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Effect of Bovine Colostrum on Zootechnical Parameters and Egg Production in Goliath Chickens

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Abstract
The aim of this study was to evaluate the effects of bovine colostrum supplementation on the growth performance, survival rate, and egg-laying productivity of Goliath chickens reared for 20 weeks at the experimental station of the Faculty of Agronomy, University of Niamey. A total of 180 chicks were randomly distributed into three homogeneous groups and fed a basal diet supplemented with 0% (T0), 1% (T1), or 2% (T2) bovine colostrum during the first 21 days of life. The parameters assessed included live body weight, feed intake, average daily gain (ADG), feed conversion ratio (FCR), mortality rate, age and weight at the onset of laying, and egg weight. Data were analyzed using Tukey's test in R software (version 4.4.0).The results showed a highly significant difference ($p = 0.0044$) in body weight during the starter phase (1–3 weeks) between the control (T0) and the treatment groups (T1 and T2). A significant difference ($p < 0.05$) was also observed between T1 and T0, and this positive trend persisted throughout the experiment. At the end of the 20-week trial, final body weights of the hens differed significantly among treatments ($p = 0.00009$). Specifically, hens in the 2% group (T2) reached a laying weight of 1484.76 ± 135.75 g, with an average egg weight of 27.50 ± 0.50 g at week 18. In the 1% group (T1), the weight at the onset of laying was 1249.12 ± 113.73 g, with an egg weight of 25.00 g, whereas control hens (T0) weighed 1280.30 ± 149.57 g at week 19, producing eggs averaging 27.33 ± 1.76 g. These findings suggest that bovine colostrum can serve as a beneficial dietary supplement for poultry, enhancing both productive and reproductive performance (egg laying) while reducing early mortality.
Keywords: Goliath chicken, bovine colostrum, growth performance, egg production, mortality, Niamey–Niger--

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I. Background

Colostrum is the first milk produced by mammals after giving birth. This biological product plays a fundamental role in the health and development of calves, far beyond its function of providing passive immunity. In addition to the immunoglobulins it provides to protect newborns against environmental pathogens (Hammon et al., 2013 ; Lopez and Heinrichs, 2022), it is particularly rich in essential nutrients and antimicrobial factors such as lactoferrin, immunoglobulin, lactoperoxidase, etc., as well as vitamins that promote the development of the immune system. It is particularly rich in essential nutrients and antimicrobial factors, such as lactoferrin, immunoglobulin, lactoperoxidase, etc., and vitamins that promote the development and proper functioning of the intestine (Cabrera et al., 2013; Nili et al., 2013; McGrath et al. 2016; Agbokounou et al., 2017). These specific components, such as cytokines, lactoferrins, and hormones, contribute to the maturation of the intestinal mucosa, improved nutrient absorption, and the establishment of a balanced intestinal microbiota (Hammon et al., 2013). This bioproduct plays a decisive role during the first 15 days of life, particularly in sensitive neonatal species such as piglets and kids (Godhina and Patel, 2013; Nili et al., 2013; Bandrick et al., 2014; Abdou et al., 2014; Rathe et al., 2014, and Hammon et al., 2020). According to these authors, the administration of bovine colostrum is a key phase in ensuring optimal growth, improved immune resilience, and a considerable reduction in digestive disorders in young mammals. The physicochemical composition and biological functions of colostrum are not identical to those of mature milk. This difference is mainly due to the high content of immunoglobulins, growth factors, and other essential nutrients in colostrum, which are present in higher quantities than in milk. The transition from colostrum to mature milk is therefore a

crucial dietary change that can influence the health status of young mammals, particularly calves (Fahey et al. 2020). According to Fahey et al. (2020) and Ilke (2023), an unbalanced intake of colostrum can compromise the immune development and health of newborns. In monogastric animals, particularly poultry, although they do not receive colostrum naturally, several studies (Y de Vries et al., 2018; Parapary et al. 2021; Arjomand et al. 2021) have shown that exogenous colostrum supplementation in their diet regulates heat stress and improves growth and production performance. This bioproduct is readily available from dairy cows, which produce sufficient surpluses to cover the needs of calves (Afzal et al. 2018). Dietary supplementation with up to 2% colostrum has shown positive effects on the productive and health performance of chickens, with no adverse effects on their overall health (Zhang et al., 2016; Del Puerto et al., 2017; Afzal et al., 2018 and Parapary et al., 2020). This is why we focused this study on testing the effect of bovine colostrum on zootechnical parameters and the age at which Goliath chickens in Niger start laying eggs.

