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## Studies on the effects of rearing cockerel chicks under intensive and semi-intensive systems of management on carcass traits and economics

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### Abstract

The current investigation was carried out to study the effects of different rearing systems on cockerels on carcass traits and economics. The study was carried out on two hundred day old cockerel chicks procured from a local hatchery which were brooded for a period of two months. The cockerel chicks slaughtered at end of the experiment and the carcass weight was statistically ( $p < 0.05$ ) significant and was heavier in the intensive system of rearing when compared to semi intensive system. The dressing percentage was higher in intensive ( $78.06 \pm 0.33$ ) system than semi intensive system ( $77.40 \pm 0.65$ ) of rearing cockerel. After two months the cockerel chicks raised in intensive system showed 1.0% mortality in first fortnight in both intensive and semi intensive system with the livability percentage of 99%. The economics was calculated on feed cost as the other management cost remained same for both the groups Revenue from sale of chicks was higher in intensive system (Rs 133.40/-) Benefit cost ratio of 1.27 and 1.00 was observed respectively in semi intensive and intensive system of rearing cockerels. The reason for increased profit Rs/ chick and B:C ratio could be due to 50% of the feed was reduced in semi intensive cockerels as they had an option of feeding on scavenging feed resources base for the duration of four hours per day and also the scavenging feed resources might have more influenced positively on organoleptic characteristic as per consumer preference.

**Keywords:** Cockerels, feed conversion ratio, intensive, production, semi-intensive

### Introduction

The poultry production in our country has increased up to 17% and in particular backyard has gone up by 46% between 2012 and 2019. Backyard is mostly led by farm women addressing three deep rooted problems malnutrition, poverty and gender biased. Women are offering egg and meat to their families in particular to children as supplemental nutrition as equivalent food buying from the market is unaffordable. Currently India has occupied third position in egg production with 90 billion eggs and per capita consumption is about just 80-85 eggs, at present 26 crore eggs are produced in a day with a growth rate of 4-6% per annum (Mahesh, 2020) <sup>[16]</sup>. Recently poultry has undergone adverse phase for survival during last few years due to escalating feed prices, scarcity of maize and soya bean, cage ban, hurdles in feed additives and pharmaceutical imports and rumors of antibiotic residues.

In semi-intensive system, birds are half-way reared in houses and half-way on field ground or range i.e. birds are confined to houses in night (Haunshi *et al.*, 2013) <sup>[10]</sup>. This system is more economical compared to intensive system of rearing. However, high cost of fencing and need for routine cleaning are some of the difficulties. Under intensive system of rearing the native birds gain more weight, with all scientific management conditions like housing, feeding, health care, watering, vaccination and all other good management conditions. (Kumar *et al.*, 2018) <sup>[14]</sup>. Rearing cockerels for table purpose is not very complicated but involves high production cost mainly because of slow growth, long rearing period and unfavorable feed conversion (Bruijn *et al.*, 2015) <sup>[11]</sup>. The strategic advantages for cockerel rearing might be consumers' choice, lower chick price, lower mortality and morbidity, lower management cost, lower initial investment, better market demand, low abdominal fat, more organoleptic preference, family labor utilization and easy management (Olaniyi *et al.*, 2012) <sup>[17]</sup>.

Although much of the previous attempts of the researchers have been directed to explore advantages of rearing broiler or cross-bred in India, however, research to study cockerels with regard to their productivity and profitability in different rearing systems has so far received

very little attention. So, the present study was designed to compare the carcass traits and profitability among cockerels reared under intensive and semi intensive systems of rearing.

### Materials and Methods

The bird trial was conducted using one day-old two hundred cockerel chicks procured from a commercial layer hatchery. The chicks were housed at poultry unit of Veterinary College, Hassan to study the influence of intensive and semi-intensive system of rearing on carcass traits and economics. Two hundred day-old chicks were weighed for recording body weight, individually wing banded for identification and distributed into two groups consisting one hundred chicks in each group. For first 2 months chicks of both groups were reared intensively during the brooding period. Later, experimental trial of two month was conducted to study the influence of intensive and semi-intensive system of rearing.

As per the diet formulation recommendations by NRC 1994 chicks of both the groups were fed with the balanced diet and water was given *ad lib* in the first 2 months. This was continued for Intensive system (group I) for the next two months. The chicks of semi-intensive system of rearing (group II) were fed with only 50% of its feed requirement and were allowed for scavenging at backyard in the compounded fence. All the chicks were vaccinated against New castle disease (ND) and Infectious bursal disease (IBD) as per the standard vaccination protocol. Livability and mortality rate were calculated accordingly when the birds died in that particular treatment group and expressed as percent mortality. The dead birds were subjected to thorough postmortem examination and lesions were recorded accordingly.

