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Effect of caponization on growth performance and blood parameter in Fayoumi Cock

Hossain Muhammad Ryad, Saroj Kumar Yadav *, Mohammad Bayazid Bostami , Bibek Chandra Sutradhar and Bhajan Chandra Das

Department of Medicine and Surgery, Chittagong Veterinary and Animal Sciences University (CVASU), Bangladesh.

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Abstract

Caponization is generally supposed to affect the growth performance, carcass composition, and meat quality of male chickens. The present research work was conducted on 90-day-old Fayoumi male birds at Shahedul Alam Quaderi Teaching Veterinary Hospital Chattogram Veterinary and Animal Sciences University during the period from August 2018 to October 2018. The objectives of the study were to evaluate the effects of caponization on surgical efficacy and complications, growth performance, and blood parameter changes (CBC, serum protein, and glucose). The experiment was divided into two groups, an experimental group, and a control group with an equal number of birds (n = 10). Only the birds of the experimental group were caponized at the age of 90 days and reared for 62 days until they reached 152 days of age. Each bird in both groups was given equal care, feeding, water, and housing. Each bird was given a separate tag number for record-keeping. The present study revealed that 20% of birds died during surgery, and on the next day of surgery, 40% of birds were found to develop wind puff, and the average wound healing period was 6 days. The feed and water intake were slightly lower in the experimental group compared to the control group. There were no significant variations in body weight gain, feed, or water intake. Blood CBC (except PCV value and monocyte count), serum protein, and glucose levels were also not significantly changed between the two groups ($p>0.05$). But the present study revealed that caponization significantly decreases the PCV value of blood and significantly keeps the monocyte count stable with the age of poultry ($p 0.05$).

Keywords: Effect; Canonization; Growth performance; Fayoumi cock

1. Introduction

A capon is a male bird (cockle) that has had its testicles removed, and is subjected to surgical castration before having reached sexual maturity to improve the quality of its meat. Caponizing chickens, in short, is the surgical operation necessary for removing the testicles and neutering the chickens. Then the bird can grow longer and larger. However, the purpose of caponizing is to get a gorgeous eating bird (Muszynski et al., 2017). Caponizing must be done fatten for a minimum period of 11 weeks (Duran, 2004). As a result, coarser and less tender meat is achieved (Franco et al., 2016). Caponization increased overall fatness, both in terms of abdominal fat and subcutaneous and intramuscular lipid accumulation (Hsieh, 2001). The accumulation of lipids in a body plays an important role in meat quality for the reason that it enhances flavour, texture, and meat juiciness when compared with intact cockerels (Chen et al., 2005). Capons are obtained in many Asian countries like Taiwan (Lin and Hsu, 2002; Lin and Hsu, 2003; Lin et al., 2012) other China (Shao et al., 2009), but few in Europe generally (Tor et al., 2002; Franco et al., 2016). In the United States, France, and Italy, capons are being produced and marketed as products of extraordinary quality (Symeon et al., 2010). Caponization is normally thought to affect the growth rate and body composition of poultry, but published reports differ as to its effects. York and Mitchell (1969) say that control broilers gained significantly more

* Corresponding author: saroj Kumar Yadav

PhD fellow, Department of Medicine and Surgery, Chittagong Veterinary and Animal Sciences University (CVASU), Bangladesh.

except for capons by 11 weeks of age. Welter (1976) reported that capons were appreciably heavier than controls at 18.5 weeks of age. Mast et al. (1981) found that caponized broilers of one strain were significantly heavier at 18 wks than at 21 wks in another strain. In recent years, there has been an increased consumer interest in food products with special aromas and flavors that are rich in nutrients (Calik et al., 2015). Native and locally adapted breeds are closely linked to the tradition and culture of rural communities. This problem can be overcome by the castration and fattening of fayoumi cockerels because surgically castrated cockerels produce superior-quality meat (Fanatico et al., 2006; Calik et al., 2015). In Bangladesh, chicken meat from locally adopted breeds has always been in high demand compared to commercially available broiler meat. Consumers in Bangladesh are willing to pay more to purchase local breeds because their market price is nearly double that of commercial broilers. In our country, Fayoumi is preferred by most consumers for its meat quality, special aroma, and flavor, as in our local breeds (Weigend and Romanov, 2002). In addition, there is a limitation of research articles on canonization and its effects on the growth performance of Fayoumi male chickens, which is an important poultry breed in Bangladesh nowadays.

