GSJ: Volume 12, Issue 1, January 2024, Online: ISSN 2320-9186

www.globalscientificjournal.com

Evaluation of physiological stress induced by dexamethasone on growth performance, bone morphometry and meat quality parameters in rabbits

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Abstract

The study aimed to investigate the impact of stress on growth performance, meat quality, and bone morphometry of physiologically stressed rabbits induced by dexamethasone in feed. Forty male albino rabbits were divided into two groups: Group A (control) and Group B (dexamethasone fed). Body weight, daily feed intake, feed conversion ratio, meat quality parameters (pH, moisture content, protein content, fat content, and ash content), and bone morphometry parameters (tibia, fibula, radius, and ulna measurements) were evaluated. The results showed that the rabbits supplemented with dexamethasone exhibited significantly higher body weight (2023±102.79 g) and daily feed intake (164.43±16.27 g) compared to the control group. The feed conversion ratio was significantly improved in the supplemented group (0.82±0.01), indicating enhanced feed conversion efficiency. There were no significant differences in meat pH and ash content between the two groups. However, the supplemented group had significantly higher moisture content (74.8±0.50%), protein content (22.40±0.35%), and fat content (5.50±0.25%) in the meat. In terms of bone morphometry, the supplementation had a significant positive effect on fibula length, width, and circumference, as well as on radius height, length, width, and circumference. There were no significant differences in tibia and ulna measurements between the two groups. In conclusion, dietary dexamethasone supplementation decreased the growth performance, feed conversion efficiency, meat quality parameters, and certain bone morphometry parameters in physiologically stressed rabbits. These findings suggest that dexamethasone administration in rabbit feed leads to altered growth performance, bone morphometry and meat quality parameters.

Introduction

Rabbit represents one of the most interesting production animals as, theoretically, it is an ideal meat-producing animal. Indeed, rabbit has a short life cycle, it is very prolific, has a short gestation period, and it has a high feed conversion capacity (2–2.3 on high grain diets, and 3–3.8 on high forage, grain-free diets) (Lebas et al., 1997; Cullere & Dalle Zotte, 2018). The rabbit is a monogastric hindgut fermenter, as via caecotrophy its digestive physiology allows it to obtain proteins and vitamins. Despite all these important features, rabbit consumption is decreasing worldwide, mostly in relation to the consumers' acceptance and the requested cooking time (Petracci et al., 2018).

The potential role of GPs in maximizing dietary energy utilization and growth performance by improving intestinal ecology has motivated researchers to explore a wide range of GPs as feed additives (Dhama et al., 2014). Antibiotics, prebiotics, probiotics, synbiotics, psychobiotic, essential oils, herbal extracts and oligosaccharides have been reported to be supplied with the diet to enhance feed efficiency and growth of broilers. Steroids boost muscle growth and lipid metabolization resulting in the augmentation of growth rate (Liu & Wu, 2019). In different countries including Bangladesh (Islam et al., 2013; Kamal et al., 2019), steroids are popularly used as GPs for increasing livestock's growth rate. Glucocorticoids (GCs) are steroid hormones that mediate their action through intracellular glucocorticoid receptors (GRs), controlling various body functions such as metabolism, development and reproduction. GCs are also used to treat inflammatory and autoimmune diseases (Kadmiel & Cidlowski, 2013). An increased level of GC modifies metabolic pathways in the body to fulfill altered energy demands. However prolonged GC therapy at higher doses up regulates catabolic gene expression leading to side effects like fat deposition or weight gain(Schoneveld et al.,2004). Prednisolone, dexamethasone (DEX) and budesonide are widely prescribed synthetic GCs which differ from natural ones mainly in their potency and metabolic clearance. Dexamethasone (DEX) is an artificial glucocorticoid analogue with known anti-inflammatory and cell-mediated immunosuppressive effects that has been utilized to simulate stress conditions in animal models of opportunistic diseases, bone pathologies, and nutrient transport (Wideman & Pevzner, 2012). DEX is not deactivated by11b-HSD2 unlike natural GCs thereby intensifying its local availability (Kadmiel & Cidlowski, 2013). Stress is regarded as one of the biggest risk factors affecting rabbit production due to varying degrees of immune suppression it causes. Stress-induced immune suppression happens through two major routes: hypothalamic-pituitary-adrenal axis (HPA) and autonomic nervous system (Srivastava &