II. MaterialAnd Methods

Study area

The study was conducted from January 1 to May 30, 2025, at the experimental station of the Faculty of Agronomy, Abdou Moumouni University of Niamey, Niger. The site is located in the fifth municipal district of Niamey, between latitudes 13°28′ and 13°35′ N and longitudes 2°03′ and 2°10′ E (INS-Niger, 2018; 2022). The district covers approximately 40 km². Ambient temperatures range from 15 °C in December–January to 45 °C between March and June.

Biological material

The research protocol was approved by the Animal Feed and Nutrition Laboratory (LANA) of the Faculty of Agronomy, University of Niamey. A total of 180 day-old Goliath chicks were used for the trial. Colostrum supplementation was administered during the first 21 days of life. The control group received a basal diet without colostrum (T0: 0%), while two treatment groups received diets supplemented with 1% (T1) and 2% (T2) bovine colostrum. Specifically, 10 g (1%) or 20 g (2%) of colostrum were added per kilogram of feed.All birds were vaccinated against Newcastle disease, Gumboro disease, and infectious bronchitis on days 7, 10, and 13, with booster doses administered on days 21, 24, and 27, following the standard poultry vaccination schedule used in Niger.

Data Collection and Statistical Analysis.

Data were recorded and processed using Microsoft Excel. Statistical analyses were conducted using two-way ANOVA in R software (version 4.4.0). When significant differences were detected among treatments, Tukey's post-hoc test was applied to compare means at the 5% significance level.

III. Results

Changes in live weight of chickens

Overall, the live body weight of Goliath chickens increased progressively across all treatment groups from week 1 to week 20. The initial mean body weight was statistically identical among the three groups, confirming a uniform baseline distribution ($P = 1.00$). However, a highly significant difference ($P = 0.0044$) was observed during the starter phase (weeks 1–3) between the control group (T0) and the group supplemented with 2% bovine colostrum (T2). A significant difference ($P < 0.05$) was also recorded between T1 and T0. This growth advantage in the colostrum-fed groups persisted throughout the experimental period, showing a clear dose-dependent trend (T2 > T1 > T0) (Table 1). By week 20, although the T2 group maintained higher average weights, the differences among treatments were no longer statistically significant ($P > 0.05$). This pattern suggests that bovine colostrum exerts its greatest influence during the early growth phases, after which the growth rates of all groups tend to converge.

Table 1: Table 1. Effect of bovine colostrum supplementation on live body weight (g) of Goliath chickens from week 1 to week 20

Age (in week)	T0 (0% of colostrum)	T1 (1% of colostrum)	T2 (2% of colostrum)	P-value
Pi	32.9±3,69	32.9±4.34	32.9±3.32	1.00
1-3	132.02± 28.18**	146.94±33.22**	165.51±33.31***	0.0044481
4-12	745.88 ±107.85*	766.90±114.71*	931.50±128.53***	0.0001
13-20	1454.21±245.78***	1606,33±358.14*	1703.33±214.93*	0.008

Values marked with *** indicate a highly significant difference, values marked with ** indicate a significant difference, and values marked with * indicate no statistically significant difference.
Pi: initial body weight.