2. Material and methods

2.1. Place and Duration of Study Period

The present study was conducted during the period from Aug 2018 to Oct 2018 at Shahedul Alam Quaderi Teaching Veterinary Hospital (SAQTVH), Chattogram Veterinary and Animal Sciences University (CVASU), Chattogram, Bangladesh.

2.2. Selection of Experimental Birds

Apparently healthy and same age group Fayoumi male cockerels weighing from 0.5kg-1.0kg body weight, were considered and purchased from the conservation flocks of Central Government Poultry Farm, Chattogram, Bangladesh to perform the research work.

2.3. Experimental Design

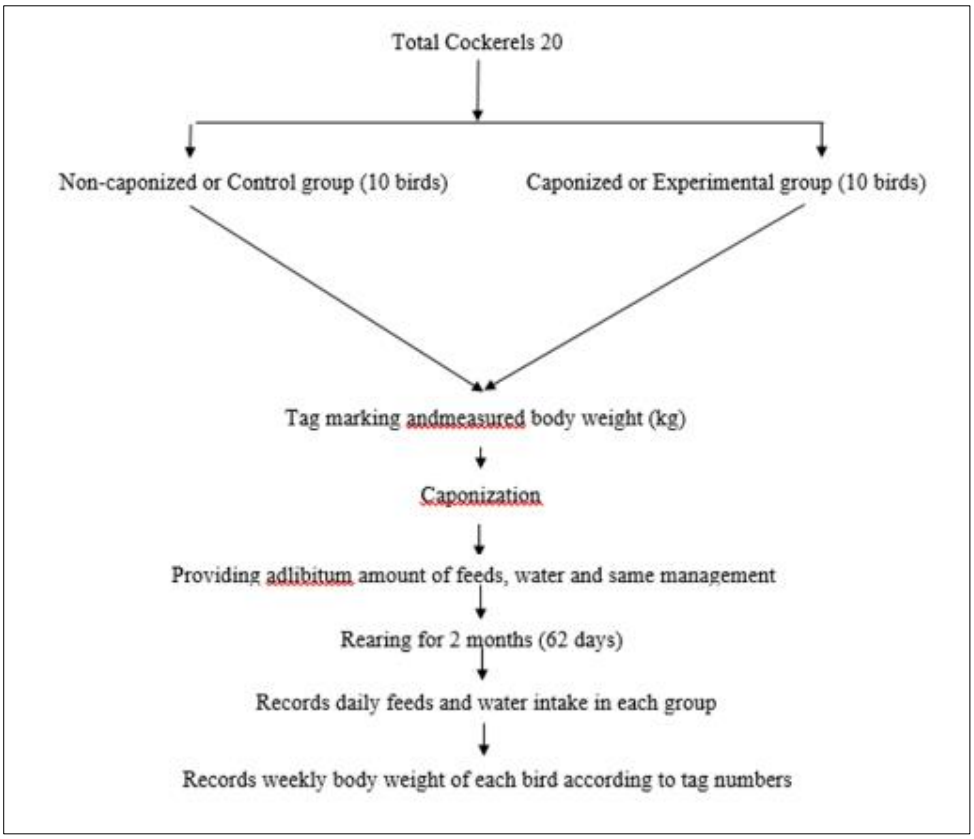

Figure 1 Schematic Diagram of the Research Plan

A total of 20 healthy selected cockerels were given individual tag numbers starting from 01 to 20. All birds were weighed and recorded individually according to their respected tag numbers. The birds were then divided into two groups, caponized or experimental group (n=10 Birds) and non-caponized or control group (n=10 birds). Each group of birds (10) were reared in a separate cage providing 1.4 sq. meters of floor space per bird with same amount of feeds, water and management.