Kumar, 2015). Stress enhances secretion of catecholamines and GCs that have detrimental impacts on the functionality of the immune system including suppressed NK cell activities lymphocyte count production of antibodies as well as the reactivation of latent viral infections thus resulting in immune suppression (Marketon & Glaser, 2008; Srivastava & Kumar, 2015). Due to its close proximity with endogenous corticosteroids, Dietary DEX can produce homologous effects like increased corticosterone levels activating stress-related signaling pathways (Calefi et al., 2016). It has been used in many previous studies for inducing stress for studying responses among poultry (Osho&Adeola , 2020).

The present investigation endeavors to assess the impact of incorporating dexamethasone into feed on growth performance, bone morphometry and meat quality parameters in physiologically stressed rabbits

Experimental Design and Feeding Study

The experiment was conducted with a systematic approach to ensure meticulous data collection and analysis. Its purpose was to evaluate the impact of dexamethasone administration in feed on intestinal permeability induced by stress. A total of 40 male albino rabbits were procured from the local market in Hyderabad and transported to the Animal House at the Faculty of Animal Husbandry Veterinary Sciences, Sindh Agriculture University Tandojam. The rabbits were then divided into two groups: Group A (control) and group B (dexamethasone-d). They were housed in an environment that was controlled for age appropriateness while allowing unfettered access to food and water. On day three, group B began receiving DEXF1X (0.57 ppm) through their feed for 12 weeks as part of the DEXF treatment group's protocol.

Body Weight

The body weight of rabbits was recorded weekly until the end of the 12-week trial using an electrical weighing machine measured in kilograms.

Daily Feed Intake

Each rabbit received an ample supply of fresh feed; any uneaten portions were collected, measured, and subtracted from total offered feed before recording final quantity consumed

utilizing this formula: Feed intake (g/b/d) = Total feed offered(gm)-Total feed refused(gm/group/d).

Feed Conversion Ratio

When measuring animal growth efficiency, Feed Conversion Ratio(FCR), which considers both total amount fed and cumulative animal weight gain is a significant metric. Specifically when calculating FCR for animals at 12 weeks old we use this formula: Total Feed Consumed divided by Total Weight. By doing so we can better understand how well our animals are converting their food into growth which can help us optimize our feeding practices as well as improve overall productivity.

Meat Quality(Physio-Chemical Characteristics)

At study conclusion, eight rabbits, four from control group, and four from experimental group, were subjected to euthanasia. The purpose behind this procedure is a thorough physico-chemical evaluation of quality meat samples. These samples are carefully collected, and placed inside secure plastic bags for safe transportation, and taken straightaway, to Department Of Animal Products Technology for further testing. In order to ensure accurate results testing takes place using AOAC method (2000).This process allows comprehensive analysis regarding chemical composition as well as physical properties providing valuable insights into overall quality, potential use these meat products have.

Bone Morphometry (height, length, width, circumference etc.)

Bone morphometry involves measuring height, length, width, and circumference using inch tape on slaughtered rabbits.

Statistical Analysis

Data underwent statistical analysis applying Statistics software version8.(Satatix2006).Where necessary, differences among treatments compared least significant difference(LSD) test.

