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Research Article

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Effect of Artificial Insemination in Turkey Production Performance at Khumaltar, Nepal

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Abstract

Artificial Insemination technology could be a better promise to the commercial turkey farmers in Nepal to generate large flocks. This research was conducted to evaluate the effect of artificial insemination with different volumes of semen on production attributes. An experimental investigation was undertaken to examine the effects of different semen volume treatments (control, 0.3 ml, 0.4 ml, and 0.5 ml) administered during artificial insemination (AI) on the production metrics of Broad Breasted Bronze turkeys at the National Agriculture Research Centre in Khumaltar, Nepal from May, 2022 to November, 2022. The total number of birds (n =108) used for the study was randomly allotted to 4 treatments replicated 3 times in each unit, each experimental unit having 3 males and 6 females. Different production parameters, like egg production, hatchability, and male weight, were monitored following AI. Offspring were then assessed for feed intake, weight gain, feed conversion ratio, and carcass composition. Results have shown that semen volume treatments did not significantly affect hatchability or offspring growth performance parameters at $p<0.05$. Interestingly, male weight significantly influenced egg production ($p < 0.05$). The 0.5 ml dose (T3) yielded the highest egg production and hatchability rates compared to other treatments and the control group. Meat quality traits of offspring from all treatment and control groups showed similar percentages of protein, ash, and moisture. Therefore, the results of the study concluded that while semen dose did not impact poult growth or carcass characteristics, the 0.5 ml dose showed promise for enhancing egg production and hatchability. Hence, optimizing semen management can improve AI efficiency and productivity in turkey production.

Introduction

The turkey is a large bird belonging to the *Meleagris* genus and is native to North America. There are two existing species of turkeys: the wild turkey (*Meleagris gallopavo*), found in eastern and central North America, and the ocellated turkey (*Meleagris ocellata*), located in the Yucatán Peninsula of Mexico. Male turkeys of both species have a distinct fleshy wattle called a snood, which hangs from the top of their beaks. They are among the largest birds in their habitats, and the males are typically larger and more colorful than the females.

Turkey production is an important and profitable industry, driven by increasing global demand for turkey products (Yakubu et al., 2013). Turkeys are adaptable to various climatic conditions (Coban Yildiz & Yildiz, 2024), and the consumption of turkey meat, along with broiler meat, is on the rise worldwide, including in developing countries (Kálmán & Szőllősi, 2023). The global production of turkey meat reached 5.6 million tons in 2012, surpassing the 5.1 million tons recorded in 2003 (Wilson et al., 2024). Turkeys are known for their ability to forage for insects, making them effective for insect control in crops, including vegetables (Groepper et al., 2013). They thrive well in arid conditions, tolerate heat better, range farther, and produce higher-quality meat compared to other poultry species (Yakubu et al., 2013).

Artificial insemination (AI) has not been widely utilized in the poultry industry due to the sensitivity of avian spermatozoa to the freezing and thawing process. (Hassan, 2022). Consequently, fresh liquid semen is conventionally used for AI in turkeys. Unlike chickens, turkeys have a well-developed pectoral muscle that hinders natural mating, making AI a necessity. (Asaduzzaman et al., 2022). The difficulty of natural breeding in turkey males has led to challenges in meeting the increasing demand for turkey meat in the market. Turkey meat is gaining popularity due to its gamey flavor and lower fat content, indicating its high production and marketing potential in Nepal.

Furthermore, rearing a large number of turkey males for natural breeding can be expensive for farmers in Nepal, considering their large frame, active feeding habits, and limited semen expulsion. The cost of feeding and managing a significant number of males for natural breeding can be financially burdensome. By exclusively utilizing artificial insemination without natural mating, farmers can achieve additional savings. The use of saddles, which are costly accessories for females during natural mating, can be eliminated, resulting in savings for farmers. (Farooq et al., 2024). Moreover, carrying fewer males from the market age through the breeding season would lead to savings in feed costs and prevent depreciation when selling breeders.