Effect of bovine colostrum on average daily gain (ADG) and feed conversion ratio (FCR)

The zootechnical performance of chicks supplemented with different levels of bovine colostrum (0%, 1%, and 2%) showed clear differences compared to the control group. During the starter phase (weeks 1–3), chicks in the 2% colostrum group (T2) achieved a highly significant increase in ADG (P = 0.002911) compared with both the control (T0) and the 1% group (T1). By the end of the trial, the 1% group (T1) recorded the highest ADG, averaging 13.65 ± 5.77 g/day per chick, which was statistically significant relative to the control. Feed conversion ratio (FCR) was similar among the colostrum-supplemented groups throughout the study. The control group exhibited a slightly lower FCR (6.93 ± 1.88), but the differences between groups were not statistically significant (P > 0.05) (Table 2). Overall, these results suggest that bovine colostrum supplementation improves growth performance in Goliath chickens, particularly during the early stages of development, while feed efficiency remains largely unaffected.

Table 2 : Effect of bovine colostrum on ADG and IC in g/rearing phase

Zootechnical parameters	Week	T0 (0% of colostrum)	T1 (1% ofcolostrum)	T2 (2% ofcolostrum)	P-value
ADG	1-3	4.71± 1.26**	5.43± 1.50**	6.31± 1.56***	0.002911
	5-12	9.10 ± 1.43*	9.20 ± 1.77*	12.15± 2.00***	0.001
	13-20	11.14± 2.86*	13.65± 5.77***	11.99 ± 4.05*	0.0059785
Indice de Consommation	1-3	1,96± 0,55***	1,74± 0,49**	1,51± 0,41**	0,0000053
	5-12	4,02 ± 0,68***	4,65 ± 0,78***	3,49 ± 0,53***	0,0001054
	13-20	6,93 ± 1,88*	7,04± 2,19*	7,77 ± 3,13*	0,21

Note: *: no significant difference; **: significant difference; ***: highly significant.

Effect of bovine colostrum on feed intake

Throughout the trial, from the starter phase to the end of the growth period, feed intake was generally similar among the three groups. Feed consumption increased gradually with age in all treatments. By the end of the experiment, chickens in the 2% colostrum group (T2) exhibited the highest average feed intake (85.30 g per bird per day), followed by the 1% group (T1) and the control group (T0) (Figure 3). These results indicate that bovine colostrum supplementation did not adversely affect feed intake, and the slight increase observed in the treated groups may reflect improved growth potential and appetite.

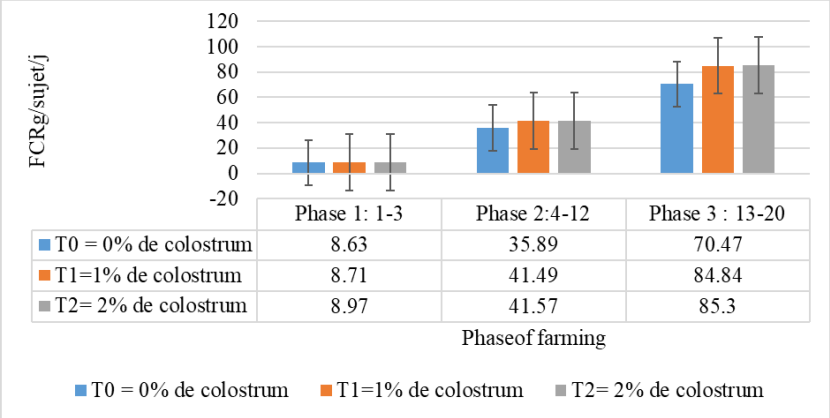

Figure 3: Effect of bovine colostrum on CA by rearing phase in g

Mortality rate

The mortality results are presented in Table 3. Across all age stages, mortality decreased as the level of colostrum supplementation increased. The 2% colostrum group (T2) consistently showed the lowest mortality, with a total rate of 4.99%, compared to 11.66% for the 1% group (T1) and 18.29% for the control group (T0) (Table 3). These findings indicate that dietary supplementation with bovine colostrum effectively reduces early mortality in Goliath chickens, highlighting its potential role in improving flock survival during the critical early stages of growth.