2.4. Caponization Techniques

Instruments for Caponization

The instruments used for caponization are as follows –

- Scissors
- Caponizing teaspoon
- Sponge forceps
- Rib spreader
- Thumb forceps
- Extraction forceps
- Scalpel handle with blade
- Babcook forceps
- Caponizing tweezer

Figure 2 Instruments for Caponization

2.5. Caponization Procedure

All birds designated to the caponized group were kept off feed and restricted water intake for 12 hours prior to the surgical operation. The birds were restrained manually, feathers were plucked off from the surgical areas and sterilized with 10% povidone iodine and 70% alcohol around the incision site. The surgery was performed after the use of a local anesthetic-1% lidocaine @ 2 ml per bird administered subcutaneously at the site of incision (Fig-3). In between last two ribs, a 2-3cm vertical linear incision was made (Fig-4). A rib spreader was inserted, the air sac was cut, the intestines were moved aside and visualized the testicles (Fig-5) and then the testicles were removed by using caponizing teaspoon and tweezer (Fig-6). The incision was closed using 3.0 catgut by simple continuous suture. Povidone iodine was applied again to the incision site. The bird was then turned and second incision was made to remove the other testicle using the same procedure. Afterwards, the birds were kept to the cage with caponized (experimental) groups.

Figure 3 Infiltration of local anesthesia (1% lidocaine)

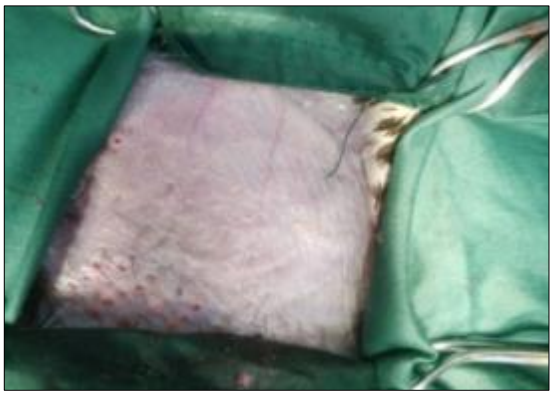

Figure 4 Incision site(Last 13th ribs)

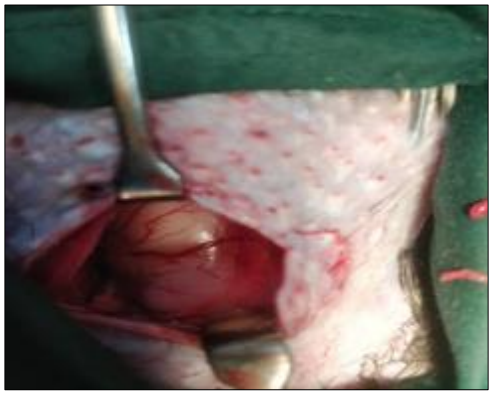

Figure 5 Visualization of testicle

Figure 6 Testectomy

2.6. Postoperative Care

Topical application of "Nebanol Ointment" (Square Pharmaceuticals Ltd, Bangladesh) was used to the site of incision for three days.

2.7. Evaluation of Feeds and Water Intake

Feeds and water was given twice in a day. For the evaluation of feed intake, the given amount of feed was weighted and placed into the feeding tray at morning and again at evening. Next morning the wastage amount of feed was weighted and recorded. The difference between given amount and wastage amount was calculated to find out the accurate amount of daily feed intake. Same calculation was applied to find out the accurate amount of daily water intake.

2.8. Measurements of Body Weight

A digital weight balance was used to measure the body weight of each bird. Initially, before caponization, all birds were measured and the body weights were recorded individually and after caponization, individual body weight of each bird was measured and recorded at weekly interval until the end of the trial (90 days – 152 days of age).