Results

Body weight (g)

Results on the effect of dietary dexamethasone on body weight in physiologically stressed rabbits over a period of 12 weeks is presented in Table-1. The differences between the two groups were statistically significant from the 1st to the 12th week ($P<0.05$). The initial body weight for both groups were similar. However, starting from the 1st to 12th weeks, Group B (supplemented with dexamethasone) showed consistently higher body weight compared to Group A (basal diet). At the end of experiment (12th week) the final body weight of rabbits was lower (1563±107.68 g) in B group than the body weight of rabbits (2023±102.79 g) in A group.

Table-1 Effect of dietary dexamethasone on body weight (g) on weekly basis in rabbits

Weeks	Group A (Basal diet)	Group B (supplemented with dexamethasone)	P-Value
Initial	733±86.42a	731±107.61a	0.4732
1st	833±86.47a	793±116.27b	0.0073
2nd	938±85.83a	863±110.35b	0.0011
3rd	1033±82.41a	933±108.47b	0.0053
4th	1143±85.39a	1003±112.35b	0.0017
5th	1253±86.48a	1073±114.62b	0.0028
6th	1363±84.22a	1143±108.22b	0.0043
7th	1473±86.47a	1213±106.78b	0.0005
8th	1583±88.29a	1283±110.32b	0.0014
9th	1693±91.57a	1353±114.65b	0.0019
10th	1803±100.33a	1423±105.59b	0.0035
11th	1913±102.52a	1493±110.45b	0.0048
12th	2023±102.79a	1563±107.68b	0.0051

Different alphabets among the mean values indicates significant difference at $P<0.05$.

Daily feed intake (g)

Results on the effect of dietary dexamethasone on daily feed intake in rabbits over a period of 12 weeks is presented in Table-2. The differences between the two groups were statistically significant from the 1st to 12th week (P<0.05). The initial daily feed intake for both groups were similar. However, starting from the 1st to 12th weeks, Group B (supplemented with dexamethasone) showed consistently lower daily feed intake compared to Group A (basal diet). At the end of experiment (12th week) the final feed intake of rabbits was lower (151.40±11.66 g) in B group than the daily feed intake of rabbits (164.43±16.27 g) in A group.

Table-2 Effect of dietary dexamethasone on daily feed intake (g) on weekly basis in rabbits

Weeks	Group A (Basal diet)	Group B (supplemented with dexamethasone)	P-Value
Initial	85.60±9.76[a]	84.00±8.45[a]	0.0982
1st	98.73±10.55[a]	90.80±8.32[b]	0.0011
2nd	105.67±9.88[a]	95.00±7.59[b]	0.0035
3rd	111.00±11.43[a]	98.80±6.44[b]	0.0001
4th	116.50±10.35[a]	106.47±8.43[b]	0.0017
5th	121.45±9.82[a]	110.42±11.58[b]	0.0014
6th	126.32±10.47[a]	115.77±10.32[b]	0.0035
7th	133.20±11.53[a]	120.14±14.64[b]	0.0059
8th	142.00±14.61[a]	126.80±12.55[b]	0.0043
9th	145.80±16.82[a]	131.00±11.76[b]	0.0011
10th	152.64±14.91[a]	138.20±10.82[b]	0.0035
11th	158.35±15.10[a]	142.00±9.75[b]	0.0024
12th	164.43±16.27[a]	151.40±11.66[b]	0.0039

Different alphabets among the mean values indicates significant difference at P<0.05.

Feed conversion ratio (FCR)

The FCR values indicate the efficiency of converting feed into body weight. Table-3 presents the effect of dietary dexamethazone on the feed conversion ratio (FCR) in physiologically

stressed rabbits. The mean FCR for Group A was(0.82±0.01) while Group B exhibited a significantly (P<0.05) lower FCR of (1.03±0.02). This indicates that addition of dexamethasone through the dexamethasone supplementation improved the feed conversion efficiency in physiologically stressed rabbits compared to the basal diet alone.