The proposed study aims to compare the feasibility of natural breeding and artificial insemination in turkey birds, recommend the appropriate dose of semen that is effective for higher productivity in turkey through AI, evaluate their meat quality traits, and gain a deeper understanding of their production performance in Khumaltar. Through this study, insights and recommendations will be provided regarding the most effective method to achieve higher productivity in turkey birds.

Methods

Experimental area

The experiment was carried out at the Nepal Agriculture Research Council (NARC), Khumaltar, Lalitpur, from May 20 to November 22, 2022.

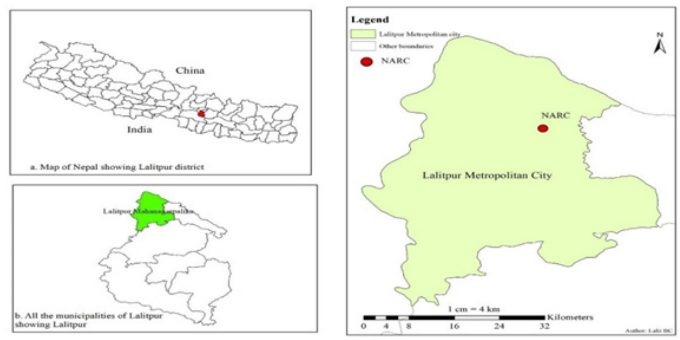

Figure 1: *Research Area showing NARC, Khumaltar.*

Experimental birds

The experiment was carried out on Broad Breasted Bronze turkey. One hundred and eight broad-breasted bronze turkeys of 9 months old were used for the experiment. The birds were allotted to 4 treatments replicated 3 times in each unit. Each experimental unit has 3 male and 6 female turkeys.

Experimental design

A completely randomized Design (CRD) was employed to investigate the control and treatment condition in Turkey birds. The total number of birds (n =108) used for the study were randomly allotted to 4 treatments (4x3) replicated 3 times in each unit, i.e., 4 treatments with 3 replications. Treatment included T0= control, T1= 0.3 ml, T2= 0.4 ml, and T3= 0.5 ml of semen. For comparison of offspring from broad-brested bronze, two treatment groups were designated, namely, poult born from artificial insemination (AI) and natural insemination (NI), respectively.

Layout of experimental design

The experiment was carried out in a Completely Randomized Design. Each treatment was applied to 72 females each. The overall layout of the experiment is shown in the figure.

Treatments	Replication		
Control (T0)	R1	R2	R3
0.3 ml (T1)	R1	R2	R3
0.4 ml (T2)	R1	R2	R3
0.5 ml (T3)	R1	R2	R3

***Table 1:** Layout of the experimental design.*

T0R1	T1R3	T2R2	T3R1
T1R1	T0R2	T2R3	T3R2
T2R1	T0R3	T3R3	T1R2

***Table 2:** Enlarged view of treatment and replication.*

Diet composition

The feeds were formulated containing 20 % crude protein and metabolizable energy at the level of 2900 Kcal/Kg to meet the requirement. The compound feed formulation composition of the concentrate mixture is given in Table 3.

Ingredients	Percentage
Maize	60
Rice bran	4.88
Soya meal	30.17
Soya-oil	0.06
Bone meal	3
OST/ Shell	0.8
Lysine	0.16
Methionine	0.18
Mineral Vit.	0.25
Liber tonic	0.1
Salt	0.3
Toxin binder	0.1
Total	100
Protein %	20
ME	2900

Note: ME = Metabolizable energy

***Table 3:** Composition of concentrate compound feed mixture fed to the experimental turkey during the experimental period.*

The samples of feed ingredients were analyzed at the National Animal Nutrition Research Centre (NANRC), Khumaltar, Lalitpur, for proximate analysis. Representative samples from offered concentrate mixture were analyzed for Dry Matter (DM), Crude Protein (CP), Crude fiber (CF), total ash (TA), and energy. The DM was determined by oven drying at 100°C for 24 hrs. The crude protein of the samples was determined using the Kjeldahl method. Ash content was determined by ashing at 550°C in a muffle furnace for 16 hrs.