At the end of the biological trial ten birds from each group were slaughtered and subjected to carcass characteristics study. Randomly picked cockerels were starved for 12 hours, only just plain water was provided. Before slaughter the body weight was recorded, this gives the pre slaughter live weight. The birds were sacrificed by modified kosher method and the individual weight of eviscerated carcass were studied. The carcass characters like carcass weight, dressed weight, dressing percentage, giblet weight which includes weight of heart, liver & gizzard, also weight of spleen, pancreas, proventriculus, head, shank, wing, thigh and breast were collected and weighed using digital balance. The data was analyzed statistically using right statistical method. The method used was unpaired 't' test, as per the procedures described (Snedecor and Cochran 1994)<sup>[16]</sup>.

### Results

The results of carcass characteristics like carcass weight, dressed weight, dressing %, giblet weight (liver without gall bladder, heart without pericardium and gizzard without horny layer), spleen, pancreas, head, proventriculus and body cut up parts is presented in Table 1. The cockerel chicks slaughtered at end of the experiment and the carcass weight was statistically ( $p < 0.05$ ) significant and was heavier in the intensive system of rearing when compared to semi intensive system. The dressed weight was  $951.0 \pm 0.03$ g in intensive system of cockerel rearing and in semi intensive system of rearing it was  $856.0 \pm 0.02$ g. The dressing percentage was higher in intensive ( $78.06 \pm 0.33$ ) system than semi intensive system ( $77.40 \pm 0.65$ ) of rearing cockerel. The abdominal fat content of cockerel chicks ( $p < 0.05$ ) was  $13.9 \pm 0.28$  and  $11.2 \pm 0.46$ g respectively in intensive and semi intensive system.

The weight of the head was  $68.4 \pm 2.35$  g and  $68.1 \pm 2.41$ g in intensive & semi intensive system respectively of cockerel rearing which was statistically non-significant ( $p < 0.05$ ). Weight of shank, wing, breast and thigh ( $p < 0.05$ ) was  $53.0 \pm 1.63$ ,  $53.1 \pm 2.61$ ,  $158.1 \pm 3.87$ ,  $59.1 \pm 2.15$ g respectively in intensive system of cockerel rearing and in semi intensive system of rearing it was ( $p < 0.05$ )  $50.3 \pm 1.48$ ,  $52.2 \pm 2.35$ ,  $155.1 \pm 5.10$  and  $55.8 \pm 2.14$  g respectively.

The weight of the giblet which included weight of liver without gall bladder, heart and gizzard ( $p < 0.05$ ) was  $25.5 \pm 0.50$ ,  $7.3 \pm 0.40$  and  $28.7 \pm 0.61$ g respectively in intensive whereas in case of semi intensive ( $p < 0.05$ ) it was  $25.3 \pm 0.50$ ,  $7.1 \pm 0.35$  and  $28.5 \pm 0.73$ . Weights of internal organs such as spleen, pancreas and proventriculus were  $1.40 \pm 0.16$ ,  $2.5 \pm 0.02$  and  $3.80 \pm 0.17$  g in the group of intensive cockerel rearing. Similarly,  $1.30 \pm 0.15$ ,  $2.6 \pm 0.03$  and  $3.60 \pm 0.16$  g in semi intensive group which were non-significant ( $p < 0.05$ ).

The evaluation scores were  $7.40 \pm 0.24$ ,  $6.60 \pm 0.24$ ,  $6.40 \pm 0.24$ ,  $7.20 \pm 0.20$ ,  $5.80 \pm 0.20$  and  $6.60 \pm 0.24$  for appearance, taste, texture, aroma, juiciness and overall appearance respectively in the cockerel chicks group reared under intensive system. Whereas, the points of  $7.80 \pm 0.37$ ,  $7.60 \pm 0.24$ ,  $7.0 \pm 0.32$ ,  $7.40 \pm 0.40$ ,  $6.80 \pm 0.20$ ,  $7.20 \pm 0.37$  respectively for appearance, taste, texture, aroma, juiciness and overall acceptance in the group of Semi intensive system of rearing. Among the attributes only taste and juiciness differed significantly ( $p < 0.05$ ). Higher points were observed in semi-intensive system of rearing cockerels.

Mortality was slightly higher during first fortnight of brooding. The mortality of 3.0 % was observed in Group I and Group II during 0-2 months of the trial. In both the groups no mortality was observed during third and fourth fortnight. After two months the cockerel chicks raised in intensive system showed 1.0% mortality in first fortnight in both intensive and semi intensive system with the livability percentage of 99%. The mortality percent of cockerel chicks was nil in second, third and fourth fortnight.