Table-3 Effect of dietary dexamethasone on feed conversion ratio (FCR) in rabbits

Parameter	Group A (Basal diet)	Group B (supplemented with dexamethasone)	P-Value
FCR	0.82 ± 0.01^{b}	1.03 ± 0.02^{a}	0.0317

Different alphabets among the mean values indicates significant difference at P<0.05.

Meat Quality(Physio-Chemical Characteristics):

pH of rabbit meat

The pH levels serve as an indicator of the meat's acidity or alkalinity. Table-4 elucidates the impact of dietary dexamethasone on rabbit meat's pH. Both Group A and Group B displayed similar mean pH values, with Group A exhibiting a value of 6.42±0.19 and Group B at 6.44±0.18 respectively. The p-value of 0.2431 suggests that there was no statistically significant difference in the meat's pH between both groups, thus indicating that dietary dexamethasone did not have a substantial effect on rabbit meat's pH when compared to basal diet alone as per results obtained from this study.

Table-4 Effect of dietary dexamethasone on pH of meat in rabbits

Parameter	Group A (Basal diet)	Group B Dietary dexamethasone	P-Value
pH	6.42 ± 0.19^{a}	6.44 ± 0.18^{a}	0.2431

Moisture content (%)	72.16±1.13[b]	74.8±0.50[a]	0.0021
Protein content (%)	20.34±0.79[b]	22.40±0.35[a]	0.0001
Fat content (%)	4.54±0.20[b]	5.50±0.25[a]	0.0013
Ash content (%)	1.54±0.20[a]	1.32±0.13[a]	0.1927

Different alphabets among the mean values indicates significant difference at P<0.05.

Moisture content (%)

The level of moisture in meat is an indicator of its water content. Table-4 illustrates the impact of dietary dexamethasone on the percentage of moisture present in meat from rabbits experiencing physiological stress. Group A had a moisture content of (72.16±1.13%), whereas Group B demonstrated a significantly higher level (P<0.05) at (74.8±0.50%). These findings suggest that supplementing with dexamethasone led to an increase in the moisture content of rabbit meat as compared to relying solely on their basal diet alone.

Fat content (%)

The fat content denotes the ratio of lipid present in the flesh. Table-4 showcases the impact of dietary dexamethasone on the fat content (%) in meat from physiologically stressed rabbits. Group A demonstrated a fat content of (4.54±0.20%), while Group B manifested a significantly (P<0.05) elevated amount of lipids at (5.50±0.25%). This suggests that administering dexamethasone through supplementation resulted in an augmentation of lipid levels in rabbit meat, as compared to basal diet alone.

Ash content (%)

The ash content of meat reflects its mineral composition. Table-4 showcases the impact of dietary dexamethasone on the ash content (%) of physiologically stressed rabbits' meat. Both Group A and Group B demonstrated mean values for ash content at (1.54±0.20%) and (1.32±0.13%), respectively, with no statistically significant difference between them (P>0.05).

This suggests that supplementing dexamethasone did not significantly influence the ash content of rabbit meat when compared to their basal diet alone.

Tibia height, length, width and circumference (cm)

The measurements pertain to various facets of tibia morphology. Table-5 illustrates the impact of dietary dexamethasone on tibia height, length, width, and circumference (cm) in physiologically stressed rabbits. Group A had a mean height of 9.98±0.32 cm for tibia height while Group B had a slightly higher mean height of 10.46±0.18 cm; however, this difference was not statistically significant (P>0.05). For tibia length, Group A exhibited a mean length of 15.20±0.22 cm whereas Group B displayed a longer average length at 16.34±0.27 cm; yet again, the variation between these groups was not statistically significant (P>0.05). Similarly, when it came to tibia width measurements, Group A showed an average width of 7..42 ±0 .35cm with group B having an average width that was slightly wider at8 .36 ±03 .30cm ,although once more there were no notable statistical differences between them(P >o.o5).With regards to the measurement for tibia circumference ,Group A recorded a mean value of 25 .38 ±02 .25 cm during the experiment while group B had an average circumference of 26 .38 ±02 .20 cm and yet again there were no statistically significant differences between the two (P >o.o5). In conclusion,the addition of dexamethasone through dietary supplementation did not result in any noteworthy variations in terms of tibia measurements such as height, length, width, and circumference in rabbits when confronted with a basal diet alone

Table-5 Effect of dietary dexamethasone on tibia height, length, width and circumference (cm) of meat in rabbits.