Observations recorded

For the study of different parameters, all 108 birds were used to minimize the error. The following observations related to the objectives of the study were recorded for the treatment.

Weight of the turkey

The weight of the 9-month-old individual Male was recorded to see the response of Male weight on semen volume during the research period. The average weight of the experimental bird was recorded with the help of a digital balance. The weight of the bird was taken at the time of semen collection.

Semen volume

The semen volume of the 9-month-old individual male was recorded to see the response of semen volume on the hatchability of egg and egg count. Semen was collected from the bird in an Eppendorf tube. The collected semen was divided into treatment groups, namely 0.3 ml, 0.4 ml, and 0.5 ml with control. The semen was administrated directly into female vagina within 30 minutes of collection.

Feed intake of offspring from broad-breasted bronze

Total concentrate feed offered to the experimental birds on the dry matter basis was recorded daily on a group basis and the refusal the next morning. The water was measured daily on a group basis. Feed was weighed and recorded on the following day regularly. Average feed intake was calculated for each replicate in all treatments by subtracting feed left over from each previous day's feed offered.

Feed intake = feed given – refused feed.

Body weight of offspring from broad-breasted bronze

The daily and weekly body weights of the offspring of broad-breasted bronze were recorded during the research period. The average body weight of the experimental bird was recorded with the help of a digital balance in the morning hours before feeding.

Body weight gain of offspring from broad-breasted bronze

The average body weight gain of the offspring of broad-breasted bronze was calculated by subtracting the live weight of the previous recording from that of the current recording and recorded in grams.

Feed conversion ratio of offspring from broad-breasted bronze

Average feed consumption rates per bird were calculated for different feeding methods.

The total feed weight was divided by net production to obtain the feed conversion factor.

FCR was calculated by:

$$\text{Feed conversion ratio: } \frac{\text{Feed consumed (g)}}{\text{Body weight gain (g)}} \text{ (Adrizal et al., 2011)}$$

Weight of various parts of carcass of offspring from broad-breasted bronze

This section focuses on the weight measurements of different carcass parts, such as breast, thighs, wings, etc., to determine whether treatment affects the distribution of weight in the offspring of broad-breasted bronze.

Semen collection

The male turkey was stimulated by gently stroking its abdomen with the right hand while simultaneously pushing its tail upward and toward its head with the left hand. The ejaculates were collected into 1 ml microtubes, and after each collection, they were visually and microscopically examined. Precautions were taken to prevent contamination of the semen with feces, urates, or transparent fluid, as these can negatively affect the quality of the semen. The collected semen was used within 30 minutes of collection, and to minimize the impact of individual differences among the donors, the semen was pooled in equal amounts based on the required semen volume.

Method of separating spermatozoa from semen

To wash the spermatozoa, the semen was diluted in a 1:1 ratio with Millonig's phosphate buffer and subjected to centrifugation to remove the buffer and seminal plasma. The resulting spermatozoa were then resuspended in a 2% phosphate-buffered glutaraldehyde solution for fixation. Additionally, the sperm were fixed with a 0.5% phosphate-buffered solution of osmium tetroxide for 1 hour.

Following fixation, the spermatozoa were dehydrated using a graded ethanol solution. A drop of ethanol containing suspended sperm was placed on glass coverslips, allowing the sperm to settle. Subsequently, the sperm samples were scanned using a compound microscope.

Semen analysis

Semen analysis was performed to assess the quality of the collected semen for artificial insemination (AI). Initially, a compound microscope was used to observe the viability of the semen. Smears were prepared and stained with eosin and nigrosin, following the methods outlined by (Bakst & Dymo, 2013). The percentage of live-dead spermatozoa and abnormal spermatozoa was determined through microscopic examination. Spermatozoa that were stained were considered dead.

The evaluation of abnormal spermatozoa involved observing the morphology of a total of 100 spermatozoa. Sperm motility was assessed by examining a small drop of semen (4-5 µl) under a microscope at 10x magnification. Sperm concentrations were determined using a Neubauer hemocytometer. These analyses provided insights into the viability, morphology, motility, and concentration of the spermatozoa, which are important factors in assessing semen quality for AI purposes.