2.9. Blood Collection for CBC and Serum Analysis

Blood was collected from each bird of each group and recorded individually according to their respected tag numbers. For collecting blood sample, at first the bird was restrained manually, collection site was disinfected with 70% alcohol, 23-gauge needle was inserted carefully into the wing vein and 3 ml blood was collected from each bird, then immediately transferred into the collection tubes 1 ml blood into the tube containing EDTA for CBC test and 2 ml blood into the plane tube for serum biochemistry determination. The samples were kept in an ice box, using ice packs and transferred to the Physiology laboratory of Chattogram Veterinary and Animal Sciences University for further assays.

2.10. Periods of Blood Collection

Blood was collected twice during the whole experimental period. First collection was made on Day-1 (before caponization) and second collection was made on Day-62 at the end of trial.

2.11. Complete Blood Count (CBC) Testand Serum Biochemistry Analysis

Differential WBC counts were made on monolayer blood films, fixed and stained with Giemsa-Wright's stain. Total red blood cell (TRBC) and total white blood cell count (TWBC) were determined by a manual method using hemacytometer (Campbell, 1995). Packed cell volume (PCV) was measured by a standard manual technique using microhematocrit capillary tubes and centrifuged at 2500 rpm for 5 min. Hemoglobin concentration (Hb) was measured by Cyanmethemoglobin method.Biochemistry values, total protein and glucose were determined by automatic analyzer (Kodak Ektachem®; Eastman Kodak Company, Rochester, New York). Annex-4 and 5 represents the CBC test results before (Day-1) and after (Day-62) caponization of control and experimental group respectively and Annex-6 represents serum biochemistry analysis.

2.12. Statistical Analysis

The body weight of Fayoumi cockerel and all of the hematological and serum biochemical values were expressed as mean ± standard deviation. Parameters of both groups were compared using Student's t-test. The level of significance was reported at $P < 0.05$.

3. Results

All 10 Fayoumi male cockerels from group-2 were caponized using standard surgical procedure and 2 birds (20%) were died during surgery. But, the following day after surgery 4 caponized birds (40%) were found to develop wind puff. The lesion was found to spread from the site of incision up to the thigh region (Fig-13). The wound healed spontaneously and the average period was 6 days after surgery.

Table 1 Wound healing times of caponized birds (Group-2)

Bird Number	Healing Times (Days)	Average Healing Times
11	6	6 days
12	5	
13	7	
14	7	
15	5	
16	5	
17	6	
18	7	
19	6	
20	6	

Figure 7 Wind puff around incision site (arrow sign)

3.1. Effects of Caponization on Feeds and Water Intake

In group-2, it was observed that most of the caponized birds (Bird number 11, 12, 14, 15, 16,18, 19) were remain off feed with less water consumption for the 1st day of caponization. They were found to increase feed consumption and water intake gradually up to 5th days of caponization. The birds were found to intake full scale of feeds and water from 6th days and onwards up to the end of trial. In group-1, feeds and water intake was found normal from the 1st day up to the end of trial compared to group-2. In control group (group-1), total feed consumption was 61625 gm by 62 days. That means, average feed intake for each bird in case of control group was 101 gm/day. In experimental group (Group-2), total feed consumption was 60010 gm by 62 days. That means, average feed intake for each bird in case of experimental group was 96.8 gm/day.It was observed that average water intake for each bird in case of control group was 197.58 ml/day and in case of experimental group was 192.25 ml/day.In comparison with caponized and noncaponized group after calculation, it was found that each caponized bird intake in an average (101 gm – 96.8 gm) 4.2 gm less feed per day than that of uncaponized bird and each caponized bird intake average (197.58 ml – 192.25 ml) 5.33 ml less water per day in comparison with uncaponized bird and the water intake was 2 times more compared to feed intake for both control and experimental group.

3.2. Effects of Caponization on Body Weight

Birds before caponization, initial (Day-1) average total body weight of 10 control birds were 8420 gm and initial average total body weight of 10 experimental birds were 8550 gm. Final body weight (Day-61) of 10 control birds were 13340 gm and final body weight of 10 experimental birds were 13610 gm. From the above data, percentage of body weight gain for the control group was 58.43% and for the experimental group was 58.62%. Growth performances are same for the both caponized and non-caponized group. Therefore, caponization has no significant effects on live weight gain in case of Fayoumi male.