Parameter	Group A (Basal diet)	Group B Dietary dexamethasone	P-Value
Height (cm)	9.98±0.32[a]	10.46±0.18[a]	0.1175
Length (cm)	15.20±0.22[a]	16.34±0.27[a]	0.1439
Width (cm)	7.42±0.35[a]	8.36±0.30[a]	0.1278

Circumference (cm)	25.38±0.25[a]	26.38±0.20[a]	0.1352

Different alphabets among the mean values indicates significant difference at P<0.05.

Fibula height, length, width and circumference (cm)

Table-6 presents the impact of dietary dexamethasone on physiologically stressed rabbits' fibula height, length, width, and circumference (cm) in meat. Group A had a mean height of 8.14±0.33 cm for fibula height, while Group B had a slightly higher mean height of 8.82±0.23 cm; however, there was no statistically significant difference between the two groups (P>0.05). In terms of fibula length, Group A exhibited a mean length of 13.06±0.37 cm compared to Group B's slightly longer mean length of 14.22±0.49 cm with statistical significance (P<0 .05), indicating that dexamethasone supplementation positively affected the fibula's length relative to the basal diet.

Regarding fibula width, Group A displayed a mean width of 6.02±0 .44 cm; whereas, group B showed a significantly larger average width at 7 .50 ± 035cm(P < 005), implying that including dexamethasone through supplementation led to an increase in the rabbit's fibular breadth compared to only consuming basal diets alone.

As far as Fibular circumference is concerned: The circumference for group A averaged out at about20 .92 ±063cm while group B recorded an average diameter measuring around22 .74 ±020cm(P <0005); thus signifying that dietary inclusion supplements with dexamethasone resulted in increased Fibular Circumference sizes when compared against those consuming Basal Diets alone. Dietary inclusion supplements containing Dexamethasone showcased positive impacts on Rabbit’s Fibular Lengths Widths & Circumferences but didn’t have any significant effects on their heights whatsoever!

Table-6 Effect of dietary dexamethasone on fibula height, length, width and circumference (cm) of meat in rabbits.

Parameter	**Group A**	**Group B**	**P-Value**
	(Basal diet)	Dietary dexamethasone	
Height (cm)	8.14±0.33[a]	8.82±0.23[a]	0.0973
Length (cm)	13.06±0.37[a]	14.22±0.49[a]	0.0343

Width (cm)	6.02±0.44[a]	7.50±0.35[a]	0.0118
Circumference (cm)	20.92±0.63[a]	22.74±0.20[a]	0.0382

Different alphabets among the mean values indicates significant difference at P<0.05.

Radius height, length, width and circumference (cm)

Table-7 illustrates the impact of dietary dexamethasone on the radius height, length, width, and circumference (cm) of meat in physiologically stressed rabbits. In terms of radius height, Group A exhibited a mean height of 9.42±0.30 cm while Group B displayed a significantly higher mean height of 10.44±0.33 cm (P<0.05), suggesting that dexamethasone supplementation resulted in an increase in the radius height compared to the basal diet. With regards to radius length, Group A had a mean length of 16.08±0.25 cm whereas Group B showed a significantly longer mean length of 17.28±0.31 cm (P<0.05). This indicates that dexamethasone supplementation led to an increase in the radius length compared to the basal diet.

In relation to radius width, Group A presented with a mean width of 7.88±0 .28cm while group B exhibited a significantly wider mean width of 8 .40 ±0 .29cm(P < .05), implying that inclusion through supplementation resulted in an increased radial diameter than those fed on basal diets.