AI in Turkey female

The females were inseminated using the "Venting" method, which was described by (Bakst & Dymo, 2013). Venting involved applying pressure to the left side of the abdomen around the vent, causing the cloaca to protrude along with the oviduct. A 1 ml plastic syringe without a needle containing the appropriate amount of semen was then inserted into the oviduct. The semen was delivered at a depth of 1.5 to 2 cm inside the vent.

Artificial insemination (AI) was conducted once a week, specifically between 4-5 p.m., to ensure that there were no hard-shelled eggs present in the uterus. It is important to perform AI when there is no hard-shelled egg likely to be in the uterus or at least not within 3 hours of oviposition, as suggested by (Getachew, 2016). The entire AI process was completed within 30 minutes of semen collection.

Only ejaculates with a milky appearance, devoid of fecal material, and with over 70% mass motility were used for AI. Freshly collected undiluted pooled semen was drawn into a 1 ml syringe, and 0.3 ml, 0.4 ml and 0.5 ml of semen was deposited into the vagina of the female.

After the semen was deposited into the vagina, the pressure around the vent was released, and gentle massage was applied to the vent area. This massage assisted the female in retaining the sperm either in the vagina or the oviduct, promoting successful fertilization. Throughout the entire process of insemination, great care was taken to avoid any rough handling of the females. Gentle and careful handling was maintained before, during, and after the insemination process.

Once the insemination was completed, the females were released gently to prevent any regurgitation of semen from the vagina. This precautionary measure aimed to maintain optimal fertility rates by ensuring that the deposited semen remained in the reproductive tract of the female.

Statistical analysis

All the collected data were then entered in MS Excel and converted into text files (MS-DOS). The effect of treatment was analyzed using a one-way ANOVA procedure by the Completely Randomized Design (CRD).

Data were analyzed for descriptive statistics, and the relation between the variables was analyzed using SPSS. The statistically significant means were then compared using Duncan's Multiple Range Test (DMRT) computer software as modified by Kramer in 1957 at $p \leq 0.05$ level of significance.

The linear model: $Yij = \mu + TRi + Rep + Ei$, was used to summarize the statistics employed to analyze the data;

Where Yi is the dependent variable,

μ is the overall mean,

TRi is the treatment effect (the effect due to semen volume and weight of male)

Rep is the replication and

Ei is the error.

Results and Discussion

A comprehensive analysis of various parameters related to feed intake, growth performance, feed conversion ratio, and hatchability is presented. The study examines the effects of different levels of semen volume applied to the birds.

Hatchability of eggs

Egg production and hatchability according to treatment

Table 4 indicates that the application of various treatments had a non-significant ($p > 0.05$) difference in hatchability. In case of treatment T0, T1, T2 and T3, the egg production percentage was 30.06 ± 0.72, 32.02 ± 0.62, 36.06 ± 0.67 and 38.17 ± 0.48 respectively. Similarly, the hatchability percentage for treatment T0, T1, T2, and T3 was 34%, 36%, 35% and 37%, respectively. These findings showed that the overall egg production and hatchability were found to be higher in treatment (T3), whereas lower in Treatment (T0). The data show higher egg production with treatment (T3); however, the overall application of treatment was found to be non-significant. This shows that the treatments had no significant effects on the egg production and hatchability of the experimental birds. This finding aligns with the results obtained by Subedi et al. (2018), during their study in Rampur, Chitwan, Nepal. Burilo & Kashoma (2023) also reported similar findings regarding the lack of relationship between semen volume and the number of chicks hatched. On the other hand, Pearlin et al. (2020) reported that adequate semen volume is necessary to ensure fertility in eggs.