Table-4 represents the comperative body weight gain between non-caponized (Control) and caponized (Experimental) groups of Fayoumi male chicken before and after caponization.The result revealed gradually weight gain in both groups from day-1 to day-62. In group-1 and group-2 at day-1 the Mean±SD value was 842.00±131.85 and 858 ±113.28 respectively and at day-62 the value was 1334.00±178.29 and 1361±108.77 respectively. There is no significance body weight gain between day 1 and day 62 of two groups.

Table 2 Effects of caponization on comparative body weight gain of two groups

Day	Control Group (Group-1), n=10			Experimental Group (Group-2), n=10			p-value
	Min-Max (gm)	Mean±SD (gm)	S.E	Min-Max(gm)	Mean±SD (gm)	S.E	
Day1	540.0-995.0	842.00±131.85	41.69	635.0-1055.0	858.±113.28	35.82	0.063
Day6	605.0-1120.0	941.50±141.54	44.75	550.0-1180.0	871.±176.56	55.83	0.164
Day13	730.0-1200.0	1061.00±138.68	43.85	600.0-1190.0	941.5±172.57	54.57	0.394
Day20	790.0-1255.0	1105.00±137.33	43.42	690.0-1225.0	1016±163.00	51.54	0.497
Day27	820.0-1315.0	1141.50±144.47	45.68	780.0-1280.0	1084.±155.20	49.07	0.634
Day30	850.0-1375.0	1184.00±154.52	48.86	860.0-1350.0	1149.5±153.82	48.64	0.527
Day41	895.0-1415.0	1226.00±156.84	49.59	930.0-1400.0	1207±148.96	47.10	0.483
Day48	925.0-1465.0	1265.00±161.98	51.22	1010.0-1450.0	1263±142.32	45.00	0.393
Day55	940.0-1500.0	1287.50±163.45	51.68	1110.0-1500.0	1312±126.95	40.14	0.296
Day62	965.0-1540.0	1334.00±178.29	56.38	1230.0-1545.0	1361±108.77	34.39	0.198

3.3. Effects of Caponization on Blood CBC

Represents the total RBC, WBC, Hemoglobin (HB), Packed Cell Volume (PCV) and Erythrocyte Sedimentation Rate (ESR) test reports of control and experimental group at the age of 90 days (Day-1) and Annex-5 represents the CBC test results for both groups at the age of 152 days (Day-62). From annex-4and 5 it was revealed that, there was no significance variation of blood parameters between two groups.

Table 3 Hematology between before (Day1) and after (Day62) caponization ofFayoumi male chicken in two groups

Category	Parameters (n=10)	Day-1			Day-62			p-value
		Min-Max	Mean±SD	S.E	Min-Max	Mean±SD	S.E.	
RBC	Group-1	1.87-3.37	2.65±0.40	0.13	2.00-3.20	2.65±0.47	0.15	0.823
	Group-2	2.25-2.97	2.68±0.21	0.07	2.10-2.90	2.38±0.28	0.088	0.152
Hb	Group-1	11.80-16.50	14.27±1.55	0.49	10.00-17.00	13.41±2.40	0.76	0.468
	Group-2	12.00-15.40	13.69±1.04	0.33	11.10-15.50	13.14±1.46	0.46	0.468
PCV	Group-1	27.60-47.20	38.98±5.58	1.77	26.00-50.10	36.40±7.86	2.49	0.577
	Group-2	34.50-45.70	39.40±3.26	1.03	30.90-44.80	35.81±5.15	1.63	**0.002**
Lymphocyte	Group-1	39.00-72.00	65.50±9.69	3.06	65.00-85.00	73.20±6.18	1.95	0.408
	Group-2	67.00-73.00	70.50±2.42	0.76	63.00-74.00	69.60±3.89	1.23	0.561
Monocyte	Group-1	1.00-5.00	3.30±1.34	0.42	2.00-7.00	4.80±1.62	0.51	**0.025**
	Group-2	0.00-5.00	2.80±1.69	0.53	2.00-7.00	3.80±1.69	0.53	0.559
Neutrophil	Group-1	23.00-26.00	23.80±1.14	0.36	10.00-20.00	16.60±3.37	1.07	0.823
	Group-2	22.00-26.00	24.00±1.25	0.40	17.00-25.00	22.00±2.49	0.79	0.768
Eosinophil	Group-1	2.00-6.00	3.80±1.14	0.36	3.00-8.00	5.40±1.78	0.56	0.785
	Group-2	2.00-5.00	3.60±0.84	0.27	3.00-7.00	5.30±1.34	0.42	0.624