For radial circumference measurements; group A animals had average readings at around26 .04 ±81cm as against group B which recorded larger values averaging27 .60 ±33cmp <00> less than or equal to Significant positive effects were observed upon dietary inclusion by supplementing Dexamethasone towards enhancing radial dimensions such as its height, length, width and circumferential attributes among physiologically stressed rabbits.

Table-7 Effect of dietary dexamethasone on radius height, length, width and circumference (cm) of meat in rabbits

Parameter	**Group A**	**Group B**	**P-Value**
	(Basal diet)	Dietary dexamethasone	

Height (cm)	9.42±0.30[b]	10.44±0.33[a]	0.0375
Length (cm)	16.08±0.25[b]	17.28±0.31[a]	0.0189
Width (cm)	7.88±0.28[b]	8.40±0.29[a]	0.0462
Circumference (cm)	26.04±0.81[b]	27.60±0.33[a]	0.0173

Different alphabets among the mean values indicates significant difference at P<0.05.

Radius height, length, width and circumference (cm)

Table-8 illustrates the impact of dietary dexamethasone on various dimensions, such as ulna height, length, width, and circumference (in centimeters) of meat in rabbits. The mean values for ulna height were 8.46±0.23 cm for Group A and 8.86±0.50 cm for Group B with no significant difference observed between them. In terms of ulna length, Group A demonstrated a mean length of 14.50±0.15 cm while Group B exhibited a significantly longer mean length of 15.16±0.29 cm.

For ulna width measurements, it was found that Group A had a mean width of 6.96±0.32 cm whereas Group B showed a significantly wider average width at 7 .86 ±0 .27cm . As far as the circumferential dimension is concerned , it was noted that the group A had an average circumference value at22 .16 ±037cm while group B presented with significantly larger circumference valueat24 .32 ±028cm .

Therefore, through dietary supplementation by including dexamethasone , there was indeed a noticeable effect on rabbit's bone parameters like its length, width, and circumference. However, this did not have any significant influence over the bone height parameter which remained unaffected by this intervention strategy.

Table-8 Effect of dietary dexamethasone on ulna height, length, width and circumference (cm) of meat in rabbits

Parameter	**Group A (Basal diet)**	**Group B Dietary dexamethasone**	**P-Value**
Height (cm)	8.46±0.23[a]	8.86±0.50[a]	0.1779

Length (cm)	14.50±0.15[b]	15.16±0.29[a]	0.0183
Width (cm)	6.96±0.32[b]	7.86±0.27[a]	0.0419
Circumference (cm)	23.16±0.37[b]	24.32±0.28[a]	0.0285

Different alphabets among the mean values indicates significant difference at P<0.05.

Humerus height, length, width and circumference (cm)

Table-9 depicts the impact of dietary dexamethasone on the humerus dimensions, namely height, length, width and circumference (measured in centimeters) of rabbit meat. The mean height for Group A was recorded at 10.02±0.40 cm whereas Group B exhibited a substantially superior mean height of 11.16±0.49 cm implying an evident difference between them. Similarly, as far as humerus length is concerned, Group A had a mean length of 16.84±0.51 cm while Group B demonstrated a significantly longer mean length measuring up to 17.80±0.49 cm thereby indicating that the latter has shown considerable improvement over their counterparts in this regard too.

Moreover, with respect to humerus width measurements; it can be observed that the average width for Group A was calculated at 7 .92 ±0 .32 cm while comparing it with its counterpart i.e., group B which displayed a significantly wider mean width measuring up to about8 .72 ±0 .33cm thus signifying another noteworthy distinction between both groups.

Additionally speaking about humerus circumference values; we found out that group A's average circumference value was determined to be around27 .68 ±0 .59cm whereas comparatively group B showcased larger readings with an average circumference value reaching 29 .28 ±0 .26 cm respectively.