Treatment (Semen volume)	Egg Production	No. of chicks hatched	Hatchability
T0	30.06 ± 0.72	12	34%
T1	32.02 ± 0.62	8	36%
T2	36.06 ± 0.67	10	35%
T3	38.17±0.48	14	37%
CV	14.27		18.84
p-value	0.190(NS)		0.796(NS)

NS = non-significant

Table 4: *Egg production and Hatchability according to treatment during the experimental period.*

Effect of weight of male weight on egg production and hatchability

Table 5 suggests that the weight of the male had a significant effect on the Egg production of the turkey. However, the weight of birds had a non-significant difference on the hatchability of eggs. Kuda (2023) reported that heavier birds reduced fertility and hatchability significantly, and also mentioned that the overweight of males was associated with a significant reduction in hatchable eggs. Rahman et al. (2019) however, found that the body weight treatment groups did not affect the hatchability. Subedi et al. (2018) during their study in Rampur, Chitwan, Nepal, found that the weight of male had a significant effect on hatchability.

Factor	Egg Production	No. of poult hatched	Hatchability
T0 (9 kg)	30.06 ± 0.72	12	34 %
T1 (8 kg)	32.02 ± 0.62	8	36%
T2 (10 kg)	36.06 ± 0.67	10	35%
T3 (12 kg)	38.17 ± 0.48	14	37%
CV	14.27		18.84
p-value	0.03*		0.796(NS)

NS = non-significant, *significant at 5% level

Table 5: *Effect of weight of male on hatchability during the experimental period.*

Performance of offspring of broad-breasted bronze

Comparison of group feed intake of offspring of broad-breasted bronze

Age of birds	Treatments				p-value	Level of significance
	T0 (Mean ± SE)	T1 (Mean ± SE)	T2 (Mean ± SE)	T3 (Mean ± SE)		
1st week	160.26 ± 0.33	161.22 ± 0.36	161.39 ± 0.31	162.02 ± 0.36	0.505	(NS)
2nd week	322.66 ± 0.66	321.26 ± 0.35	323.12 ± 0.63	322.26 ± 0.73	0.144	(NS)
3rd week	712.22 ± 0.36	712.38 ± 0.83	714.22 ± 1.53	716.28 ± 1.49	0.003	**
4th week	1136.89± 1.28	1135.98 ± 0.72	1140.56 ± 0.65	1142.45 ± 0.59	0.515	(NS)
5th week	1893.81± 2.26	1652.06 ± 2.14	2089.62 ± 1.26	2087.66 ± 2.31	0.002	**
6th week	2266.65± 0.83	2268.35 ± 0.94	2274.75 ± 0.82	2276.68 ± 0.89	0.269	(NS)
7th week	3650.25^b ± 22.6	3715.80^a ± 24.07	3744.61^a ± 2.99	3758.22^a ± 1.96	0.009	**
8th week	4076.89 ± 1.32	4173.19 ± 1.39	4167.72 ± 1.72	4169.52 ± 1.62	0.788	(NS)
9th week	5398.22 ± 1.16	5389.77 ± 1.79	5391.35 ± 5.56	5389.25 ± 4.36	0.204	(NS)
10th week	6392.98 ± 1.13	6394.62 ± 1.62	6384.26 ± 2.96	6386.43 ± 1.78	0.083	(NS)
11th week	7362.68 ± 0.78	7365.37 ± 0.81	7365.37 ± 0.81	7364.27 ± 0.89	1.00	(NS)
12th week	9050.40^b ± 1.22	9118.46^a ± 1.87	9125.71a ± 0.99	9128.72a ± 0.86	0.002	**
13th week	11352.92^b ± 14.26	11443.40^a ± 15.89	11434.98^a ± 86.14	11458.63^a ± 80.26	0.003	**
14th week	12203.42 ± 2.20	12200.47 ± 2.21	12205.47 ± 2.21	12203.58 ± 1.98	1.00	(NS)

*Significant at p<0.05, **Significant at p<0.01, ***Significant at p<0.001, NS= non-significant

Table 6: *Comparison of group feed intake of offspring of broad-breasted bronze during the experimental period.*

Table 6 suggests that for most weeks, i.e., 1st, 2nd, 4th, 6th, 8th, 9th, 10th, 11th, and 14th, there were no significant difference in feed intake between the treatment and control groups. However, in the 3rd, 5th, 7th week, 12th week, and 13th week, there were a significant difference at p<0.01. This means that the difference in feed intake between the treatment and control groups during these weeks was statistically significant and unlikely due to chance. This might be due to the development of the gastrointestinal tract in later stages (Pandey et al., 2023). However, further research is needed to understand these differences. Pandey et al. (2023), found that there was significant feed intake at the 12th and 13th week of age of the turkey under the control diet, which is in alignment with our research. Also, there was non-significant feed intake at 1st, 2nd, 4th, 6th, 8th, 9th, 10th, 11th and 14th week of age. A similar result was obtained by (Amer et al., 2021), where feed intake was higher in the control group only after the 14th week of age.