Table 5 represents the haematological parameters (CBC) of Fayoumi male chicken in control (Group-1) and experimental (Group-2) groups. After data analysis it was found that the p-value of RBC and Hb in control and experimental group at day-1 vs day-62 is greater than 0.05. Therefore, caponization has no significance effect on RBC & Hb value.

But caponization has significance effects on PCV parameters. Because P-value of experimental group after caponization at day-62 significantly decreased as p-value is 0.002 ($P<0.05$). Therefore, caponization significantly decrease the PCV value of blood.

It was revealed thatcaponization has no effects on changing the results of Lymphocyte, Neutrophil & Eosinophil value of bloodas $p>0.05$. But in control group, Monocyte count significantly increases with the age of poultry at day 62 asp<0.05. But caponization keeping the Monocyte count stable as $p>0.05$. Therefore caponization has significance effects on keeping the Monocyte value stable with the age of poultry asp<0.05.

3.4. Effects of Caponization on Serum Protein and Glucose

Represents the test report of total serum protein and glucose concentrations of control and experimental group at the age of 90 days (day-1) and 21 weeks (day-62). It was observed that the total protein level in blood serum is slightly (not all) higher at the earlier age and a bit lower at the older age for both caponized and non-caponized group. Therefore, caponization has no effects on changing serum glucose and protein level to increase or decrease.

Table 4 Serum protein and glucose value between 2 groups at day-1 and day-62 of Fayoumi male chicken

Para-meter	Category	Day-1				Day-62				p-value (D1 vs D2)
		Min-Max	Mean±SD	S.E	p-value	Min-Max	Mean±SD	S.E	p-value	
Serum protein	Group-1	2.11-5.03	3.77±1.04	0.32	0.012	0.55-3.78	2.52±0.85	0.27	0.630	0.097
	Group-2	2.38-4.96	3.43±.87	0.27		2.09-3.02	2.56±0.34	0.10		0.842
Serum Glucose	Group-1	195.32-226.16	212.11±9.83	3.10	0.868	93.45-285.00	221.32±492.95	15.58	0.966	0.622
	Group-2	179.82-270.54	238.22±28.34	8.96		191.10-268.90	240.02±310.87	9.83		0.580

Table 6 represents comparative parameters of serum protein and glucose of Fayoumi male chicken between control and experimental groups. The result revealed that the protein value decreased at day 62 compared to day 1 in both groups and the glucose value increased at day 62 compared to day 1 in both groups. But there is no significance variation of serum protein and glucose parameters in two groups between day 1 and day 62 as $p>0.05$.

4. Discussion

During surgery 20% (2 cockerels out of 10) cockerels were died during surgery. The result is consistent with Rikimaru *et al*. (2009), who found that caponizing losses are estimated to range between 5% to 20%. Gogolewski and Czerwiński (2012) report that mortality may reach up to 50% in older birds and 40% (4 out of 10) caponized birds were found to develop wind puff. In consistent with Irwin 1946, 25% or more cases will develop wind puffs.