The economics was calculated on feed cost as the other management cost remained same for both the groups (Table 2). Revenue from sale of chicks was higher in intensive system (Rs 133.40/-) and in group of semi intensive was Rs 118.31/-. Whereas, Profit per chick was Rs 25.26/- in semi intensive system and in intensive was just Rs 0.17/- per cockerel chick. Therefore, the Benefit cost ratio of 1.27 and 1.00 was observed respectively in semi intensive and intensive system of rearing cockerels.

### Discussion

Higher body weight and body weight gains have been observed in cockerels raised on intensive system which reflected in better carcass characteristics. Similar results had been reported by Champati *et al.*, (2020)<sup>[3]</sup> as 74.79% and 72.78% of dressing percent in intensive and semi intensive system of rearing of Hansli x CSML bird which was significantly differed and lower than the present study. On the contrary lower dressing percentage has been recorded (Hasan *et al.*, 2020)<sup>[8]</sup>.

There was significantly ( $p < 0.05$ ) lower abdominal fat (g) was observed in semi intensive cockerel ( $11.2 \pm 0.46$ g) compared to intensive system of cockerel ( $13.9 \pm 0.28$ g) group. The carcass with lower abdominal fat is preferred by the consumers. The reduction in the abdominal fat in cockerels raised in semi intensive system might be due to reduction in energy intake and some energy is utilized for exercise during

scavenging. Whereas, in intensive system the movement of birds is restricted and optimum energy intake might have increased the abdominal fat content. Commercial broilers contain 56% water and 320calories /100g of meat energy. Hence, carcass with less abdominal fat is preferred by the consumer.

The results indicate cockerels raised in semi intensive system have less abdominal fat when compared to cockerels in intensive system. Similar result has been reported attributable to more intensive locomotor activity. (Castellini *et al.*, 2002; Fanatico *et al.*, 2005) [2, 4]. Rearing system has positive effect on meat quality traits like breast and thigh and in improving sensory quality (Castellini, *et al.* 2002) [2].

Weight of the body cutup parts (g) i.e., wing, breast and thigh of cockerel chicks was higher in intensive than the semi intensive system, which was statistically ( $p < 0.05$ ) non-significant. Similarly Champati *et al.*, (2020) [3] reported non-significant wings yield and breast yields whereas significant ( $p < 0.05$ ) difference in thigh yield was reported in intensive and semi intensive systems of rearing Hansli x CSML bird.

The Giblets weights like liver, heart and gizzard was non-significant ( $p < 0.05$ ) between the groups. Slightly heavier weight was recorded in cockerels of intensive system. Present study are in accordance with previous report (Champati *et al.*, 2020) [3] who reported non-significant ( $p < 0.05$ ) difference in giblet yield among intensive and semi intensive systems of rearing Hansli x CSML birds. Weights of head, shank, proventriculus, spleen and pancreas did not differ significantly ( $p < 0.05$ ) among semi intensive and intensive managed cockerels. Lower spleen and pancreas weight has been reported in ISA brown cockerels (Hasan *et al.*, 2020) [8]. This indicates raising cockerel chicks in intensive or semi intensive system doesn't influence on weights of cutup parts and organ weights.

The organoleptic parameters like taste, texture, aroma, juiciness and overall acceptance for cockerels raised on semi intensive system was better than cockerels raised on intensive system. The better taste and aroma might be due to various scavenging feed resource consumed by cockerel chicks in semi intensive system and optimum exercise for production of tough meat as per consumer preference. As Haleem *et al.*, (1978) advocated the suitability of male chicks from layer strains for preparation of chicken delicacies due to its desirable flavor, less abdominal fat and juiciness. Similar results were reported by Champati *et al.*, (2020) [3] reported that outdoor rearing systems (free range, semi intensive) reduce stress while increasing comfort and bird welfare, thus enhancing the flavor (taste and aroma) as compared to intensive (conventionally) raised birds in Hansli X CSML crossbred chickens. Similarly, Leenstra (2014) [15] reported that cockerels were liked very much for their culinary

properties, real chicken taste, firm but tender meat.

The farmers believe that the cockerels are less susceptible to disease compared to broilers. These results indicate better adaptability of cockerel chicks for harsh climatic situation and these results are in close agreement with various findings that cockerels have low mortality and less susceptible to diseases and higher livability of cockerel chicks of local/native chicks/native cross chicks as reported by Faruque *et al.* (2007) [5] in chickens of Desi, Hilly and Naked Neck type of chickens, Sarkar *et al.* (2008) [18] in cockerel chicks, Jha *et al.* (2013) [11] in desi birds and Hasan *et al.* (2020) [8] in ISA brown cockerels under intensive and semi intensive management system. However, the present findings differ from that of Khawaja *et al.* (2012) [13] in desi chicks, Hassen *et al.* (2006) [9] in Northwest Ethiopian indigenous chicken, Khadda *et al.* (2017) [12] in CARI- Nirbheek chicken and Halima *et al.*, (2006) [7] in RIR birds, who reported high or low mortality under intensive and semi intensive management system.

