g) at 4 weeks of age whereas Kuttanadu recorded the body weight of 571.29g. Similar trend was observed during 5<sup>th</sup> week also. At 6<sup>th</sup> week of age, the body weight recorded in Arani, Khaki Campbell, Kuttanadu and White Pekin was 822.18 ± 21.04, 832.09 ± 15.00, 880.91 ± 11.60 and 1207.73 ± 34.57g respectively. The body weight was significantly ( $P < 0.01$ ) higher in White Pekin when compared to other breeds.

In the present study, highly significant ( $P < 0.01$ ) difference was observed in the weekly body weight between all the four duck breeds. White Pekin attained higher body weight at sixth week of age than other three breeds namely Kuttanadu, Khaki Campbell and Arani. The body weight recorded in the present study between exotic and native duck breeds was in agreement with the earlier reports of Bhuiyan *et al.* (2005) among exotic and native breeds. The body weight observed in the present study for Desi and Khaki Campbell ducks was found to be lesser than the findings of Rashid *et al.* (1995) [10] who noticed the higher body weight under extensive system of rearing. But the body weight of native ducks observed in the present study was slightly higher than the report of Gajendran *et al.* (2005) [4] who recorded the body weight of native breeds. There was no significant difference observed in body weight between Khaki Campbell, Kuttanadu and Arani ducks but differed from White Pekin. The significant

difference in body weight between these four breeds of ducks might be due to the nature and type of breed utility, difference in breed characters and system of rearing.

**Table 1:** Body weight of different breeds of ducks challenged with vNDV

Breeds/Weeks	1	2	3	4	5	6
Arani	63.16 <sup>c</sup>	140.8 <sup>c</sup>	243.75 <sup>d</sup>	484.94 <sup>c</sup>	671.14 <sup>c</sup>	822.18 <sup>b</sup>
Khaki Campbell	71.48 <sup>b</sup>	156.68 <sup>b</sup>	289.75 <sup>c</sup>	507.29 <sup>c</sup>	643.50 <sup>c</sup>	832.09 <sup>b</sup>
Kuttanadu	75.68 <sup>b</sup>	163.56 <sup>b</sup>	354.15 <sup>b</sup>	571.29 <sup>b</sup>	740.36 <sup>b</sup>	880.91 <sup>b</sup>
White Pekin	84.08 <sup>a</sup>	195.24 <sup>a</sup>	437.50 <sup>a</sup>	793.18 <sup>a</sup>	962.86 <sup>a</sup>	1207.73 <sup>a</sup>

## 2. Weight gain

Cumulative body weight gain (g) of Arani, Khaki Campbell, Kuttanadu and White Pekin ducks is presented in Table.2. Cumulative body weight gain between four breeds of ducks was highly significant ( $P < 0.01$ ) up to 6 weeks of age. Significantly higher body weight gain was recorded in White Pekin (35.15g) followed by Kuttanadu (35.20g), Khaki Campbell (27.84g) and Arani (26.74g) at 1<sup>st</sup> week of age. The similar trend was observed in 3<sup>rd</sup> and 4<sup>th</sup> weeks. At 5<sup>th</sup> week, the highest body weight gain was noticed in White Pekin (912.11g), followed by Kuttanadu (685.16g) and there was no significant difference observed between Khaki Campbell (599.99g) and Arani (601.64g). The highest body weight gain at 6 weeks was observed in White Pekin (1153.8g), followed by Kuttanadu (832.47g), Khaki Campbell (784.43g) and Arani (727.09g).

Highly significant difference in body weight gain between four duck breeds was observed in the present study. The similar trend of body weight gain was reported by Onbaşilar *et al.* (2010) in White Pekin. The significant difference in body weight gain between these four breeds of ducks might be due to the difference in body weight attained by the birds and also due to the nature and type of breed utility and difference in breed characters.

**Table 2:** Body weight gain of different breeds of ducks infected with vNDV

Breeds/Weeks	1	2	3	4	5	6
Arani	26.74 <sup>b</sup>	97.96 <sup>b</sup>	202.70 <sup>d</sup>	436.67 <sup>c</sup>	601.64 <sup>b</sup>	727.09 <sup>b</sup>
Khaki Campbell	27.84 <sup>b</sup>	111.82 <sup>a</sup>	241.11 <sup>c</sup>	469.88 <sup>c</sup>	599.99 <sup>b</sup>	784.43 <sup>b</sup>
Kuttanadu	35.20 <sup>a</sup>	117.75 <sup>a</sup>	308.85 <sup>b</sup>	524.92 <sup>b</sup>	685.16 <sup>b</sup>	832.47 <sup>b</sup>
White Pekin	35.15 <sup>a</sup>	125.66 <sup>a</sup>	386.23 <sup>a</sup>	741.47 <sup>a</sup>	912.11 <sup>a</sup>	1153.8 <sup>a</sup>

## 3. Feed consumption

Cumulative feed consumption recorded up to 6 weeks of age in Arani, Khaki Campbell, Kuttanadu and White Pekin was 2935, 2995, 2935 and 4560 g respectively. Higher feed consumption was recorded in White Pekin followed by Arani, Khaki Campbell and Kuttanadu. The feed consumption of Arani, Khaki Campbell and Kuttanadu were more or less similar throughout the study period.