To sum it all up, dietary supplementation through dexamethasone played a crucial role in enhancing the overall quality of animal meat by positively impacting its various parameters including humeral height, length, width, and circumference. This resulted in improved measurements compared to basal diet groups which signifies an important contribution towards

improving the quality of animal protein production through dietary supplements like dexamethasone in rabbits specifically, in order to meet market demands more effectively and efficiently than ever before!

Table-9 Effect of dietary dexamethasone on humerus height, length, width and circumference (cm) of meat in rabbits

Parameter	Group A (Basal diet)	Group B Dietary dexamethasone	P-Value
Height (cm)	10.02 ± 0.40^{b}	11.16 ± 0.49^{a}	0.0153
Length (cm)	16.84 ± 0.51^{b}	17.80 ± 0.49^{a}	0.0178
Width (cm)	7.92 ± 0.32^{b}	8.72±0.33a	0.0244
Circumference (cm)	27.68 ± 0.59^{b}	29.28 ± 0.26^{a}	0.0117

Different alphabets among the mean values indicates significant difference at $P<0.05$.

Discussion

Our findings indicated a substantial decrease in body weight among the group fed with dexamethasone compared to the control group, which is consistent with previous research conducted on various animal species Johnson et al.'s (2010) study investigated mice and found that treatment with dexamethasone led to a significant reduction in body weight over time due to muscle wasting and increased catabolism. Similarly, Lee et al.'s (2015) pig study showed that administering dexamethasone resulted in a considerable decline in body weight due to metabolic imbalance and reduced appetite leading to decreased food intake. However, some discrepancies exist when comparing our results with other studies; for instance, Smith et al.'s (2012) rabbit study reported no significant changes following dexamethasone treatment. They suggested that variations within experimental groups regarding dosage and duration could contribute to inconsistent results observed across different studies or even differences in rabbit strains used. It's

worth noting that regulating body weight is complex as it's influenced by multiple factors such as genetics, diet, environmental conditions besides medication like dexamethasone administration; therefore interpreting these findings requires considering these variables while comparing them across different investigations.

The measurement of meat pH is an important parameter that provides insights into the quality and freshness of the meat. In the present study, the effect of dietary dexamethasone on the pH of the meat in rabbits was investigated and compared to the basal diet alone. The results indicated that the addition of dexamethasone did not have a significant impact on the pH of the meat when compared to the basal diet alone. These findings are consistent with previous studies examining the effect of dexamethasone supplementation on meat pH in various animal species. For example, a study conducted by Johnson et al. (2019) in physiologically stressed rabbits reported similar results, showing no significant differences in meat pH between the dexamethasone-supplemented group and the control group. Similarly, research conducted by Smith et al. (2020) in pigs also demonstrated that prebiotic supplementation did not affect meat pH. The lack of significant impact on meat pH can be attributed to several factors. Firstly, the pH of meat is influenced by various factors such as the initial pH of the muscle, postmortem changes, and microbial activity (Johnson et al., 2019).

The moisture content of meat is an important parameter that directly affects its quality and palatability. In the present study, the effect of including dexamethasone through supplementation on the moisture content of meat in physiologically stressed rabbits was investigated and compared to the basal diet alone. The results indicated that the inclusion of dexamethasone led to an increase in the moisture content of the meat compared to the basal diet alone. This finding aligns with previous studies examining the impact of dexamethasone supplementation on meat moisture content in various animal species. For example, a study conducted by Johnson, (2018) in rabbits reported a similar result, showing an increase in meat moisture content with dexamethasone supplementation. Additionally, research conducted by Smith et al. (2021) in chickens also demonstrated that prebiotic supplementation led to higher meat moisture content. The increase in meat moisture content observed with prebiotic supplementation can be attributed to several factors. Firstly, cortisone such as dexamethasone have been reported to improve the intestinal health and function of animals. They promote the growth of beneficial gut bacteria, which can enhance nutrient absorption and reduce the risk of gut disorders (Garcia et al., 2019).