Table3 : Mortality rate

Age (Week)	T_0(0% ofcolostrum)	T_1(1% of colostrum)	T_2(2% of colostrum)	Total
0-3	8.33	5	3.33	16.66
3-12	6.66	3.33	1.66	11.65
12-20	3.33	3.33	0.00	6.66

Age at first lay and egg weight

Table 4 presents the changes in hen body weight at the onset of laying (weeks 18–20) and the corresponding egg weights according to the level of colostrum supplementation. Hen body weight increased gradually with age across all treatments. A highly significant difference (P = 0.00009) was observed between the 2% colostrum group (T2) and the other groups, while no significant difference was detected between the control (T0) and 1% (T1) groups. Hens in the 2% group consistently showed the highest body weight at the start of laying, followed by the 1% group, with the control group recording the lowest values. Egg weight also increased with age, but no statistically significant differences were observed among the treatments (P > 0.05). Nevertheless, eggs from the 2% group were numerically heavier, followed by those from the 1% and control groups.

Table 4. Age at start of laying, body weight of hens, and egg weight (g) according to colostrum supplementation

Age en semaine	**T_0 (0% of colostrum)**	**T_1 (1% of colostrum)**	**T_2 (2% of colostrum)**	**P-value**
18	1211.80±153.63*	1249.118±113.73*	1484.76±135.75***	0.001
19	1280.30±149.57*	1328.70 ±135.05*	1559.23±153.26***	0.001
20	1348.16±150.27*	1427.03±188.24*	1628.33±176.24***	0.0001
Effectif	29	34	39	
Egg weight				
18	0	25	27.50±0.5	0.212
19	27.33 ± 1.76	32.40±2.20	28.50±1.83	0.252
20	3.16±1.07	32.42±2.36	36.11±2.11	0.267

*pas de différence significative entre ces valeurs, *** : la différence est hautement significative.

IV. Discussion :

In this study, the initial body weight of the chicks was uniform across the three groups (P = 1.00), confirming a balanced distribution at the start, consistent with the observations of Afzal et al. (2018). During the starter phase (weeks 1–3), a highly significant difference (P = 0.003) was observed between the control group (T0) and the colostrum-supplemented groups (T1 and T2). This difference persisted until week 4, following a dose-dependent pattern (T2 > T1 > T0). These results align with those of Parapary et al. (2021), who reported significant variations in weight among Ross-308 chicks receiving different levels of bovine colostrum during the first 10 days (0%: 143.13 g; 0.5%: 147.05 g; 1%: 150.38 g; 1.5%: 152.84 g; 2%: 146.82 g). Beyond the first four weeks, differences were no longer statistically significant, although the 2% group maintained higher average weights throughout weeks 4–20. This contrasts slightly with Parapary et al. (2021), who observed optimal weight gain with 1.5% colostrum supplementation.

Bovine colostrum gradually enhances body weight gain due to its richness in essential nutrients, growth factors, and bioactive compounds. The results of this study differ from those of Arjomand et al. (2022), who reported no significant weight differences among Ross-308 chicks during the first ten days of life. In the present study, supplementation with 2% colostrum positively influenced feed intake and average daily gain in Goliath chickens. This improvement is likely attributable to the high content of essential nutrients, immunoglobulins, and growth-promoting factors in colostrum, which enhance digestion, nutrient utilization, and overall growth. The close relationship between feed intake and average daily gain can be explained by the higher energy and protein intake in supplemented birds, directly contributing to increased body weight.

These findings demonstrate that including up to 2% bovine colostrum in the diet not only promotes growth but also improves nutrient utilization, making it an effective nutritional additive for enhancing performance in Goliath chickens. These results are consistent with Bayril et al. (2017), Mokhtarzadeh et al. (2022), and Mokhtarian et al. (2023), who reported positive effects of colostrum on growth performance in Japanese quails. Similarly, Hamani et al. (2022) showed that replacing 50% of fish meal with maggots improved feed intake and average daily gain in local chickens in Niger, highlighting the value of functional feed alternatives for optimizing zootechnical performance.

The feed conversion ratio (FCR), reflecting feed efficiency, was improved in birds receiving 2% colostrum, followed by 1% and 0%. Lower FCR values indicate better feed utilization for weight gain. These results align with Mokhtarian et al. (2023), who observed significant reductions in FCR in Japanese quails fed colostrum supplements. Mortality rates also decreased in the treated groups, particularly during the early weeks, likely due to the immunostimulatory effects of colostrum, which strengthens chicks' natural defenses. These findings support previous reports by Afzal et al. (2017), Mokhtarzadeh et al. (2022), and Arjomand et al. (2022), emphasizing the role of bovine colostrum in enhancing survival during critical early life stages.