Economics of rearing cockerels in intensive and semi intensive system revealed better returns in semi intensive system as other cost remained similar in both the groups only feed cost was considered for calculation of economics. The reason for increased profit Rs/ chick and B:C ratio could be due to 50% of the feed was reduced in semi intensive cockerels as they had an option of feeding on scavenging feed resources base for the duration of four hours per day and also the scavenging feed resources might have more influenced positively on organoleptic characteristic as per consumer preference. Similar results are reported by Sarkar *et al.* (2008) [18] as rearing chicks in semi intensive system reported better returns when compared to chicks raised on intensive system. Hence, it is beneficial to raise cockerel chicks in semi intensive or backyard rearing with less investment and to get maximum profit.

## Conclusion

Under the experimental conditions employed in the study, the cockerel chicks slaughtered at the end of the experiment and the carcass weight was statistically ( $p < 0.05$ ) significant and was heavier in the intensive system of rearing when compared to semi intensive system. The dressing percentage was higher in intensive system than semi intensive system. The organoleptic evaluation scores for appearance, taste, texture, aroma, juiciness and overall appearance were higher in semi intensive system of rearing with statistical significance in taste and juiciness differed. The better feed conversion ratio and profitability in semi-intensive system might be due to availability of better animal protein source like insects, earthworms etc., which have higher digestibility and bioavailability of nutrients for growth of cockerel chicks.

**Table 1:** Influence of management of cockerel chicks under intensive and semi intensive systems of rearing on Carcass Characteristics

Parameters	Intensive	Semi-Intensive	P value
Live Weight (g)	1218.0± 0.034 <sup>b</sup>	1106.0 ± 0.026 <sup>a</sup>	0.0188
Carcass weight after bleeding (g)	1199.0± 0.035 <sup>b</sup>	1074.0 ± 0.027 <sup>a</sup>	0.0109
Carcass weight after DE feathering (g)	1123.0 ± 0.035 <sup>b</sup>	1006.0 ± 0.025 <sup>a</sup>	0.0133
Dressed weight(g)	951.0 ± 0.03 <sup>b</sup>	856.0 ± 0.02 <sup>a</sup>	0.0140
Dressing (%)	78.06±0.33	77.40±0.65	0.3737
Abdominal fat (g)	13.9 ± 0.28 <sup>a</sup>	11.2 ± 0.46 <sup>b</sup>	0.0001
<b>Body Cutup parts</b>			
Wing (g)	53.1 ± 2.61	52.2 ± 2.35	0.8009
Breast (g)	158.1 ± 3.87	155.1 ± 5.10	0.6452
Thigh (g)	59.1 ± 2.15	55.8 ± 2.14	0.2911

Giblets			
Liver (g)	25.5 ± 0.50	25.3 ± 0.50	0.7796
Heart (g)	7.3 ± 0.40	7.1 ± 0.35	0.7088
Gizzard (g)	28.7 ± 0.61	28.5 ± 0.73	0.8360
Other Parts			
Head (g)	68.4 ± 2.35	68.1 ± 2.41	0.9301
Shank (g)	53.0 ± 1.63	50.3 ± 1.48	0.2348
Proventriculus (g)	3.8 ± 0.17	3.6 ± 0.16	0.4073
Spleen (g)	1.4 ± 0.16	1.3 ± 0.15	0.6601
Pancreas (g)	2.5±0.02	2.6±0.03	0.0421

Means bearing common superscript row wise do not differ significantly ( $p < 0.05$ )

**Table 2:** Influence of management of cockerel chicks under intensive and semi intensive systems of rearing on relative economics

Particulars	Intensive	Semi-intensive
Initial body weight (g)	30.25	30.28
2 <sup>nd</sup> month body weight(g)	479.30	474.34
Final body weight(g)	1212.71	1075.51
Variable cost		
Cost of chick	0.00	0.00
Feed consumption (g/bird)	0-45 days	955
	45-60 days	450
	60-90 days	1045
	90-120 days	1245
Feed cost/chick (50% feed reduced in semi intensive system)	0-45days (feed intake 955g/bird @ 37.24/kg feed)	35.55
	45-60 days (feed intake 450g/bird @ 34.28/kg feed)	15.44
	60-90 days (feed intake 1045g/bird @ 34.28/kg feed)	35.83
	90-120 days (feed intake 1245 g/bird @ 33.26/kg feed)	41.41
Miscellaneous (disinfection, vaccination etc.) @ Rs. 5/chick	5.00	5.00
Total variable cost	133.23	93.05
Revenue		
Sale of chicks @ Rs. 110/ kg live weight	133.40	118.31
Profit Rs per chick	0.17	25.26
B:C ratio	1.00	1.27

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