Comparison of weight gain of offspring of broad-breasted bronze

Age of birds	Treatments				p-value	Level of significance
	T0 (Mean ± SE)	T1 (Mean ± SE)	T2 (Mean ± SE)	T3(Mean ± SE)		
1st week	160.26 ± 0.33	161.22 ± 0.36	161.39 ± 0.31	162.02 ± 0.36	0.505	(NS)
2nd week	322.66 ± 0.66	321.26 ± 0.35	323.12 ± 0.63	322.26 ± 0.73	0.144	(NS)
3rd week	712.22 ± 0.36	712.38 ± 0.83	714.22 ± 1.53	716.28 ± 1.49	0.003	**
4th week	1136.89± 1.28	1135.98 ± 0.72	1140.56 ± 0.65	1142.45 ± 0.59	0.515	(NS)
5th week	1893.81± 2.26	1652.06 ± 2.14	2089.62 ± 1.26	2087.66 ± 2.31	0.002	**
6th week	2266.65± 0.83	2268.35 ± 0.94	2274.75 ± 0.82	2276.68 ± 0.89	0.269	(NS)
7th week	3650.25^b ± 22.6	3715.80a ±24.07	3744.61a ±2.99	3758.22^a ±1.96	0.009	**
8th week	4076.89 ± 1.32	4173.19 ± 1.39	4167.72 ± 1.72	4169.52 ± 1.62	0.788	(NS)
9th week	5398.22 ± 1.16	5389.77 ± 1.79	5391.35 ± 5.56	5389.25 ± 4.36	0.204	(NS)
10th week	6392.98 ± 1.13	6394.62 ± 1.62	6384.26 ± 2.96	6386.43 ± 1.78	0.083	(NS)
11th week	7362.68 ± 0.78	7365.37 ± 0.81	7365.37 ± 0.81	7364.27 ± 0.89	1.00	(NS)
12th week	9050.40^b ± 1.22	9118.46^a ± 1.87	9125.71^a ± 0.99	9128.72a ± 0.86	0.002	**
13th week	11352.92^b ± 14.26	11443.40^a ± 15.89	11434.98^a ± 86.14	11458.63^a ± 80.26	0.003	**
14th week	12203.42 ± 2.20	12200.47 ± 2.21	12205.47 ± 2.21	12203.58 ± 1.98	1.00	(NS)

*Significant at p<0.05, **Significant at p<0.01, ***Significant at p<0.001, NS= non-significant

Table 7: *Comparison of weight gain of offspring of broad-breasted bronze during the experimental period.*

The table suggests that for most weeks, excluding the 13th week (1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th, and 14th), there were no significant difference in weight gain between the treatment and control groups. However, in the 13th week, there was a significant difference at the p<0.05 level (indicated by *). This means that the difference in weight gain between the treatment and control groups during this week was statistically significant and unlikely to be due to chance. This could suggest that the method of insemination may have an impact on feed intake at certain stages of growth. This could suggest that the method of insemination may have an impact on weight gain at certain stages of growth. However, Taye & Esatu (2022), reported that when artificial insemination is practiced, weight gain percentages were increased compared to natural mating. The average weight of poults obtained from this study was consistent with the results of (Soyalp et al., 2023). On the other hand, the weight of turkeys born from both breeding techniques at 12 weeks of age was obtained to be 3.3 kg, which is lower than the weight obtained by Karki (1970), where the weight of the turkey at 12 weeks of age was 3.93 kg.