Although the experiment focused primarily on the growth phase, early improvements in body uniformity and vitality in colostrum-supplemented birds may have positively influenced early laying performance. Previous studies in quails (Bayril et al., 2017; Mokhtarzadeh et al., 2022) have shown that early nutritional benefits can affect long-term reproductive performance, including egg quality and laying rate. In this

study, hens receiving 2% and 1% colostrum produced numerically heavier eggs than the control group, likely reflecting better overall physiological condition. This observation aligns with Tougan et al. (2019), who reported heavier eggs in hens raised with growth-promoting supplements compared to controls.

V. Conclusion :

In summary, dietary supplementation with bovine colostrum had a significant effect on body weight during the first weeks of life, with the 2% treatment showing the greatest improvement, followed by 1% and 0%. Colostrum also enhanced average daily gain, feed intake, and feed conversion efficiency, particularly in birds receiving 2% supplementation, indicating better palatability and more efficient feed utilization. Although no statistically significant differences were observed in egg weight, hens supplemented with 2% colostrum showed numerically higher body weight and egg production, as well as reduced early mortality. These findings suggest that bovine colostrum can be an effective nutritional strategy to improve growth performance and early reproductive potential in Goliath chickens. Further research is recommended to investigate the long-term effects of colostrum supplementation on production efficiency and reproductive performance.

Abbreviations :
ADG – Average Daily Gain
FCR – Feed Conversion Ratio
T0 – Treatment 0 (0% colostrum)
T1 – Treatment 1 (1% colostrum)
T2 – Treatment 2 (2% colostrum)

Conflict of Interest
The authors declare that there are no conflicts of interest.

Authors' contributions

HA designed and planned the study. SHA and HHA collected the data and drafted the first version of the manuscript. SHA and HA revised all versions of the manuscript. J-LH coordinated and revised the initial draft. SHA and AGT performed the statistical analyses and revised the first draft. HI, BKH, and HM revised the first draft of the manuscript. HA coordinated the work from study design to the revision of the final manuscript.

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Références Bibliographiques

[1]. Abdou, H., Marichatou, H., Beckers, J-F., Dufrasne, I., &Hornick, J-L. (2014). Chemical Composition Of Colostrum From Azawak Cow In Niger Compared With Meta-Analytical Data Animal Genetic Resources. © Food AndAgriculture Organization Of The United Nations. 1-7. DOI: 10.1017/S2078633614000241.
[2]. Afzal, I., Khan A. A., Banday, M. T., Manzoor, A., Untoo, M., Khurshid, A., Bashir, S. U., &Rovida, M. (2018). Effect Of Incorporation Of Bovine Colostrum In Broiler Chicken Diets On Body Weight, Mortality Pattern And Economics Of Production. Journal Of EntomologyAnd Zoology. Studies. 6 (2), 711-714p.
[3]. Agbokounou, A. M., Serge Ahounou, S. G., Bengaly, Z., Abdou Karim, I. Y., Mensah, G. A., Koutinhouin, B., Hornick, J-L. (2017). Physiologie De L'immunité Colostrale Chez Les Porcins Et Facteurs De Variation Du Rendement Et De La Qualité Immunitaire Du Colostrum De La Truie. International JournalOf Biology And Chemical . Sciences. 11(1): 420-443p. DOI : Http://Dx.Doi.Org/10.4314/Ijbcs.V11i1.34.
[4]. Arjomand, M., Nobakht, A., &Mehmannavaz, Y. (2022). Effects Of Different Forms Of Cattle Colostrum For Broiler Chickens. Iran. J. Appl. Anim. Sci. In Press.
[5]. Bandrick, M., Ariza-Nieto, C., Baidoo, S. K &Molitor, T. W. (2014). Colostral Antibody Mediated And Cell-Mediated Immunity Contributes To Innate And Antigen Specific Immunity In Piglets.Developmental And Comparative Immunology. 43(1): 114-120. DOI:10.1016/J.Dci.2013.11.005
[6]. Boudry, C. (2009). Biological And Immune Effects Of Bovine Colostrum On Piglets At Weaning. Doctoral Thesis, University Faculty OfAgricultural Sciences Of Gembloux, Gembloux, 141p.
[7]. Cabrera, R., Lin, X., Ashwell, M., Moeser, A., &Odle, J. (2013). Early Postnatal Kinetics Of Colostral Immunoglobulin G Absorption In Fed And Fasted Piglets And Developmental Expression Of The Intestinal Immunoglobulin G Receptor. Journal OfAnimal Science. 91(1): 211-218. DOI: 10.2527/Jas.2011-4426.
[8]. Del Puerto, M., Cabrera, M.C., &Saadoun, A. (2017). A Note On Fatty Acids Profile Of Meat From Broiler Chickens Supplemented With Inorganic Or Organic Selenium. International Journal Of Food Science, 7613069, 8p. Doi: 10.1155/2017/7613069
[9]. Parapary M. H. G., Nobakh, A., &Mehmannavaz, Y. (2021). The Effect Of Colostrum Powder Supplementation On Performance, Intestinal Morphology, Blood Biochemical Parameters, Immunity And Antioxidant Status Of Broilers. Iran. J. Appl. Anim. Sci. 2021, 11, 809-816.
[10]. National Institute Of Statistics (INS). (2018). Statistical Yearbook OfNiger, 2013-2017. 260p
[11]. National Institute Of Statistics (INS). 2022. Survey On The Population Projection Of Niamey By Municipal District. 6p.