4.1. Effects on Feed and Water Intake

All caponized birds were remaining off feed for the 1st day following caponization. Water consumption was also very less. But, feeds and water intake was found normal for control group. At the end of the trial, it was observed that, caponized group intake slightly low amount of feed and water in comparison with uncaponized group but weight gain is same in both groups. Mahmud *et al*., 2013, found that capons are having better feed conversion rate than intact male chicken and feed and water consumptions are less compared to intact males.

4.2. Effects on Weight Gain

Generally, caponization is done to increase the growth performance and meat quality in male chickens throughout the world. There are many reported articles that suggest, caponization has effect on growth performance and meat quality. Present study revealed that no significant body weight gain in Fayoumi male cocks. Caponized birds show higher weight gains and better feed conversion, final body weight is 10–20% higher compared to intact male birds (Rahman *et al*., 2004; Mahmud *et al*., 2013). On the other hand, present study consistent with Miguel *et al*. (2008) and Shao *et al*. (2009) shown that no increase in the body weight of caponized chickens. These inconsistent results might be attributable to differences in breed/genotype, castration age, feeding level, rearing conditions, and slaughter age of the compared birds. In Tor *et al*. (2002) hypothesis that caponizing was found to have a beneficial effect on increasing the weight of breast muscles (265.1 vs 347.9 g) and leg muscles (267.1 vs 305.2 g) but the present research work didn't find any similarity but Higher body weight in capons observed by a few other researchers (Lin and Hsu, 2002; Tor *et al*., 2002; Rahman *et al*., 2004; Chen *et al*., 2006, 2007). on the other hand, some studies mention that decrease in weight of capons (Shao *et al*., 2009) or indicate that caponization has no significant effect on body weight (Durán, 2004; Chen *et al*., 2006; Miguel *et al*., 2008; Symeon *et al*., 2010; Symeon *et al*., 2012; Franco *et al*., 2016). The above-mentioned contradictions in results are probably caused by the use of different breeds, variations in the duration of rearing, different diets and the age at which the castration procedure was carried out (Shao *et al*., 2009). In present study reveal that caponization has no significant effects on growth performance.

4.3. Effects on Blood Parameters

The present study revealed that caponization does not affect any significant results on blood parameters (RBC, WBC, Hb, PCV) as $p>0.05$. This result is consistent with Shao et al. (2009), who also did not find any significant variation in blood parameters between capons and intact male chickens. But, Rahman et al. (2004) found that red blood cell counts, hemoglobin concentrations, and hematocrit values were significantly lower in castrated cockerels, which was also observed by Mahmud et al. (2013) and Kasperek et al. (2013).

4.4. Effects on Serum Biochemistry (Protein and Glucose)

The present study revealed that serum protein values are slightly higher at day-1 (Younger age) compared to day 62 (Older age) and serum glucose values are slightly lower at day-1 (Younger age) compared to day 62 (Older age) in both groups and also revealed there are no significant variations in the serum total protein and glucose level between two groups ($p>0.05$). Therefore, caponization does not affect the serum protein and glucose of fayoumi male chicken. This result is consistent with Shao et al. (2009), who also did not find any significance on serum protein and glucose level between capons and intact male chickens. Serum protein might be affected by the age of poultry but not due to caponization and serum glucose levels are not affected by caponization as well as age factors.

5. Conclusion

Present study concluded the following findings –

- Intra and post-operative complications may be common in caponization procedure
- Fayoumi male chickens are not suitable for considerable body weight gain for commercial meat production.
- Caponization does not significantly effect on blood components (except PCV value and Monocyte count), glucose and protein parameters.
- Caponization significantly decreases the PCV value of blood &significantly keeping the Monocyte count stable with the age of poultry.
- Caponized Fayoumi male chicken consumes less feed and water compared to intact male chicken. So regarding this aspect,the caponization of Fayoumi male chickens may help to use surplus cockerels and may be a profitable business for the farmers, which also has an economic dimension.
- Present study also suggests that, further research work on other breeds/strains of poultry may be necessary to evaluate increase meat production.

Compliance with ethical standards

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Disclosure of conflict of interest

Authors declare that there is no conflict of interest.

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