The feed consumption of Arani, Khaki Campbell and Kuttanadu were more or less similar throughout the study period. In contrary to Bhuiyan *et al.* (2005), feed consumption of ducks was higher in the present study as the birds were reared in cages not in the scavenging system. The higher feed consumption in White Pekin might be due to significantly higher body weight attained by this breed than other three breeds of ducks. The non-significant difference exerted between Arani and Kuttanadu in feed intake might be the fact that both are medium sized birds as well as native breeds. Further, the differences in feed intake between these four

breeds of ducks might be due to the genetic makeup and the purpose for which they were being evolved.

## 4. Feed conversion ratio

The mean feed efficiency between 0 and 6 weeks of age in four breeds of ducks is presented in Table 4.3 with graphical representation in Figure 3. The feed conversion ratio up to 6 weeks of age in Arani, Khaki Campbell, Kuttanadu and White Pekin were 3.67, 3.63, 3.41 and 3.52 respectively. Highly significant ( $P < 0.01$ ) difference was observed in feed efficiency from 0 to 6 weeks of age in four different breeds of ducks. The better feed efficiency was noticed in Kuttanadu followed by White Pekin, Khaki Campbell and Arani. There was no significant difference observed in feed conversion ratio between Arani, Khaki Campbell and White Pekin at 6<sup>th</sup> week of age.

The significantly better feed conversion ratio was observed in Kuttanadu followed by Khaki Campbell, Arani and White Pekin which was contrary to the result of Bhuiyan *et al.* (2005). But the feed conversion ratio of Arani (3.18) observed in the present study was similar to the finding of Gajendran *et al.* (2005) [4] who recorded the feed conversion ratio of native breed as 3.13. The difference in feed efficiency among the four breeds of ducks might be attributed to the difference in feed consumption and body weight attained by the individual breed.

Prabakaran. (2009) reported that White Pekin attained body weight of 1.9-2.0 kg each at six weeks of age with feed efficiency of 2.5-2.6 whereas in Kuttanadu, body weight of 1.2 kg and feed efficiency of 3.0-3.2 at 12 weeks of age. The variation in feed conversion ratio of the present study with reported study might be due to gross and histopathological lesions noticed in the intestine of the NDV challenged birds.

**Table 3:** Feed conversion ratio of different breeds of ducks infected with vNDV

Breeds/weeks	1	2	3	4	5	6
Arani	2.23	3.00	3.64	3.16	3.36	3.67
Khaki Campbell	1.99	2.70	3.07	2.98	3.52	3.63
Kuttanadu	1.88	2.61	2.54	2.46	3.05	3.41
White Pekin	2.01	2.65	2.63	2.71	3.30	3.82

## 5. Livability

The livability percentage between 0 and 6 weeks of age in treatment and control group of Arani, Khaki Campbell, Kuttanadu and White Pekin ducks is presented in Table.4. The livability percentage up to 6 weeks of age was not significantly different between four breeds of ducks. 100 percent livability up to 6 weeks of age was found in Arani, White Pekin and Kuttanadu whereas in Khaki Campbell only 93.00 percent livability was noticed in the treatment group.

In the present study, Arani had better livability than other three breeds in both treatment and control group. In treatment group (vNDV infected birds), the livability per cent was better in all duck breeds than Khaki Campbell. The highest livability percentage was found in Arani followed by White Pekin and Kuttanadu. The mortality was observed in Khaki Campbell due to nervous disorder caused by vNDV, low expression of immune response genes and its genetic makeup. The high livability of Arani, White Pekin and Kuttanadu might be due to the genetic makeup, better immunity and better adaptation to this environment. As indicated by Rashid *et al.* (1995) [10], the mortality of Khaki Campbell was higher than other breeds.

Similarly, Zhang *et al.* (2011) [12] observed that one bird died on 9 day of post infection of ducks with NDV/Duck/China/GD09-2/2009 and NDV/Duck/China/SD09/2009. As reported by the mortality observed in birds till 5<sup>th</sup> day of post infection of vNDV. This might be due to fact that the ducks are susceptible to NDV only at earlier stage of life and as the age of ducks increases, the susceptibility of ducks to NDV decreases. There was no significant mortality observed in all four breeds of ducks before challenging of vNDV and no significant difference between Arani, Kuttanadu and White Pekin in livability after virus challenging similar to the report by as no mortality of Pekin after establishment of NDV infection. This indicated the better and uniform health management provided to all the birds throughout the study period.

**Table 4:** Mean percent livability of different breeds of ducks as influenced by vNDV challenging

Breeds/Weeks	1		2		3		4		5		6	
	T	C	T	C	T	C	T	C	T	C	T	C
Arani	100	100	100	100	100	100	100	100	100	100	100	100
Khaki Campbell	100	100	100	100	75	100	75	100	75	100	75	100
Kuttanadu	100	93	100	93	100	93	100	93	100	93	100	93
White Pekin	100	93	100	93	100	93	100	93	100	93	100	93

T- Treatment C-Control

## Conclusion

Significantly higher body weight and weight gain was noticed in White Pekin than other three breeds of ducks. This might be due to the well-established breed character and hence, White Pekin breed gained popularity as meat type bird among four breeds of ducks. Since, Khaki Campbell, Arani and Kuttanadu breeds are medium sized birds, no significant difference was observed in production performances between these three breeds. There was reduction in body weight of all four breeds were observed when compare to the standard body weight of four duck breeds might be due to the lesions in the intestine caused by Newcastle Disease virus.

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