[12]. Lopez, A. J., & ,Heinrichs, A. J. (2022). Invited Review: The Importance Of Colostrum In Newborn Dairy Calf. J. Dairy Sci. 105:2733-49.
[13]. Mcgrath, B. A, Fox, P. F, Mcsweeney, P.L.H., &Kelly, A.L. (2016). Composition And Properties Of Bovine Colostrum: A Review. Dairy Sci. Technol. 96:133-58.
[14]. Nili M., Ben Mohamed C Et Bouameur N., (2013). Caracterisation Physico-Chimique Du Colostrum Camelin (Camelus Dromedarius). Revue Des Bioressources, Vol, 3. 35-41p.
[15]. Parapary, M. H. G., Nobakht, A., &Mehmannavaz, Y. (2020). Co-Supplementation Of Colostrum Powder On Performance, Intestinal Morphology, Blood Biochemical Parameters And Antioxidant Status Of Broilers In Heat Stress. Semina: Ciências Agrárias, Londrina, V. 41, N°6, Suplemento 2, 3419-3428p. DOI: 10.5433/1679-0359.2020v41n6Supl2p3419.
[16]. Y De Vries, J., Pundir, S., Mckenzie E., Keijer, J., &Kussmann M. (2018). Maternal Circulating Vitamin Status And Colostrum Vitamin Composition In Healthy Lactating Women A Systematic Approach. Nutrients, 10(6), 687. Doi: 10.3390/Nu10060687.
[17]. Zhang, L., Zeng, X., Zhou, L., Cao, G., &Yang, C. (2016). Effects Of Dietary Supplementation Of Probiotic, Clostridium Butyricum, On Growth Performance, Immune Response, Intestinal Barrier Function, And Digestive Enzyme Activity In Broiler Chickens Challenged With Escherichia Coli K88. Journal Of Animal Science And Biotechnology, 7(1), 3. Doi : 10.1186/S40104-016-0061-4.
[18]. Tougan, UP., Yayi-Ladekan, E., Alassani A. M., Adanlin, P. M., Koutinhouin, B. G., &Soumanou, M. M. (2019). Influence Du Promoteur De Croissance 'DI Grow' Vert Sur Les Caractéristiques Physico-Chimiques Et Nutritionnelles Des Œufs De Poules Lohman Brown Elevées A Sokode. International Journal Of Progressive Sciences And Technologies.Vol 17, Numero 1. 9p.