Age of birds	Treatments			
	T0	T1	T2	T3
1st week	1.23	1.26	1.27	1.22
2nd week	1.42	1.44	1.43	1.40
3rd week	1.91	1.91	1.90	1.92
4th week	2.16	2.41	2.18	2.23
5th week	2.20	2.16	2.79	2.59
6th week	2.31	2.32	2.33	2.36
7th week	2.76	2.78	2.82	2.89
8th week	2.49	2.51	2.48	2.62
9th week	2.58	2.59	2.60	2.59
10th week	2.58	2.58	2.58	2.58
11th week	2.51	2.53	2.52	2.52
12th week	2.70	2.71	2.72	2.71
13th week	2.86	2.99	2.89	2.90
14th week	2.86	2.86	2.86	2.86

Table 8: *Comparison of feed conversion ratio of offspring of broad-breasted bronze during the experimental period.*

Comparison of feed conversion ratio of offspring of broad-breasted bronze

The table shows the comparison of the FCR of poults born from various treatments. For most weeks (1st, 2nd, 3rd, 6th, 8th, 9th, 10th, 11th, and 14th), the FCR were almost identical between the treatments. This suggests that the method of insemination did not significantly affect the efficiency of feed conversion during these weeks. However, in the 4th week, the FCR for the treatment group was higher than that for the control group. This suggests that during these weeks, the AI group was less efficient at converting feed into body mass. In contrast, in the 5th week, the FCR for the control group was significantly higher than that for the treatment group. This suggests that during this week, the control group was less efficient at converting feed into body mass. In the 7th week, 8th week, and 13th week, there were slight differences in FCR between the treatments and control groups as well. Here, the feed conversion ratio in the 2nd week was slightly similar for all treatments. Havenstein et al. (2007) reported that the FCR of turkeys in 2nd week was 1.368, which is slightly similar to the findings in the research. This could suggest that the method of insemination may have an impact on feed conversion efficiency at certain stages of growth.

The same pattern continues for the remaining weeks, with the FCR obtained in this research and Turkey's data obtained by Abdalla et al. (2021), generally increasing with the age, but with some fluctuations. Also, the FCR obtained in this research on the 14th week was 2.86, which is slightly lower than the FCR obtained by Fereja (2020), who obtained FCR to be 3.54. These findings could support the conclusion that different breeding techniques have different efficiencies in converting feed into body mass, and these efficiencies can change as the birds age.

Comparison of the chemical composition of carcass characteristics of offspring of broad-breasted bronze

Treatment	Protein (%)	Ash (%)	Moisture (%)
T0	22.86	1.07	73.52
T1	22.54	1.03	72.63
T2	22.52	1.06	73.62
T3	22.50	1.04	71.26

Table 9: *Comparison of chemical composition of carcass characteristics of offspring of broad-breasted bronze during the experimental period.*

The table indicates the comparison of carcass characteristics of offspring of broad-breasted bronze from various treatments. The findings indicate that the protein % in the control and treatment groups were 22.86, 22.54, 22.52, and 22.50, respectively, and the moisture % were 73.52, 72.63, 73.62, and 71.26, respectively. This finding aligns with the results obtained by Kambarova et al. (2021), who reported a moisture content of 73.8% and a crude protein content of 22.1% in turkey meat samples.

Similarly, the Ash % in both control and treatment groups were 1.07, 1.03, 1.06, and 1.04, respectively. A contrasting result was reported by Gabdukaeva et al. (2021), where meat samples contained 2.3% ash.

It is important to consider that variations in turkey meat composition can arise from factors such as breed, diet, age, and processing methods. Further research is necessary to obtain a more comprehensive understanding of the composition of turkey meat under different conditions and sample sources.

Conclusion

From the research, it can be concluded that both control and treatment groups have similar effects on the growth performance, feed intake, and carcass characteristics of Poults. However, the method of insemination has an impact on feed conversion efficiency at certain stages of growth of the offspring of broad-breasted bronze, and these efficiencies can change as per the bird's age. In addition, hatchability of eggs has increased significantly after the artificial insemination in female but volume of semen has no significant impact on the hatchability of eggs.

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