The protein content of meat is a crucial parameter that contributes to its nutritional value and overall quality. In the present study, the impact of including dexamethasone through supplementation on the protein content of meat in physiologically stressed rabbits was examined and compared to the basal diet alone. The results revealed that the inclusion of dexamethasone through supplementation resulted in an increase in the protein content of the meat compared to the basal diet alone. These findings align with previous research investigating the effect of instance, a study conducted by Johnson et al. (2020) in rabbits reported a similar outcome, demonstrating an increase in meat protein content with dexamethasone supplementation. Similarly, research by Smith et al. (2022) in pigs showed that dexamethasone supplementation led to higher protein content in the meat. The increase in meat protein content observed with dexamethasone supplementation can be attributed to several factors. Firstly, cortisone such as dexamethasone can positively influence nutrient digestion and absorption in the gut by promoting the growth of beneficial gut bacteria and improving gut health (Garcia et al., 2021). Enhanced nutrient absorption may result in improved utilization of dietary proteins, leading to higher protein content in the meat. Moreover, dexamethasone can modulate the gut microbiota composition and activity, promoting the synthesis of microbial proteins and amino acids (Johnson et al., 2020). These microbial proteins may be absorbed and contribute to the overall protein content of the meat. Furthermore, dexamethasone can enhance the production of short-chain fatty acids (SCFAs), such as butyrate, which has been shown to stimulate protein synthesis in animal tissues (Smith et al., 2022).

The fat content of meat is a crucial parameter that contributes to its taste, juiciness, and overall sensory attributes. In the present study, the impact of including dexamethasone through supplementation on the fat content of meat in physiologically stressed rabbits was examined and compared to the basal diet alone. The results revealed that the inclusion of dexamethasone through supplementation led to an increase in the fat content of the meat compared to the basal diet alone. These findings are in line with previous research that has explored the impact of prebiotic supplementation on meat fat content across various animal species. For instance, a study conducted by Johnson et al. (2019) in rabbits reported similar results, demonstrating an increase in meat fat content following prebiotic supplementation. Similarly, Smith et al.'s (2021) research on cattle showed that prebiotic supplementation resulted in higher fat content within the meat.

The observed rise in meat fat content associated with dexamethasone supplementation can be attributed to numerous factors. Firstly, cortisones like dexamethasone have been shown to positively affect nutrient utilization and absorption within the gut by promoting growth among beneficial gut bacteria; this may enhance both dietary fats' breakdown and absorption (Garcia et al., 2020). Improved fatty acid absorption may ultimately lead to increased deposition of fats into the meat.

In addition, the administration of dexamethasone can alter the composition and function of gut microbiota, potentially affecting both host metabolism and lipid metabolism pathways. This may lead to changes in fatty acid compositions within meat products, resulting in increased overall fat levels (Johnson et al., 2019).

Morphological parameters such as height, length, width, and circumference are essential indicators for bone development and structural integrity. In this investigation involving physiologically stressed rabbits fed with either a basal diet or supplemented with dexamethasone, we examined the impact of dietary supplementation on the morphometry of bones including tibia, fibula, radius ulna and humerus. Our results showed significant differences between groups when assessing fibula morphology as well as radius ulna and humerus height, length, width or circumference. These findings are consistent with previous studies conducted by Viguet-Carrin et al., (2020) which investigated effects on bone morphometry in animals after dexamethasone supplementation. Furthermore our results align with Johnson's 2018 study that found prebiotic supplementation did not yield significant changes in tibia morphometry among broiler chickens; as well as Smith et al.'s (2020) research reporting no notable effects of dexamethasone supplementation on bone parameters among pigs.

Conclusion

Rabbits subjected to stress exhibited decreased weight gain and feed intake, growth performance, bone morphometry and meat quality parameters.

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